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M E M O

TO: Interim Joint Committee on Education

FROM: Commissioner Brigid L. DeVries on behalf of Sports Safety Work Group, 2009 HB383

SUBJECT: Sports Safety Work Group Final Report

DATE: October 23, 2009

On March 24, 2009, Governor Steve Beshear signed HB383 following the 2009 Regular Legislative Session. One of the stipulations in the bill required that a Sports Safety Work Group (SSWG) be established, and include individuals from the athletic, educational, and medical professions. The purpose of this committee was to coordinate a study of sports safety for interscholastic sports in Kentucky. The study was coordinated by Commissioner Brigid L. DeVries of the KHSAA and Michael Dailey, with the Kentucky Department of Education. The SSWG met on the following dates: May 4, 2009, June 1, 2009, July 9, 2009, August 10, 2009, September 1, 2009, September 15, 2009, and October 1, 2009. The KHSAA office was the host site for the meetings.

The SSWG concluded its work on October 1, 2009 and made several recommendations and reached consensus on a variety of subjects. The report includes a review of each component outlined in HB 383, and includes consensus statements from the SSWG. The following are the central points of the consensus statements and summarize the key recommendations:

I. Air Quality Index information needs to be available to coaches and administrators in pre-determined areas of the state.

II. The 2009 Sports Safety Course should continue to be used to fulfill the mandatory sports safety requirement in KHSAA regulations, specifically Bylaw 27 and outlined in 2009 HB383.

III. The KHSAA, KDE, KMA and KATS should work collaboratively with KCSS to develop guidelines for emergency preparedness plans for athletic contests, practices, contests and facilities.

IV. The General Assembly should appropriate funds to collect interscholastic sports injury information to provide injury data specific to Kentucky.

V. The KHSAA and KDE should continue to distribute and refer health and sports safety information to coaches, student- athletes, parents and volunteers through the use of the internet and other means.

VI. The SSWG recommends that the Kentucky Board of Education review current sports safety regulations and requirements for coaches at the middle school level.

VII. Existing sports safety guidelines should be made available for use by school programs at any grade level as well as other activity groups such as band, drill team or dance.

VIII. The Kentucky General Assembly should consider changes to KRS 311.900-311.928 to remove current restrictions limiting the work settings for Athletic Trainers (as defined in the report) promoting a funding alternative for better coverage and availability of trainers.

As Commissioner I am pleased to have had the opportunity to work with the members of the SSWG on this important study. Attached please find a copy of the full report.

KENTUCKY SPORTS SAFETY WORK GROUP

HB383 REPORT

OCTOBER 22, 2009

Introduction

On March 24, 2009, Governor Steve Beshear signed House Bill 383 (2009 Regular Session). The Sports Safety Work Group (SSWG) was established as a result of this legislation. The bill also contained an emergency provision, meaning that the law went into effect immediately, and included two major components:

1) Kentucky High School Athletic Association, with assistance from the Kentucky Department of Education, shall staff and coordinate a study of sports safety to be completed no later than October 1, 2009.
2) The Kentucky Board of Education or organization or agency designated by the board to manage interscholastic athletics shall require each high school coach to complete a sports safety course consisting of training on how to prevent common injuries. The course shall also be focused on safety education and shall not include coaching principles.

Twenty-two members of the education and athletics professions were selected to serve on the work group, satisfying the following requirements spelled out in House Bill 383:

a) At least two (2) members of the Kentucky Board of Education, selected by the board chairman;
b) At least two (2) representatives from the Kentucky Department of Education, selected by the commissioner of education;
c) At least two (2) high school coaches selected by the chair of the Board of Control;
d) At least two (2) members from the KMA, appointed by the executive director;
e) At least three (3) certified sports trainers (refer to definitions of Athletic Trainer in report); and
f) Others as deemed appropriate by the commissioner of education and the executive director of the Kentucky High School Athletics Association.

Kentucky High School Athletic Association Commissioner Brigid DeVries and Kentucky Department of Education liaison Michael Dailey created and assembled the following work group to ensure that all groups listed in the bill were represented.

a) Dorie Combs, Doug Hubbard and Austin Moss, members of the Kentucky Board of Education;
b) Brigette Combs Stacy, Michael Dailey and Darryl Thompson of the Kentucky Department of Education;
c) Mark Peach, Head Football Coach at Anderson County High School and Sara Raakers, Head Soccer Coach at Notre Dame Academy;
d) Dr. James "Pete" Bowles, Dr. Philip Hurley, Dr. Ben Kibler and Dr. Michael Miller, members of the Kentucky Medical Association and the KMA Committee on the Medical Aspect of Sports;

e) Bob Barton, PhD, Sheri McNew, Greg Rose and Tom Steltenkamp, Certified Athletic Trainers and members of the Kentucky Athletic Trainers Society;

f) Brigid DeVries, KHSAA Commissioner; David Weedman, 2009-10 President of the KHSAA Board of Control; Dale Brown, Superintendent of Warren County Schools; Lonnie Burgett, Superintendent of Mayfield Independent Schools; Lea Wise Prewitt, Member of the KHSAA Board of Control and parent of three high school student-athletes; Jerry Wyman, Director of Athletics and Activities for the Jefferson County Public Schools.

To complete its work, the SSWG drew from the expertise of its members and created sub-committees assigning each of them the task of researching specific areas of sport safety. In addition to the Committee members' professional and personal knowledge and experience, members were provided information from other states high school athletic and activity associations; collegiate and professional sports safety standards and plans; injury information and position statements from the National Federation of High Schools; and presentations from experts recognized as leaders in their field of study. Beginning in May, the SSWG held seven meetings at the KHSAA offices in Lexington to discuss ideas as a group and to report on and present findings from established subcommittees and outside presenters. These meetings were open to and often attended by members of the general public. Summaries of the information reviewed are included in Appendix B.

Committee members were advised from the beginning that the objective of the SSWG was to make an assessment of the current state of high school athletics with respect to sports safety in Kentucky and suggest what could be done to maintain and improve safety for student-athletes of all ages. As the group continued to meet, several common themes emerged, including:

- Coaches at all levels (freshmen, junior varsity or varsity), head and assistant, paid or unpaid, need to be trained in basic life-saving and sports safety skills. It was stated that in no way are these skills meant to serve as a substitute for qualified, licensed medical professionals, but rather to teach the coaches how to respond to emergency medical situations.
- Parties involved in training, or administering training need to utilize existing educational resources or create new ones, if necessary, to educate coaches and student-athletes about safety including heat related illness, supplement use, proper nutrition and weight training,
- There must be support for a philosophical shift from the current sports medicine principles which tend to be reactive, to a more proactive approach with emphasis on preventative measures,
- A need exists for there to be education of and support for, uniform sports safety standards for coaches and student-athletes in Kentucky's middle schools in addition to high schools which should apply to certain non-athletics based activities, and
- The most effective treatment is rendered in an emergency situation at the point of injury. An education program that teaches skills to be used in an emergency situation is most effective when it is taught during a situation where the skills can be practiced. Treatment and skill instruction can be effectively delivered by Certified Athletic Trainers.

CURRENT KHSAA REQUIREMENTS

The SSWG examined the existing coaching education requirements in place within KHSAA regulations as detailed in Bylaw 27 and empowered by regulation in 702 KAR 7:065. In addition, the SSWG reviewed the content of the new, mandatory KHSAA Sports Safety Course and considered the best way to communicate this type of information in the future.

According to Bylaw 27, all coaches of a high school sport in Kentucky, a person must complete:

- A certified first aid course that includes training in the use of Automatic External Defibrilator (AED),
- A certified coaching education program (beginning in 2009, the National Federation of High Schools course; before 2009, the American Coaching Education Program course),
- The newly implemented KHSAA Sports Safety Course every two years.

According to Bylaw 27, a head coach of a high school sport in Kentucky, a person must complete:

- A Medical Symposium for head coaches at least once every two years, and;
- A sports specific rules clinic for head coaches each year.

The SSWG addressed the following areas in this report as stated by the language of House Bill 383:

a) The requirements and their adequacy for sports safety education in public middle and secondary schools, including heat-related and air quality issues, chronic and overuse injuries, and other risk factors,

b) Required training programs for secondary school coaches, to include how training is certified to demonstrate knowledge and competencies of participants,

c) Required first aid and medical assistance protocols or standards of care for students suffering minor and major injuries during practices and competitions,

d) Data regarding sports injuries, by sport, in Kentucky and an examination of data reporting requirements and responsibilities during practices and competitions,

e) Education for high school coaches, volunteers, parents, and student athletes relating to nutrition, weight training, and the dangers of steroids and other illegal supplements,

f) The availability of sports injury prevention programs and other safety resources, and

g) Other information as deemed appropriate by the study group to fully examine the status of sports safety in Kentucky for high school students.

DEFINITIONS AND OPERATIVE TERMS

Initially, the SSWG needed to establish common language and terminology. The SSWG represented various professional occupations, and therefore the use of specific terms needed to be consistent prior to any recommendations from the SSWG. The following "Definitions" were the result of this effort to establish common language.

Organizational References: The report includes references to the following organizations and entities:

a) Kentucky Medical Association (KMA),

b) Kentucky Athletic Trainers Society (KATS),

c) Kentucky Board of Medical Licensure (KBML),

d) Kentucky Board of Education (KBA),

e) Kentucky Department of Education (KDE), and

f) Kentucky High School Athletic Association (KHSAA).

Coach: Definitions (From KHSAA Bylaw 27 as incorporated into 702 KAR 7:065)

a) Level 1- A coach could be an individual that is a certified teacher and member of the regular school system faculty, or

b) Level 2- A coach could be a member of the community that either 1) works inside the school system but does not hold a teaching certificate, or 2) works outside the school system but is recognized by the school system as a coach and meets all other requirements to be a coach as defined in KHSAA Bylaw 27.

Qualified Medical Professionals: Athletic Trainers, certified to practice athletic training by the KBML; Registered Nurses, Physicians, or Physicians Assistants licensed to Practice in Kentucky as enumerated in HB383.

Practice: ..."To exercise or perform repeatedly in order to acquire or improve a skill", and includes:

a) Scheduled practice per KHSAA Bylaw 25

b) Other activities to include:

Open gym/field/facility,

Pre-season conditioning,

Tryouts,

Private (but required) lessons, i.e. Gymnastics for Cheer,

Scrimmages, and

Weight Training

Competition: …"a contest or similar test of skill or ability"

a) Regular season game/contest/meet/match,

b) Tournaments (regular season),

c) Out of State contests/tournaments,

d) Post Season Tournaments/meets/matches, and

e) Individual Contests.

High School: Students enrolled in grades 9-12. "High school" means any Kentucky public high school, the Gatton Academy and Mathematics and Science in Kentucky, and any private, parochial, or church school located in Kentucky that has been certified by the Kentucky Board of Education as voluntarily complying with curriculum, certification, and textbook standards established by the Kentucky Board of Education under KRS 156.160 (from 164.7874 §11)

Middle School: Students enrolled in graded 5-8. "Middle school" means grades five (5) through eight (8), regardless of school or district configuration (from 156.551 §3);

Secondary School: Students enrolled in grades 7-12. "Secondary school" means a school consisting of grades seven (7) through twelve (12), or any appropriate combination of grades within this range as determined by the plan of organization for schools authorized by the district board. When grades seven (7) through nine (9) or ten (10) are organized separately as a junior high school, or grades ten (10) through twelve (12) are organized separately as a senior high school and are conducted in separate school plant facilities, each shall be considered a separate secondary school for the purposes of KRS 157.310 to 157.440 (from 157.320 §11).

Athletic Trainer: Means a person with specific qualifications, as set forth in KRS 311.900 to 311.928 who is certified to practice athletic training and who, upon the supervision of a physician licensed under KRS Chapter 311, carries out the practice of preventing, recognizing, evaluating, managing, disposing, treating, reconditioning, or rehabilitating athletic injuries. In carrying out these functions, the Certified Athletic Trainer may use physical modalities, such as heat, light, sound, cold, or electricity, or mechanical devices. A Certified Athletic Trainer shall practice only in those areas in which he or she is competent by reason of his or her training or experience

a) Certified Athletic Trainer – An individual who is certified to practice athletic training by the Kentucky Board of Medical Licensure and who, upon the supervision of a physician licensed in Kentucky carries out the practice of preventing, recognizing, evaluating, managing, disposing, treating, reconditioning, or rehabilitating athletic injuries, and

b) Student Athletic Trainer – A college student studying to be an Certified Athletic Trainer who is under the direct supervision of a Certified Athletic Trainer.

Approved Sports Safety Course: The Sports Safety Course developed in the summer of 2009 with content included by representatives of KMA and KATS, and administered and delivered by the KHSAA to meet the requirements of House Bill 383, and available to all schools in Kentucky, the general public, and all other affiliated groups that desire its use.

The SSWG reviewed each study component outlined in Section 1 of HB 383.

HB 383 SECTION 1 (a)

The study shall include a review of:

a) *The requirements and their adequacy for sports safety education in public middle and secondary schools, including heat-related and air quality issues, chronic and overuse injuries, and other risk factors.*

The SSWG collected and examined data related to sports safety education, including the existing coaching education requirements outlined in KHSAA Bylaw 27. While the SSWG was asked to address aspects of high school sports safety, the group recognized that the process of collecting and analyzing data to guide safety education courses and reach valid conclusions would be time consuming and costly. In addition, the SSWG concluded that the proper collection and analysis would require fully funded legislative or regulatory amendments. The committee concluded that specific action should be taken regarding items such as required training programs for secondary school coaches or the inclusion of certification in order to demonstrate knowledge.

The SSWG also concluded that the requirements for sports safety education in secondary schools are more than adequate in the Commonwealth of Kentucky. Kentucky was one of the leaders in starting educational programs for high school head coaches. Examples of educational programs regarding sports safety go as far back as the early 1970s when courses were offered to coaches attending the boys' state basketball tournaments offered by the KHSAA. The KMA sponsored Sports Medicine Symposiums that are designed for coaches started in Lexington and eventually expanded throughout the state. Some of the early sports safety programs emphasized the importance of heat monitoring, and rehydration of student athletes during pre-season football practices, pre-season scrimmages, and pre-season bowl games. The Sports Medical Symposiums were used as models by other states throughout the southeast. The availability of educational information has increased consistently for many years.

However, all secondary school personnel should have these education materials, including courses and printed documents distributed or available to all coaches (head and assistant) in all sports. Not all assistant coaches and other school personnel currently embrace opportunities to take advantage of the resources available to them.

Existing sports safety requirements apply only to high school athletics as the other grades are not under the direct jurisdiction of the KHSAA. As such, there are no mandates in place for middle school coaches as there is no governing body for middle school athletics or activities. The SSWG recommends to member school systems that coaches at all levels complete the sports safety requirements in place for the high school level. The SSWG found that current requirements for coaches for sports safety education are adequate at the high school level and would be sufficient at the middle school level if coaches were required to complete the same mandates.

KMA and KATS representatives worked at a rapid pace to meet the needs of the current 2009-10 athletic seasons. The course designed for coaches that was authored by representatives of the KMA and KATS and administered and delivered by the KHSAA, more than meets the requirements of House

Bill 383. Heat related issues, chronic injuries, overuse injuries, risk factors and risk management considerations are covered effectively in the current course in addition to other subject areas.

The SSWG reviewed the parameters by which the KMA has operated its Sports Medicine Symposiums for the KHSAA for more than twenty-five years. The SSWG studied the current delivery mechanism (face to face, once every two years) and compared it to the new Sports Safety Course that allows for near-constant revision, and a convenient on-line delivery system that negates any of the geographic constraints of the coach or the school.

The SSWG reviewed the existing KHSAA Heat Index program that was the result of recommendations from KMA. At specific temperature levels, activity revision and event cessation is required. Annually, the schools must submit collected data from July 15 to September 15. The following represents the existing activity requirements under the Heat Index program:

Under 95 degrees Heat Index

- Provide ample amounts of water. This means that water should always be available and athletes should be able to take in as much water as they desire,
- Mandatory water breaks every 30 minutes for 10 minutes in duration,
- Ice-down towels for cooling, and
- Watch/monitor athletes carefully for necessary action.

95 degrees to 99 degrees Heat Index

- Provide ample amounts of water. This means that water should always be available and athletes should be able to take in as much water as they desire,
- Mandatory water breaks every 30 minutes for 10 minutes in duration,
- Ice-down towels for cooling,
- Watch/monitor athletes carefully for necessary action,
- Contact sports and activities with additional equipment,
- Helmets and other possible equipment removed if not involved in contact or necessary for safety,
- Reduce time of outside activity. Consider postponing practice to later in the day, and
- Re-check temperature and humidity every 30 minutes to monitor for increased Heat Index.

100 degrees to 104 degrees Heat Index

- Provide ample amounts of water. This means that water should always be available and athletes should be able to take in as much water as they desire,
- Mandatory water breaks every 30 minutes for 10 minutes in duration,
- Ice-down towels for cooling,
- Watch/monitor athletes carefully for necessary action,

- Alter uniform by removing items if possible,
- Allow for changes to dry t-shirts and shorts,
- Reduce time of outside activity as well as indoor activity if air conditioning is unavailable,
- Postpone practice to later in day,
- Contact sports and activities with additional equipment,
- Helmets and other possible equipment removed if not involved in contact or necessary for safety. If necessary for safety, suspend activity, and
- Re-check temperature and humidity every 30 minutes to monitor for increased Heat Index.

Above 104 degrees Heat Index

- Stop all outside activity in practice and/or play, and stop all inside activity if air conditioning is unavailable.

Soon after the SSWG began to meet, the Kentucky Medical Association released its *Recommendations for Cooling Due to Heat Related Illness*. According to this newly formulated protocol, it is essential for school officials to:

- Establish a written plan for emergency treatment of Exertional Heat Stroke, and conduct drills in the implementation of the plan,
- Know how to assess environmental conditions and determine when extreme conditions exist,
- Identify a spot at the athletic facility that has shade,
- Have immediate access to ice and bags to contain ice,
- Have access to water, and provide water breaks as outlined in the KMA/KHSAA Heat Illness and Prevention Policy, and
- Know the most effective sites for application of ice to the body

The KMA recommendations also noted that it is "highly desirable" that the school and school officials, during extreme environmental conditions, obtain a tub or pool, fill it with water and ice before a practice or game, be able to use it for body immersion for maximal cooling, and have personnel trained in this technique.

It was noted by the SSWG that the KHSAA amended the language of Bylaw 27, effective for the 2009-10 school year, to strengthen the first aid requirement of coaches for KHSAA-sanctioned sports. In addition to maintaining CPR certification, the content must now include instruction on how to use an automated external defibrillator (AED).

The SSWG heard a presentation from David Bensema, MD describing a new body temperature alert patch manufactured by iDOT®. The patch warns the user if they are getting close to overheating. The patch uses Thermo-Chromatic paint that changes color once a temperature threshold is met, in this instance a 100.5 degree internal body temperature. The patch is placed on the wrist or the neck of the competitor and is normally black in color. If the person's temperature reaches this unhealthy level, the patch turns yellow and can be easily seen from up to 60 meters away. Dr. Bensema stated the patch was used on an experimental basis by the Cincinnati Bengals, Pittsburgh Steelers and University of Kentucky during summer football training camps. Currently, the cost of each patch is 25 to 33 cents each, with discounts for bulk purchases. The product has been approved by the Food and Drug Administration and is awaiting a patent. Research is ongoing on this product.

The SSWG has exceeded the mandates of H.B. 383 in considering possible improvements to the safety of athletes in Kentucky's schools. Numerous presentations were reviewed covering such subjects as concussions, injections and other on-site procedures in the athletic environment, use of I.V. preparations at game sites, heat monitoring devices, and safety conscious clothing and sports equipment. The members of the SSWG received "cutting edge" information from many of the experts in sports medicine fields.

Air quality issues have been addressed by several authorities in the environmental health arena. The SSWG studied air quality information as it relates to communities in Kentucky. Mr. Tom Fitzgerald, an expert on the subject, attended the Aug. 10, 2009, SSWG meeting and had supplied written information at previous meetings. Mr. Fitzgerald discussed many of his findings and included ways to minimize athlete risk due to poor air quality. The SSWG found that credible evidence exists illustrating the effect of Air Quality on respiratory health. Poor Air Quality Index readings (100 and above) begin to have a detrimental effect on members of the population with respiratory problems. That risk escalates with higher readings. Since ambient air quality is currently only monitored in seven areas in Kentucky (Louisville, Lexington, Ashland, Owensboro, Pikeville, Bowling Green and Paducah), there are many areas of the state that are not affected by these air quality measurements. Coaches and administrators in the affected areas should be aware of conditions and take precautions to protect student-athletes on poor air quality days, including altering practice routines to reduce endurance-based activity.

<u>CONSENSUS OF THE SSWG</u>

1) **Air Quality Index information needs to be available to coaches and administrators in pre-determined areas of the state.**

   The SSWG recommends that the KHSAA take the following action regarding air quality:

   - **Work with the Environmental Protection Cabinet to identify areas of the state and specific KHSAA member schools affected by the Ambient Air Quality warnings and information,**
   - **Distribute a model plan to member schools for dealing with ambient air quality alerts, and**
   - **Work with the Environmental Protection Cabinet to study the feasibility of integrating its data into the KHSAA website with notification mechanisms.**

HB 383 SECTION 1 (b)

The study shall include a review of:

b) Required Training Programs for secondary school coaches, to include how training is certified to demonstrate knowledge and competencies of participants

The committee collected and examined data from several sports safety courses that are currently on the market, as well as courses that were developed with specific states in mind. Among the courses reviewed were the American Sport Education Program (ASEP), the American Red Cross, the Alabama Sports Foundation, and the Ohio Department of Education.

A report issued by Dr. Bob Barton, on behalf of a subcommittee established by the SSWG, noted that, while each course had positive aspects, each also had issues that made tailoring the course to the requirements of H.B. 383 difficult. The Sport First Aid course offered by ASEP is extremely detailed in its instruction; however, certification of instructors to meet the language of HB 383 could prove expensive and difficult. To date, there is only one instructor who is both approved by ASEP and licensed to practice in Kentucky. It was noted that H.B. 383 included a stipulation that for approval of a course, it must be taught by qualified professionals who shall either be licensed athletic trainers, registered nurses, physicians or physician's assistants licensed to practice in Kentucky.

According to Dr. Barton's report, the course offered by the American Red Cross is "a good program, but has little if any flexibility to the content and adaptations for a specific group." There are more instructors for this course that are licensed to practice in Kentucky, though they have expressed great concern about possible loss of Red Cross certification if they tailor the course to meet the requirements of HB383, due to the rigidity of the requirements within this course.

The review of the National Sports Foundation (Alabama) course also encountered the issue of certified instructors. Four Certified Athletic Trainers have done most of the instruction in this course; however, none are licensed to practice in Kentucky. Representatives of the National Sports Foundation, as well as Kentucky Head Football Coach Rich Brooks made a presentation to the General Assembly, though at the time the issue of instructor licensure was not addressed. According to the sub-committee report, "Meetings have been held involving the Foundation and the Presidents of KATS, and the National Athletic Trainer's Association. The Foundation remains optimistic that they can meet the requirements of the Kentucky law, however no solution to the instructor question has been presented."

The Ohio Department of Education offers a course that is required for Ohio coaches. Apparently, there are several Ohio instructors that could be licensed to teach this course and tailor it to the needs of any state.

The SSWG also concluded that many of the reviewed programs did not sufficiently address heat illness and injury prevention. In addition, it is doubtful that enough instructors could be trained to meet the needs of every coach that must complete a course without significant capital outlay. There is also the issue of cost to school districts as these courses typically ranged from $40 - $120 per person.

The SSWG concluded the best solution was to work with the existing framework of the Sports Safety Course so that it could be tailored to the needs of Kentucky coaches. This course was developed initially in 2009 by the KMA and KATS representatives and implemented by KHSAA, and included the content requirements outlined in Section 2 of HB 383:

- Emergency Planning,
- Heat and Cold Illness,
- Emergency recognition,
- Head Injuries,
- Neck Injuries,
- Facial Injuries, and
- Principles of First Aid

Every instructor in the Sports Safety Course that was offered to coaches and administrators online through the KHSAA website is licensed by the KBML as either a Medical Doctor or a Certified Athletic Trainer. The physicians and Certified Athletic Trainers offered their services without charge and the development and maintenance of a delivery and tracking system was done by the KHSAA at no charge to the member schools. This allowed each of Kentucky's school districts to meet the requirement of HB 383 by taking the course at no charge. The Sports Safety Course addresses the mandates of H.B. 383 and therefore meets the exacting specifications within the bill. It was the only course found that meets all of the HB383 requirements. The SSWG concluded that a course developed and taught by Kentucky physicians and athletic trainers who understand the sports safety conditions unique to Kentucky athletes, would be optimal. The course can continue to focus on Kentucky issues and allow for greater flexibility to update content and make changes if needed. To date, more than 7,500 coaches have completed the current Sports Safety Course. Estimates are as high as 12,000 who need to complete the course before the winter and spring sports seasons end during the 2009-10 school year. It has been estimated that this has saved Kentucky schools a minimum of $300,000 that would have been paid to other courses that did not meet HB383 requirements.

CONSENSUS OF THE SSWG

2) **The Sports Safety Course developed by the KMA with assistance from KATS should continue to be used to fulfill the mandatory sports safety requirement for coaches as detailed in KHSAA Bylaw 27 and H.B. 383. Updates in the curriculum can be made at intervals not to exceed thirty (30) months with coaches being required to attend the course not less than every twenty-four (24) months. In addition, as the need presents itself based on verifiable data or health trends, additional modules can be added to the course.**

3) **The KMA and KATS should review the Sports Safety Course; revise, update and expand the curriculum; and integrate the curriculum with the KMA Annual Medical Symposiums. The KMA could take this information and continue to work closely with the KHSAA to evaluate the existing Symposiums including the periodic review of the core content and delivery systems and consolidation of coaching requirements.**

HB 383 SECTION 1 (c)

The study shall include a review of:

c) Required first aid and medical assistance protocols or standards of care for students suffering minor and major injuries during practices or competitions

With the increase in athletic participation at all levels in recent years, there is a corresponding increase in the likelihood that medical emergencies will occur. The SSWG found that the North Carolina High School Athletic Association requires its member schools to have an Emergency Preparedness Plan on file and practice the plan. It is important that all schools have a written safety plan to be used in the event of an emergency for all athletic sites. This initiative could be facilitated with cooperation from the Kentucky Center for School Safety or other related groups. Existing regulations require that each school (through the Board of Education and Site Based Decision Making Council) have an Emergency Safety Plan on file. A partnership with the Kentucky Center for School Safety could avoid a duplication of resources and allow for faster implementation and practice of this type of plan in all schools.

CONSENSUS OF THE SSWG

4) **The KHSAA, KDE, KMA, and KATS should work collaboratively with the Kentucky Center for School Safety to develop a prototype or template of an emergency preparedness plan for athletic practices, contests and facilities. The KHSAA should distribute these materials for developing an Emergency Preparedness Plan to its member schools. These plans could be separate operational plans for athletics, or incorporated as new segments into existing school safety plans if none exist for athletics. The SSWG supports the KHSAA, KDE, KMA and KATS working collaboratively with the Kentucky Center for School Safety in routine reviews of these plans in conjunction with existing reviews of other safety issues. The SSWG recommends the development of a monitoring mechanism to assure the development of these plans.**

HB 383 SECTION 1 (d)

The study shall include a review of:

d) Data regarding sports injuries, by sport, in Kentucky and an examination of data reporting requirements and responsibilities for oversight when injuries occur

The committee examined extensive data gathered from national studies conducted by Dr. Fred Mueller from North Carolina and Dr. Dawn Comstock of The Ohio State University. However, the SSWG found that injury data for Kentucky is incomplete or has not been tracked.

There are many reasons for a lack of reliable data at the state level, primarily, a lack of funding for a comprehensive study to be performed. To conduct a reliable study, infrastructure mechanisms to adequately collect and analyze data must be in place, including proper training of researchers, the equipment to conduct research, and development of database to house and analyze the findings. This could be expensive and a lack of seed money has been a deterrent to this type of specific research in Kentucky. Another reason for the lack of reliable data is the reluctance of medical professionals to provide public reports of injury data due to privacy issues related to the Health Insurance Portability and Accountability Act (HIPPA) and other privacy regulations.

A third reason for the lack of information is the inconsistency in defining a sports injury. For some school personnel, a sports injury is one that requires hospitalization while for others it could be a sprained ankle. The only accurate way to record injury data is from qualified medical professionals who in advance, have defined the parameters. This remains an issue because many schools do not have access to a qualified medical professional on a daily basis.

There was considerable discussion by the SSWG about the licensure status of athletic trainers at KHSAA member schools. It is suspected that some schools are using individuals as trainers who are not licensed by KBML. The SSWG determined that the KHSAA should ask each of its member schools for the license number of each person entered as an athletic trainer on the KHSAA website to ensure that the individual is qualified to provide the needed data and response.

Currently, there is no reliable sports injury data specific to Kentucky. Dr. Eric Fuchs, an Associate professor at Eastern Kentucky University, has proposed one such study, which mirrors a similar effort in Georgia. At that time there was no firm proposal or cost estimate on such study. The SSWG heard a presentation from Jennifer McKeon, PhD, an associate professor at the University of Kentucky. McKeon detailed the findings of the Fayette County Injury Surveillance System (an athletic injury study) conducted at seven central Kentucky high schools. The study compiled injury data reported by athletic trainers for athletes that participated in football, soccer, volleyball, cross country, basketball, wrestling, baseball, softball, track and field and golf during the 2007-08 school year. Injuries were reported on a standardized injury evaluation form. The study, now in its fourth year, revealed several important findings, among them: a) injury surveillance is only possible at the high school level at high schools when athletic trainers provide 'every day coverage,' b) injury surveillance is not possible when left to be reported by coaches/athletes. Her study is attempting to determine if injury surveillance and accurate conclusions are is possible at schools with an athletic trainer that comes one time per week or less, which appears to be the level of coverage at many Kentucky high schools. Further study has been proposed, narrowing the number of sports studied, but projected costs are $80,000 for four schools and $20,000 for one.

CONSENSUS OF THE SSWG

5) The General Assembly should appropriate funds to collect sports injury information in Kentucky in order to provide accurate examples of what types of injuries and emergencies are occurring. It is imperative that this data come from qualified medical professionals. Such a study would give the KHSAA, KMA and KATS valuable data for the consideration of further rules and regulations to help make athletics safer for all involved.

6) High school personnel should legally provide data to researchers whenever sports injuries occur. Regardless of the severity of injuries such as those considered minor (such as sprained joints or strained muscles), or catastrophic events (such as paralysis or death), researchers are in need of this vital information. The SSWG recommends that the KHSAA continue assisting Dr. Fred Mueller at the University of North Carolina and Dr. Dawn Comstock at Ohio State University with ongoing data collection efforts.

<u>HB 383 SECTION 1 (e)</u>

The study shall include a review of:

e) Education for high school coaches, volunteers, parents and student athletes relating to nutrition, weight training, and the dangers of steroids and other illegal supplements

A review by an SSWG sub-committee found there are numerous resources available to districts and schools that provide guidance and information relating to nutrition, the dangers of steroids and other illegal supplements. The report stated, "These resources are seldom utilized by coaches for this purpose and until recently, preventative measures in these specific areas have been on an as-needed basis."

School and even district-wide policies prohibiting students from possessing, using, transmitting or being under the influence of drugs while on school property have been in place for years. However, these measures deal primarily with punishment if these policies are violated.

While Physical Education classes offer limited information on nutrition, supplements and weight training, much of the information may be found through other sources, including Youth Service Centers. According to the sub-committee report, "These centers sponsor prevention activities and provide research-based information for students throughout the school year. They collaborate with Title IV (Safe & Drug Free Schools), the Kentucky Agency for Substance Abuse Policy (KYASAP), the Kentucky Center for School Safety, Operation UNITE, health departments, regional prevention centers, and local DARE programs. They also support Drug-Free School Clubs and Alcohol, Tobacco and Other Drug (ATOD) prevention curriculum at the high school level. Each service center is guided by an advisory council comprised of local community members, parents, students and school staff. The Youth Service Centers could be an excellent resource for coaches."

Another resource for parents, coaches and student-athletes is the Kentucky Regional Prevention Centers (RPCs). RPCs assist individuals and groups in developing prevention programs that encourage healthy choices about alcohol, tobacco and other drugs. A total of 14 centers serve all 120 of Kentucky's counties. The sub-committee report stated, "Regional Prevention Centers would be a great resource for coaches to contact and request prevention information surrounding the dangers of steroids and other illegal supplements."

The 29-county area that comprises Southeastern Kentucky is served by Operation UNITE (Unlawful Narcotics Investigations, Treatment and Education). Its education team assists in school-wide substance abuse prevention and education activities.

The University of Kentucky College of Agriculture Cooperative Extension Service provides nutrition information through the Family and Consumer Sciences (FCS) Extension Agents. According to the sub-committee report, "Local offices currently collaborate with and support many school programs and activities in their local districts. Extension agents also serve on community councils and school committees. The local FCS Extension Agents would be an excellent resource for coaches to collaborate with for research-based resources when discussing nutrition with student-athletes, parents, and volunteers participating in their athletic programs."

The Jefferson County Public Schools produced a video for the 2009-2010 school year containing information on proper nutrition, injury prevention and treatment, as well as segments on Staph Infection and MRSA. Employees, parents and student-athletes were required to view the video. With funding and a few modifications, the SSWG concluded that this successful model could be used state-wide as a teaching tool.

CONSENSUS OF THE SSWG

7) The KHSAA and KDE should continue to distribute and refer health and sports safety information to coaches, student-athletes, parents and volunteers. The SSWG recommends the following initiatives be undertaken:

- **The KHSAA and KDE encourage KHSAA member schools coaches to utilize existing state and local resources addressing nutrition, the dangers of steroid and supplement use, and weight training concerns with their coaches, student-athletes, parents and volunteers.**
- **The KDE utilize state and local resources to create local community sports safety work groups in each county that could assist coaches, parents and student-athletes in addressing nutrition, the dangers of steroid and supplement use, and weight training. Teams could consist of coaches, parents, volunteers and student athletes, representatives from the Family Resource Youth Service Centers, Kentucky's Regional Prevention Centers, Family and Consumer Sciences Extension Agents, Operation UNITE (where applicable), Kentucky Center for School Safety, Kentucky Agency for Substance Abuse Policy, Champions for a Drug-Free Kentucky, KMA, KHSAA, Community Education Directors, local health departments, University of Kentucky Sports Medicine, Rudy J. Ellis Sports Medicine and the Council on Postsecondary Education.**
- **The KHSAA and the KDE continue to provide contact information and links for state and local resources on their respective websites.**
- **The KHSAA and KDE utilize all available existing media resources to distribute information to coaches, volunteers, parents and student athletes.**
- **The KHSAA should continue to utilize the resources of the Kentucky Department of Public Health for common initiatives.**

HB 383 SECTION 1 (f)

The study shall include a review of:

f) The availability of sports injury prevention programs and other safety resources

The SSWG examined the sports injury prevention programs and resources available to athletes and coaches in Kentucky. A report compiled on behalf of an SSWG sub-committee by Certified Athletic Trainer Tom Steltenkamp, states that "there are numerous opportunities for citizens of Kentucky to participate in sports injury prevention programs, and related safety programs. However, many are designed for certain populations and sometimes have prerequisites for participation."

It should be noted that the American Red Cross (ARC) offers numerous safety courses that include many aspects of safety education, as well as first aid for all populations. Included are:

- ARC Standard First Aid,
- ARC Cardiopulmonary Resuscitation,
- ARC Automatic External Defibrillator,
- ARC Workplace Safety,
- ARC Water Safety / Lifeguard Training,
- ARC AIDS Safety Awareness Classes,
- ARC Instructor Training Classes,
- ARC Sports Injury First Aid, and
- ARC Aquatics (specific for swimming) Classes

There are numerous other safety courses offered regionally through the state by different entities to help with prevention and first aid. Included are:

- Ashland Schools (in conjunction with local hospitals) offer sports injury classes, as well as the athletic training student Olympics,
- Baptist Hospital Chain (including Lexington, Louisville and Nashville) holds sports medicine workshops on a regular basis,
- Cincinnati Sports Medicine offers sports medicine workshops , both in Ohio and Kentucky on a regular basis,
- Eastern Kentucky University offers a "Rescue School" weekend program annually that often includes athletic first aid,
- Emergency Medical Technician classes are offered throughout Kentucky that are an intensive study of emergency first aid and transportation procedures for all emergency occasions (many Kentucky ATCs are also EMTs),
- Heart Association (American) offers CPR and AED classes on a regular basis throughout the state,

- Lexington Clinic (and Dr. Ben Kibler) offer sports medicine workshops on an annual basis,
- Marshall University (in conjunction with Scott Orthopedics) offers sports medicine workshops on a regular basis both in Huntington WV, as well as in Boyd, Greenup County and Ashland Area,
- Morehead State University offers an athletic training education workshop for student athletic trainers on an annual basis,
- KMA offers Sports Medicine Symposiums for coaches on an annual basis,
- The University of Kentucky, and the University of Louisville offer Sports Medicine Meetings on a regular basis, attracting athletic trainers, coaches, physical and occupational therapists, nurses, paramedics, physicians, and PA s from a four or five state region,
- KATS holds an annual meeting and clinical symposium on an annual basis,
- Western Kentucky University offers an athletic training education program on an annual basis,
- Northern Kentucky University offers sports medicine programs on a regular basis, including hosting the 2010 meeting of KATS, and
- Many medical facilities that employ athletic trainers for service at area high schools, host sports medicine "in-service" programs for their employees, and local practitioners, with an interest in sports medicine, on a regular basis.

HB 383 SECTION 1 (g)

The study shall include a review of:

g) Other information as deemed appropriate by the study group to fully examine the status of sports safety in Kentucky for high school students

Most of the research information reviewed by the SSWG addressed points a) through f) as stated in HB 383. However, through the review process, several topics were discussed that dealt with issues not specifically addressed in the law, but no less important.

In its research, the SSWG found the information pertaining to student safety and required training programs were not only adequate for high school athletic competition, but were beneficial to more than just the high school student-athlete. Other school activities, such as band and middle school sports also train and participate outdoors and could be affected by potentially hazardous conditions. It would be desirable if sponsors of these activities were trained in the basics of sports safety, just as the high school coaches are trained under current KHSAA regulations.

The question of sports safety in middle school sports remains a challenge for school systems and athletic departments. Decisions are made at the local level as to middle school expectations and requirements for coaches. This year there was a noted tendency by school administrators within school districts to implement safety related programs such as the Sports Safety Course as soon as possible in a comprehensive manner within school districts. As was demonstrated with the original KMA Sports Medical Symposium Programs, school systems that encouraged or required middle school coaches to participate in mandatory training programs, found better acceptance from all of the sports coaches when promoted the same within the districts. As the knowledge of best practices for sports safety continues to expand, it is only logical that it be shared with middle school personnel as well as other activity groups or organizations interested in administering safe sports programs for Kentucky's youth.

As a result of the work of the SSWG, it has become increasingly obvious that having an Athletic Trainer involved with high school sports programs in Kentucky improves the prevention of injuries and care of student athletes. While it is important for coaches to receive basic medical training to recognize and stabilize medical injuries and illnesses, the prevention and treatment of sports related medical injuries and illnesses is best performed by Athletic Trainers.

Approximately one-third of schools in Kentucky have access to the services of an Athletic Trainer to provide prevention and care of injuries to their high school athletes. The major obstacle that prevents many schools from having a Athletic Trainer is the lack of resources to pay for those services. Additionally, due to financial constraints at the school level, many of the Athletic Trainers provide services to multiple schools and their effectiveness is dramatically reduced in preventing and treating athletic injuries.

The high schools that have Athletic Trainers usually have them as a result of an agreement with a local hospital, clinic or physician office where the Athletic Trainer is employed. Legislation was first passed by the Kentucky General Assembly in 1978 defining within scope of practice for a Athletic Trainer. While the Athletic Training Practices Act professionalized the position of Athletic Trainer, it limited the ability of the Athletic Trainer to bill for specific services in a clinical environment. Later, in the early 1980s, legislation was enacted that would have stipulated that each school employ an Athletic

Trainer. However, the latter act was not funded and as such, was eventually withdrawn. When faced with the decision between hiring a Athletic Trainer and hiring other teaching or classified staff, most school district administrators do not have the funding available to employ an Athletic Trainer. As the work of Athletic Trainers has evolved and expanded, many schools are now using the services of Athletic Trainers from regional clinics and colleges or universities.

The practice act that governs Athletic Trainers in Kentucky (KRS 311.900 – 311.928) restricts the ability of an Athletic Trainer to bill independently for services in the employment settings listed above. This restriction is limiting the ability of hospitals, clinics and physician offices to employ Athletic Trainers, which is the primary reason that schools do not have access to Athletic Training services. The ability of these individuals to bill independently for services has limited income potential to the point that there is a shortage of Athletic Trainers in the state. Many individuals graduating with degrees and certifications to practice as an Athletic Trainer are seeking employment in other states that do not have the restrictions of the current practice act in Kentucky. This lack of qualified individuals could limit or restrict implementation of many of the recommendations of this SSWG and potentially, the directives of the legislature.

CONSENSUS OF THE SSWG

8) **The KBE should review sports safety regulations and requirements for coaches at the middle school level.**

9) **Existing KHSAA sports safety guidelines and resources should be made available and utilized by middle school personnel and non-athletic related activities such as band, dance (pep squads), and other activities.**

10) **As part of the implementation of HB 383, the Kentucky General Assembly should consider changes to KRS 311.900 – 311.928 to remove the current restrictions limiting the work settings for Certified Athletic Trainers. Removing the restrictions would allow the Certified Athletic Trainer to work as such in any hospital, clinic or office setting approved by and under the direction of a licensed physician and bill for Athletic Training services. Creating this revenue stream would then allow the work settings listed above to reduce the cost of providing Athletic Training Services to local schools. In addition, this career opportunity would increase the pool of available trainers for Kentucky Schools.**

11) **The Kentucky Board of Education and the General Assembly should revisit past legislation that would have placed Certified Athletic Trainers in every public high school in the state. This provision would represent the most expeditious method of providing competent point of injury care, employing the latest prevention techniques, presenting up to date information and education, and of collecting the most accurate injury data. This position would create the best environment in which the spirit and the letter of the intent of House Bill 383 could be implemented in the short and long term.**

APPENDICES

A) Text of Bill

B) Minutes of Meetings

C) Review of Existing National Research on Catastrophic Injuries (University of North Carolina)

D) Review of Existing National Research on Sports Injuries (Ohio State University)

E) KHSAA Heat Index Guidelines

F) Air Quality Material

G) IDOT Reference Material

H) Existing North Carolina Model for Emergency Planning

I) Documents Gleaned From Research Regarding Steroids and other Supplement Education

J) UK Sports Medicine Presentation – 2009 Annual Meeting

K) Kentucky Revised Statutes defining middle school, high school and secondary schools

AN ACT relating to interscholastic athletics and declaring an emergency.

Be it enacted by the General Assembly of the Commonwealth of Kentucky:

➔Section 1. (1) The Kentucky High School Athletics Association, with assistance from the Kentucky Department of Education, shall staff and coordinate a study of sports safety to be completed no later than October 1, 2009.

(2) The study shall include a review of:

(a) The requirements and their adequacy for sports safety education in public middle and secondary schools, including heat-related and air quality issues, chronic and overuse injuries, and other risk factors;

(b) Required training programs for secondary school coaches, to include how training is certified to demonstrate knowledge and competencies of participants;

(c) Required first aid and medical assistance protocols or standards of care for students suffering minor and major injuries during practices and competitions;

(d) Data regarding sports injuries, by sport, in Kentucky and an examination of data reporting requirements and responsibilities for oversight when injuries occur;

(e) Education for high school coaches, volunteers, parents, and student athletes relating to nutrition, weight training, and the dangers of steroids and other illegal supplements;

(f) The availability of sports injury prevention programs and other safety resources; and

(g) Other information as deemed appropriate by the study group to fully examine the status of sports safety in Kentucky for high school students.

(3) The Association shall have a formal work group composed of:

(a) At least two (2) members of the Kentucky Board of Education, selected by the board chairman;

(b) At least two (2) representatives from the Kentucky Department of Education, selected by the commissioner of education;

(c) At least two (2) high school coaches selected by the Chair of the Board of Control;

(d) At least two (2) members from the Kentucky Medical Association, appointed by the executive director;

(e) At least three (3) certified sports trainers; and

(f) Others as deemed appropriate by the commissioner of education and the executive director of the Kentucky High School Athletics Association.

(4) The commissioner of education or designee and the executive director of the Kentucky High School Athletics Association shall identify the work group members within thirty (30) days of the effective date of this Act.

(5) The Association shall submit a written report to include findings and recommendations to the Interim Joint Committee on Education by October 30, 2009. The report shall include but not be limited to recommendations to improve the safety of students participating in high school athletics and any legislation that might be necessary to implement the recommendations.

➔SECTION 2. A NEW SECTION OF KRS CHAPTER 160 IS CREATED TO READ AS FOLLOWS:

(1) The Kentucky Board of Education or organization or agency designated by the board to manage interscholastic athletics shall require each high school coach to complete a sports safety course consisting of training on how to prevent common injuries. The content of the course shall include but not be limited to emergency planning, heat and cold illnesses, emergency recognition, head injuries, neck injuries, facial injuries, and principles of first aid. The course shall also be focused on safety education and shall not include coaching principles.

(2) The state board or its agency shall:

(a) Establish a minimum timeline for a coach to complete the course;

(b) Approve providers of a sports safety course;

(c) Be responsible for ensuring that an approved course is taught by qualified professionals who shall either be certified athletic trainers, registered nurses, physicians, or physician's assistants licensed to practice in Kentucky; and

(d) Establish the minimum qualifying score for successful course completion.

(3) A course shall be reviewed for updates at least once every thirty (30) months and revised if needed.

(4) A course shall be able to be completed through hands-on or on-line teaching methods in ten (10) clock hours or less.

(5) (a) A course shall include an end-of-course examination with a minimum qualifying score for successful course completion established by the board or its agency.

(b) All coaches shall be required to take the end-of-course examination and shall obtain at least the minimum qualifying score.

(6) Beginning with the 2009-2010 school year, at least one (1) person who has completed the course shall be at every high school athletic practice and competition.

➔Section 3. Whereas there is no existing requirement for a medical professional to be on-site during high school athletic events and the safety of student athletes is sometimes compromised, an emergency is declared to exist and this Act takes effect upon its passage and approval by the Governor or upon its otherwise becoming a law.

Sports Safety Work Group
Meeting Minutes
May 4, 2009

KHSAA Commissioner Brigid DeVries and Michael Dailey from the Kentucky Department of Education convened the first meeting of the Sports Safety Work Group ("committee") on Monday, May 4 at 2:00 p.m. at the KHSAA office in Lexington. Commissioner DeVries welcomed the members of the committee and provided a brief overview on the agenda and materials for the meeting. Members of the committee present were Kentucky Department of Education members Michael Dailey, Bridgette Combs Stacy and Darryl Thompson; Kentucky Board of Education Member Dorie Combs; KHSAA Board of Control Members Lonnie Burgett, Dave Weedman and Lea Prewitt; Warren County Superintendent Dale Brown; Kentucky Medical Association members Dr. Pete Bowles, Dr. Michael Miller, and Dr. Ben Kibler; Anderson County Head Football Coach Mark Peach; Jefferson County Public Schools Director of Athletics and Activities Jerry Wyman; Certified Athletic Trainers Sheri McNew, Greg Rose, Bob Barton and Tom Steltenkamp. Also present were KHSAA Assistant Commissioners Julian Tackett, Michael Barren, Darren Bilberry and Sports Information Director Elden May. Committee members unable to attend were Doug Hubbard and Austin Moss from the Kentucky Board of Education. Each committee member introduced themselves and talked about their affiliation, credentials and interest in serving on this important committee.

The first item on the agenda was a discussion on the interpretation and stipulations contained in House Bill 383. Discussion included the timeline outlined in Section 1 of the bill, so that everyone on the committee was clear about the intent and scope of the bill. Ms. DeVries coordinated the discussion on the specific language in the bill item by item, including the requirements for the upcoming 2009-10 school year contained in Section 2 of the bill. The committee discussed the aggressive timeline which is less than optimal for implementation. The October 1, 2009, deadline for the submission of a final report and findings of the committee to the Interim Joint Committee on Education will likely necessitate regular meetings by the committee. The committee further discussed the specifics listed in Section 2 of HB 383, which states that *"The Kentucky Board of Education or organization or agency designated by the board to manage interscholastic athletics shall require each high school coach to complete a sports safety course consisting of training on how to prevent common injuries. The content of the course shall include but not be limited to emergency planning, heat and cold illnesses, emergency recognition, head injuries, neck injuries, facial injuries and principles of first aid."* The provisions in Section 2 prompted discussion among the committee regarding the terminology mentioned in the bill. As an example, Sheri McNew requested an interpretation on what constitutes a practice including offseason conditioning etc. Dale Brown raised the question of who is identified as a coach within the language of bill. The committee agreed to prepare a set of suggested definitions for review at the next meeting to address some of the ambiguities in the bill.

The next item on the agenda was a discussion of current KHSAA Coaching Education Requirements. Michael Dailey read the wording of the current KHSAA By-Law 27, as well as the proposed changes that are scheduled to go before the Administrative Regulation Review Subcommittee at May 12, 2009. Among the changes are wording that includes AED/CPR training and a coaching safety requirement. Commissioner

DeVries noted both provisions will be easily enforced beginning in the fall of 2009. For coaches, only CPR training that includes use of AED'S will be accepted for certification while all newly hired coaches must complete the sports safety requirement before being allowed to coach.

Julian Tackett informed the group that by July 15, (the start of fall practice for the 2009-10 school years) an online sports safety course in development by the Kentucky Medical Association will be available, so that at least one person who has completed the course, or is eligible to teach the course, can be at every high school athletic practice and competition. Darryl Thompson requested a clarification about the enforcement of the provision and whether or not practice must cease if a qualified person was not present. Mr. Tackett shared that by the Legislative Research Committee's interpretation, the answer is that there is no practice or participation in contests unless a coach is in compliance with the requirement. Brigid DeVries stressed that while an online course will be available to certify personnel in time to satisfy the requirements of the law this year, it will be the responsibility of the committee to make recommendations for the best long-term curriculum. In addition, by July 15, an online coaching registry will be developed by the KHSAA to track and update the completion of all coaching requirements by each school and district. The committee made the recommendation that since the course materials must be reviewed every 30 months, the recommendation for re-certification by coaches be every two years.

Michael Dailey led the discussion on Section I of HB 383 along with other topics listed in the bill that the committee needed to review and report on for the safety study. To comply with one of the items for study in the bill, Julian Tackett suggested obtaining national sports injury information from Dr. Fred Mueller from North Carolina and Dawn Comstock, a professor for The Ohio State University who conducts research for the National Federation of High Schools. The data will be analyzed for trends and potential impact on sports safety in Kentucky. A link to this data will be provided to committee members.

In the interest of more efficient communication, Commissioner DeVries suggested that the group split into smaller committees and review current sports safety courses in time for the next meeting. Bridgette Combs Stacy, Dr. Philip Hurley, Tom Steltenkamp and Dr. Pete Bowles will review the Red Cross course; Bob Barton and Dr. Ben Kibler will review the ACEP course; and Greg Rose and Sherry McNew agreed to review the American Sport Education Program. Dale Brown, Darryl Thompson, Jerry Wyman, Dorie Combs, Lonnie Burgett, Dave Weedman and Mark Peach will study the educational impact and implementation of the new regulations. The KHSAA staff agreed to obtain state and national sports injury data.

The next Sports Safety Work Group committee will meet on June 1, 2009 at 1:30 p.m. at the KHSAA office in Lexington.

The meeting adjourned at 4:05 p.m.

Sports Safety Work Group
Minutes
June 1, 2009

KHSAA Commissioner Brigid DeVries and Michael Dailey from the Kentucky Department of Education convened the second meeting of the Sports Safety Work Group ("committee") on Monday, June 1 at 1:30 p.m. at the KHSAA office in Lexington. Commissioner DeVries welcomed the members of the committee and provided an overview of the agenda and materials for the meeting.

Members of the committee present were Kentucky Department of Education members Michael Dailey, Brigette Combs Stacy and Darryl Thompson; Kentucky Board of Education members Dorie Combs and Doug Hubbard; KHSAA Board of Control Members Lonnie Burgett, Dave Weedman and Lea Wise Prewitt; Notre Dame Academy Soccer Coach Sara Raaker, Kentucky Medical Association Members Dr. Pete Bowles, Dr. Philip Hurley and Dr. Ben Kibler; Anderson County Head Football coach Mark Peach; Jefferson County Public Schools Director of Athletics and Activities Jerry Wyman; Certified Athletic Trainers Sheri McNew, Greg Rose Bob Barton and Tom Steltenkamp. Also present were KHSAA Assistant Commissioners Michael Barren, Darren Bilberry, Butch Cope, Sports Information Director Elden May, Information Technology Coordinator Rob Catron with guest Lexington Herald-Leader reporter Valerie Honeycutt Spears. Committee members Dr. Michael Miller, Superintendent of Warren County Schools Dale Brown and Kentucky Board of Education member Austin Moss were unable to attend.

The first item on the agenda was a review of existing sports safety programs and the positive and negative aspects of each. As assigned in the first Sports Safety Workgroup Meeting, Bob Barton and Dr. Ben Kibler analyzed the American Coaching Education Program (ACEP) and reported their findings to the committee. The findings were positive about the program overall and very thorough but the section about heat illnesses was a bit weak. There were also concerns about how the ACEP program could satisfy the requirements of House Bill 383 because the program has no capability for online testing. Much of the training for instructors would likely have to take place out of state, something that could cause financial hardship or drive up the cost for the program.

Dr. Pete Bowles, Tom Steltenkamp, Bridgette Combs Stacy and Dr. Philip Hurley reviewed the American Red Cross course. The positives for the Red Cross program included a hybrid online element as well as face-to-face instruction. There is also a cost of $50 per individual taking the course and the Red Cross does not allow instructors to tailor the course. In the case that an instructor changes anything from the course presentation, that person could lose certification with the Red Cross. Greg Rose and Sherry McNew reported their findings of the American Sport Education Program. They expressed concern over the cost per coach ($86 per coach) as well as the fact the program does not address prevention of injuries.

Barton mentioned the fact that the Ohio High School Athletic Association developed a course itself, that took elements of many existing courses and tailored them to the personnel and situations unique to Ohio. The course covered the basic guidelines of sport safety. Barton said it was not as in-depth as the existing programs but it provided a lot of flexibility.

Dr. Ben Kibler showed the committee one Power Point segment of the Sports Safety course in development by the Kentucky Medical Association for the 2009-10 school year. Upon its conclusion Commissioner DeVries told the committee of the plan for implementation. July through October will be the first phase of implementation and will meet the minimum requirement of the law. The feedback received from the first wave of coaches who complete the course will allow designers of the course to make any changes or adjustments necessary as the year goes along.

The next agenda item dealt with Committee Assignments for House Bill 383 topics and a discussion of terminology. Among the definitions discussed were arriving at the definition of who is considered a coach, what constitutes a practice and what determines a competition. A new definition that was recommended by Jerry Wyman was the need to define a school-sponsored activity. In the Jefferson County Public School district, Wyman defines sports as 'school-sponsored' for insurance purposes as anything occurring after school that is done in connection with a school. In their case it includes varsity and junior varsity athletics, band, club sports and school clubs. Jefferson County is requiring all supervisors of a school-sponsored activity to complete the safety course before being allowed to coach in the county.

The next agenda item was a look at the Virginia High School League Heat Guide and how it compares and contrasts to the policy currently in place in Kentucky. While the policy in Virginia has lower heat index thresholds than Kentucky, it is not required of member schools in that state to abide by it. Committee members will review the policy and discuss it at the next meeting, scheduled for Thursday, July 9 at 1:30 p.m.

With no further business on the agenda, the meeting adjourned at 4:20 p.m.

Sports Safety Work Group
Minutes
July 9, 2009

KHSAA Commissioner Brigid DeVries convened the third meeting of the Sports Safety Work Group ("committee") on Thursday, July 9 at 1:30 p.m. at the KHSAA office in Lexington. Commissioner DeVries welcomed the members of the committee and provided an overview of the agenda and materials for the meeting.

Members of the Committee present were Kentucky Department of Education members Brigette Combs Stacy and Darryl Thompson; Kentucky Board of Education members Dorie Combs and Doug Hubbard; KHSAA; KHSAA Board of Control member Lea Wise Prewitt; Kentucky Medical Association members Dr. Pete Bowles and Dr. Phillip Hurley; Anderson County Head Football Coach Mark Peach; Certified Athletic Trainers Greg Rose and Bob Barton; Warren County Schools Superintendent Dale Brown and Mayfield Independent Schools Superintendent Lonnie Burgett. Also present were KHSAA Assistant Commissioners Julian Tackett, Butch Cope, Michael Barren and Darren Bilberry, along with Sports Information Director Elden May. Louisville Courier-Journal environmental reporter James Bruggers was attending as a guest. Committee members Dr. Michael Miller, Kentucky Department of Education member Michael Dailey; Kentucky Board of Education member Austin Moss; KHSAA Board of Control member Dave Weedman; Notre Dame Academy Soccer Coach Sara Raaker; Jefferson County Public Schools Director of Athletics and Activities Jerry Wyman; Certified Athletic Trainers Sheri McNew and Tom Steltenkamp were unable to attend.

The first item on the agenda was an update on the 2009-10 Sports Safety Course, including course certification and technology. Julian Tackett explained the process of how users initially log in providing a user name and password, and school affiliation. Once an individual completes that process they may begin to take the course. The Sports Safety Course contains seven (7) modules – Emergency Planning, Sports First Aid Elements, Recognizing Athletic Emergencies, Heat Illness, Head and Neck Injuries, Facial Injuries, and MRSA and Skin Conditions. Mr. Tackett demonstrated how the program and testing elements function by showing the entire "Heat Related Illness" module to the group. A point was raised by Dorie Combs about whether the questions would always appear in the same order, raising the possibility of a group taking the course together and sharing the answers. Mr. Tackett said the issue was addressed in the design stages and the questions were programmed to appear in random order, and included multiple choice options. Mr. Tackett also demonstrated the administration pages that display overall the numbers of people who have completed the course. It also includes a page that school administrators can log onto and see how many modules each coach within the school system has completed. A total of 1,637 coaches had signed up for the course and 1,386 had entered information while 870 had completed all seven modules as of July 9, 2009.

The second agenda item included committee reports on study requirements listed in HB 383. From Item E of the bill, "Education for High School Coaches," Butch Cope gave a demonstration of some of the educational materials available on the KHSAA website, including a short video about proper hydration from the Gatorade Sports Science Institute. This video, along with other information is shared with school personnel on a regular basis at the Annual Meeting, required principal's meetings, rules clinics, etc.

Dr. Pete Bowles then talked about the newest Kentucky Medical Association recommendations for cooling methods for student-athletes. The KMA detailed the methods in a press release issued in late June. Essential recommendations include establishing a written plan for treatment of Exertional Heat Stroke (EHS), assess environmental conditions and know when a danger exists, identify a specific spot at the athletic facility that has shade, have immediate access to ice and bags that contain ice, have access to water and provide water breaks as outlined in the KMA/KHSAA Heat Illness and Prevention Policy, and know the most effective site for application of ice on the body.

Dr. Bowles also opened the discussion on an Air Quality Index and its effect on outdoor activity. Dr. Bowles stated that he had a conversation with Dr. Tom Fitzgerald, who is one of the foremost authorities on the subject of air quality. He stated that as far as he was concerned, the scientific data that Dr. Fitzgerald had compiled was very thorough and the Air Quality Index and readily available to the general public to review. Because of that, he indicated there is no reason to reinvent the wheel and asked for a consensus of the committee on adopting air quality index along with the current heat index policy. Dorie Combs suggested that the committee review the Air Quality information on the subject before making a decision or recommendation and asked Dr. Bowles how air quality index is measured. Bowles said air quality index has a level, above 100 on the scale, where no outside activity is recommended. However, unlike the heat index, it is his understanding that the air quality index is only measured in seven or eight areas in Kentucky where high levels of pollution are known to exist and are monitored.

Mark Peach also raised the question of information inconsistency as coaches are required to measure heat index on site and submit the form to the KHSAA, while the air quality index would be not be measured on site and instead taken from a website.

The group decided the next step should be a review of the history of the air quality index around the state and look at a comparison of schools might have been forced to cancel or curtail activities due to high readings. Dr. Bowles added that it would be a good idea to get additional information from Dr. Fitzgerald and discuss it at the next meeting.

Ms. Combs also reported that much of the information from NASBE (National Association of State Boards of Education) did not have any information that was different than the sports safety information the group was already reviewing.

From Item D of HB 383, Julian Tackett presented information from reports compiled by Dawn Comstock and Dr. Fred Mueller regarding sports injuries. One of the common threads in compiling high school injury data is that many are not reported, making information difficult to compile on specific injuries and causes. Among the reasons for this are liability issues, as well as the fact that, unlike collegiate and professional athletes, high school athletes are not adults and privacy issues come into play. However, one of the more alarming trends Ms. Comstock is finding is that cheerleading is the second-most common sport for serious injuries, or injuries that require a trip to an emergency room or hospitalization.

The next agenda item was discussion of other information, including the Virginia High School League ("VHSL") Heat Guide. Julian Tackett noted the ("VHSL") guide was actually a recommendation, not a regulation, and did not address situations state-wide for Virginia.

Dr. Phillip Hurley made the recommendation that the group wait until its August meeting to continue discussing definitions, since individuals on that committee were unable to attend the July meeting.

Middle School Access to the Sports Safety Course was a topic of discussion. The language of HB 383 includes middle schools but the KHSAA only has jurisdiction over grades 9-12. Brigette Combs Stacy asked the members of the Kentucky Board of Education if it was too late to place this item on the agenda for discussion at its August meeting. Doug Hubbard, Chairman of the KBE, confirmed the issue will be addressed, if not at the August meeting, at a subsequent meeting.

Bob Barton suggested that group members are continuing to study the information available in the various safety courses on the market, as well as the one developed by KMA. Mr. Barton submitted a written report regarding the safety course review to date. The group will discuss it at the next meeting, scheduled for August 10 at 1:30 p.m. at the KHSAA office.

With no further business on the agenda, the meeting adjourned at 4:40 p.m.

Sports Safety Work Group
Minutes
August 10, 2009

KHSAA Commissioner Brigid DeVries convened the fourth meeting of the Sports Safety Work Group ("committee") on Monday, August 10, 2009 at 1:40 p.m. at the KHSAA office in Lexington. Commissioner DeVries welcomed the members of the committee and provided an overview of the agenda and materials for the meeting.

Members of the committee present were Michael Dailey, Brigette Combs Stacy and Darryl Thompson from the Kentucky Department of Education; Doug Hubbard and Dorothy Combs from the Kentucky Board of Education; Kentucky Medical Association members Dr. Pete Bowles, Dr. Michael Miller and Dr. Phillip Hurley; Certified Athletic Trainers Bob Barton, Greg Rose and Tom Steltenkamp; KHSAA Board of Control President Dave Weedman; Anderson County Head Football Coach Mark Peach; Notre Dame Academy Soccer Coach Sara Raaker; Jefferson County Public Schools Director of Athletics and Activities Jerry Wyman and Mayfield Independent Schools Superintendent Lonnie Burgett. Also in attendance were KHSAA Assistant Commissioners Michael Barren, Julian Tackett, Butch Cope and Darren Bilberry; as well as KHSAA Sports Information Director Elden May. Guests included Assistant Professor at Eastern Kentucky University Dr. Eric Fuchs, Paige Short, Dr. David Bensema, Tom Evans, David Foley and Dan Short from IONX International, Inc, as well as Bill Collins and former Kentucky Governor Martha Layne Collins. Committee members Austin Moss from the Kentucky Board of Education, KHSAA Board of Control member Lea Wise Prewitt, Warren County Schools Superintendent Dale Brown, Dr. Ben Kibler and Certified Trainer Sheri McNew were unable to attend.

Ms. DeVries directed committee members to view the Health and Safety Items distributed prior to the meeting, including position statements from the National Federation of High Schools regarding anabolic steroids, supplements and invasive medical procedures on the day of competition, as well as the 2008 Consensus Statement on Concussion in Sport.

The second item on the agenda was an update on the 2009-10 Sports Safety Course. Julian Tackett explained there were minimal problems accessing the course after the initial wave of customer support questions following its launch on July 2. The only issue with the course early on was the fact that information was not getting to coaches who registered for the course using a Hotmail or MSN email account due to the stringent SPAM filter policies of each account. Mr. Tackett explained a phone call to Microsoft Tech Support had eliminated the issue one that company became aware that information coming from the KHSAA to those accounts was not SPAM. The issue of SPAM blockers on email accounts and web browsers is something users must be cognizant of, especially those using state accounts, explained Mr. Tackett. The perception of the state government system being one massive unit that is easily controlled is false; in fact, it is a system made of hundreds of small units interacting, each with its own specialized SPAM blockers. To date, more than 6,000 coaches have completed the course with another spike expected before the winter and spring sports seasons begin. Dave Weedman commented that among the coaches and administrators he has communicated with, the overall feeling is positive from coaches. Individuals taking the course expressed much appreciation for the flexibility allowed in the time and location the course may be taken. Dorie Combs was complementary to Mr. Tackett and the doctors at the Kentucky Medical Association for their ability to compile such a course and give the user so many flexible options, with the result of 6,000 completions all within a nine-week time frame.

The third agenda item was a committee update from the sub-committees charged with the task of researching the specific bullet-point topics as outlined in House Bill 383. Brigette Combs Stacy provided the group with an update on Item E (education for high school coaches, volunteers, parents, and student athletes relating to nutrition, weight training, and the dangers of steroids, and other illegal supplements). Ms. Stacy stated that the committee's research had found that specific education in this area targeted toward student-athletes is rare, though there are numerous resources available that could be utilized more. Students are currently getting limited information on the subject in their health and physical education classes. However, the information is tailored for the entire student body and more general in nature, with next to nothing mentioned about proper weight training.

The committee recommended that the Youth Service Centers available at more than 200 Kentucky High Schools, as well as Kentucky Regional Prevention Centers and agencies such as Operation Unite, could be utilized in that area. The youth service centers provide services to 29 counties in southeastern Kentucky. State agencies also may distribute additional information but it will be up to the coaches, administrators and parents to seek out these resources. The committee noted that some schools have tried random drug testing of students with varying degrees of success.

Ms. Stacy concluded the problem is not that resources do not exist to remedy the situation – they just are not being utilized properly.

Mike Barren gave the group an update on definitions that are acceptable when discussing the language of HB 383 and the items referenced within it. The definition of "coach" shall be tied to the language used by the KHSAA to define a coach. There is no such thing as a volunteer coach – only Level 1 (head) and Level 2 (assistant) coaches. As a result, the sub-committee recommended that schools have all coaches take the Sports Safety Course and strongly encourage its middle school coaches to take the course too. This recommendation could also extend to dance, band and other school sponsored activities, basically anyone with direct supervision of students. Dorie Combs suggested the definition of a coach needs to be put in the Kentucky Board of Education regulations so this may cover all schools. The KHSAA only has jurisdiction over high schools. Mr. Barren also said the subcommittee agreed, that when speaking of Certified Athletic Trainers, the only people who may be referred to as certified are those who hold a state license.

The next agenda item featured a presentation from David Bensema, MD, describing a new body temperature alert patch by iDOT® that warns the user if they are getting close to overheating or showing signs of hypothermia. Mr. Bensema, a heat stroke survivor, explained how the patch functions. The patch uses Thermo-Chromatic paint that changes color once a temperature threshold is met, in this instance a 103.5 degree internal body temperature. The patch is placed on the wrist or the neck of the competitor and is normally black in color. If a temperature reaches unhealthy levels, the patch turns yellow and can be easily seen from up to 60 meters away. Dr. Bensema stated the patch is currently being used on an experimental basis this summer at Cincinnati Bengals, Pittsburgh Steelers and University of Kentucky football training camps. Currently the cost of each patch is 25 to 33 cents each, with discounts for bulk purchases. The product has been approved by the Food and Drug Administration and is awaiting a patent.

Mr. Tom Fitzgerald, an attorney who teaches environmental law at the University of Louisville, presented Air Quality Information to the group. Fitzgerald described the EPA Air Quality Index and how it works. For instance, a reading of 100-150 is unhealthy for people with breathing problems; 150-200 is unhealthy for active people. Mr. Fitzgerald explained many of Kentucky's air quality problems are in river valleys, where air tends to be stagnant. Currently the EPA monitors air quality in seven Kentucky areas – Ashland, Northern Kentucky, Paducah, Owensboro, Pikeville, Lexington and Bowling Green. The Louisville metro area has its own air quality monitoring stations. The public may get an Air Quality Index reading in real time at eppcapp.ky.gov/daq and Mr. Fitzgerald urged coaches to check the reading before every practice and if the reading is at an unhealthy level, make alternate practice plans that avoid endurance activities that day. Mr. Tackett asked what the parameters of an air quality region were. Mr. Fitzgerald explained the EPA divides areas into regions, often several counties, and monitors the air quality. For example, Ashland is in the Huntington, WV region consisting of Boyd and Greenup counties in northeastern Kentucky along with counties in southern Ohio and western West Virginia. Dr. Michael Miller asked Dr. Fitzgerald if this recommendation is for all children or just those susceptible to breathing problems. Mr. Fitzgerald explained he would like to see it across the board for all kids in every county as part of the heat rules that currently govern KHSAA activities. He has also stated that it would need to apply equally to all schools so not to give one school an advantage over another. Dr. Philip Hurley asked if there is a correlation between heat index and air quality. Mr. Fitzgerald explained while there was a correlation, one does not necessarily trump the other. While heat index could be day to day, air quality could be a multiple day issue due to stagnant air. Doug Hubbard asked if the technology is available to monitor air quality at every location statewide and Mr. Fitzgerald said currently measuring mechanisms cost several thousand dollars each and would make such a plan unfeasible. Aside from the seven areas currently monitored, the rest of the state is non-classified, or has no history of air quality problems and is therefore not monitored. Mr. Fitzgerald asked Mr. Tackett if the group could provide him with a map of schools that would be affected in each of the areas so he would analyze and provide data to the group on the relationship between air quality and heat index. Mr. Fitzgerald also agreed to rework an existing Air Quality Plan in place by the state of Idaho and provide specific details for what coaches need to do if unhealthy air quality levels exist.

Eric Fuchs then gave a presentation to the group detailing an existing study by the University of Georgia Department of Kinesiology on the effects of EHI (Exertional Heat Illness). Among the findings were: EHI is three times higher in the southeastern United States than any other area; athletes are at three times more risk to develop EHI in August and days 6-13 of football practice had 82 percent of all EHI cases. An additional NCAA study found that EHI rates were 1.5 times higher for athletes in Division I than Division III, due in part to earlier start times for practice. Mr. Fuchs expressed interest in conducting a three-year study of high school athletes in Kentucky because of the July 15 date for the start of fall sports practice. Fuchs estimated a study would cost $185,000, including $100,000 for the first year. The group was receptive to the idea, but Ms. DeVries cautioned that funding might be a problem. The group felt that they might consider recommending to the legislature a study of this issue with the hope that seed money might be found to fund it.

Mr. Tackett discussed the North Carolina High School Athletic Association policy regarding sports safety, and the importance of each school developing and implementing an Emergency Action Plan. The first five minutes of a medical emergency are the most crucial to keeping a person alive. Schools not only need to have a plan but to also practice it with the appropriate personnel.

Ms. DeVries opened the floor for miscellaneous items and Greg Rose suggested the group recommend an amendment to the Practice Act as part of its final report. In short, Rose said the language of the current law states that the only place an athletic trainer can be a trainer is at an educational institution. A local hospital recently released a certified trainer due to budget constraints, forcing the local school district to scramble to find trainer services for the 2009-10 school year. Mr. Rose stated that if the law were amended to allow an athletic trainer to bill for services, it would keep medical clinics from footing the entire bill. Rose stressed the point that certified athletic trainers still will not bill for athletic training services. Ms. DeVries suggested the certified athletic trainers in the group consult with KHSAA General Counsel George Fletcher after the meeting to determine what the appropriate steps would be to propose a change in legislation.

The group decided to meet again on Tuesday, Sept. 1, 2009, at 10 a.m. at the KHSAA office in Lexington.

With no further business to discuss, the Sports Safety Work Group meeting adjourned at 4:40 p.m.

Sports Safety Work Group
Meeting Minutes
September 1, 2009

KHSAA Commissioner Brigid DeVries convened the fifth meeting of the Sports Safety Work Group ("SSWG") on Tuesday, September 1, 2009 at 10:00 a.m. at the KHSAA office in Lexington. Commissioner DeVries welcomed the members of the committee and provided an overview of the agenda and materials for the meeting.

Members of the SSWG present were Michael Dailey, Brigette Combs Stacy and Darryl Thompson from the Kentucky Department of Education; Doug Hubbard from the Kentucky Board of Education; Dr. Phillip Hurley from the Kentucky Medical Association; Certified Athletic Trainers Bob Barton, Greg Rose, Tom Steltenkamp and Sheri McNew; KHSAA Board of Control member Lea Wise Prewitt; Anderson County Head Football Coach Mark Peach; Jefferson County Public Schools Director of Athletics and Activities Jerry Wyman and Mayfield Independent Schools Superintendent Lonnie Burgett. Also in attendance were KHSAA Assistant Commissioners Michael Barren, Julian Tackett, Butch Cope and Darren Bilberry; as well as KHSAA Sports Information Director Elden May. Committee members Austin Moss and Dorie Combs from the Kentucky Board of Education, Notre Dame Academy Soccer Coach Sara Raaker, KHSAA Board of Control president Dave Weedman, Warren County Schools Superintendent Dale Brown, Dr. Ben Kibler, Dr. Pete Bowles and Dr. Michael Miller were unable to attend. Guests included Jennifer Stewart.

Ms. DeVries directed committee members to review the items for study by the committee, including topics not covered to date.

The second agenda item included an extensive review of the preliminary draft and format for the October 1, 2009 report due to the legislative subcommittee. KHSAA Sports Information Director Elden May addressed the group and explained the process behind how the draft of the report was compiled and solicited suggestions from the committee for additional information. The committee had a chance to review, discuss and edit the report.

Committee members addressed the legislation point-by-point, as outlined in HB 383.

The third agenda item addressed preliminary recommendations from the Committee. Julian Tackett gave an update on the Sports Safety Course and reported that more than 6,500 coaches have completed the course to date, with an expected surge of winter sports coaches beginning to take the course. Basketball coaches likely constitute the largest group of coaches in Kentucky and a total similar to if not exceeding the number of fall sports coaches is expected.

The SSWG discussed recommending an emergency plan be required to be in place at all schools. The recommendation states that the KHSAA should require its members by June 30, 2010. It was suggested that schools could electronically submit their emergency plan for its athletic facilities to the KHSAA and be available for other schools to use in developing similar plans. Brigette Combs Stacy suggested the KHSAA work with the Kentucky Center for School Safety, which already requires every school council to have an Emergency Safety Plan and a Plan for Incidents on file with the Site Based Decision Making Council. Michael Dailey agreed, adding that the legislature would appreciate a linkage to existing educational infrastructure. Utilizing existing information could make the effort much more efficient.

The SSWG also examined recommendations made regarding air quality. The proposed recommendation states that the KHSAA should work with the Environmental Protection Cabinet to identify areas of the state affected by the Ambient Air Quality warnings and information. It could then work with Environmental Protection to integrate data from Jefferson County along with other counties into the KHSAA website with notification mechanisms. Mr. Tackett suggested a third component of the recommendation based on discussions at the last meeting with Mr. Tom Fitzgerald would be to distribute a model plan detailing a procedure for what to do when air quality conditions reach unhealthy levels. The state of Idaho currently has a plan in place and Mr. Fitzgerald agreed to develop a plan specific to Kentucky. Mr. Fitzgerald has not submitted additional information to date.

Darryl Thompson suggested that further clarification is needed to be included in the definitions of high school, middle school and secondary school when discussing sports safety at the middle school level for the final Sports Safety Work Group report. Julian Tackett suggested that the recommendations included in the report denote a connection to high school athletes, while a separate part of the report could contain recommendations for middle schools. A mechanism to ensure information is reaching coaches and athletes at the middle school level could be developed and would be appropriate

The SSWG agreed to meet again on Tuesday, Sept. 15, 2009 at 10 a.m. with the option for additional meetings leading up to the Oct. 1 deadline for the final report to the legislature.

With no further business to discuss, the meeting adjourned at 1:20 p.m.

Sports Safety Work Group
Meeting Minutes
September 15, 2009

KHSAA Commissioner Brigid DeVries convened the sixth meeting of the Sports Safety Work Group ("SSWG") on Tuesday, September 15, 2009 at 10:00 a.m. at the KHSAA office in Lexington. Commissioner DeVries welcomed the members of the committee and provided an overview of the agenda and materials for the meeting.

Members of the SSWG present were Brigette Combs Stacy from the Kentucky Department of Education; Doug Hubbard from the Kentucky Board of Education; Certified Athletic Trainers Bob Barton, Greg Rose, Tom Steltenkamp and Sheri McNew; KHSAA Board of Control member Lea Wise Prewitt; Anderson County Head Football Coach Mark Peach;. Also in attendance were KHSAA Assistant Commissioners Michael Barren, Julian Tackett, Butch Cope and Darren Bilberry; as well as KHSAA Sports Information Director Elden May. Committee members Michael Dailey and Daryl Thompson from the Kentucky Department of Education. The following members were unable to attend: Austin Moss and Dorie Combs from the Kentucky Board of Education; Notre Dame Academy Soccer Coach Sara Raaker; KHSAA Board of Control president Dave Weedman; Jefferson County Public Schools Director of Athletics and Activities Jerry Wyman; Mayfield Independent Schools Superintendent Lonnie Burgett; Warren County Schools Superintendent Dale Brown; Dr. Ben Kibler, Dr. Pete Bowles, Dr. Philip Hurley and Dr. Michael Miller.

The SSWG heard a presentation from Jennifer McKeon, PhD, an associate professor at the University of Kentucky. McKeon detailed the findings of the Fayette County Injury Surveillance System (an athletic injury study) conducted at seven central Kentucky high schools. The study compiled injury data reported by athletic trainers for athletes that participated in football, soccer, volleyball, cross country, basketball, wrestling, baseball, softball, track and field and golf during the 2007-08 school year. Injuries were reported on a standardized injury evaluation form. The study, now in its fourth year, revealed several important findings, among them: a) injury surveillance is possible at the high school level at high schools with athletic trainers providing 'every day coverage,' b) injury surveillance is not possible when left to be reported by coaches/athletes, and c) can injury surveillance be possible at schools with an athletic trainer that comes one time per week or less (the level of coverage at most Kentucky high schools). Further study has been proposed, narrowing the number of sports, but comes at a cost of $80,000 for four schools and $20,000 for one sport.

The next agenda item included an extensive review of the preliminary draft and format for the October 1, 2009 report due to the legislative subcommittee. Ms. DeVries addressed the group and explained the process behind how the draft of the report was compiled and solicited suggestions from the committee for additional information, as well as revisions to the existing draft.

The SSWG then had a chance to review, discuss and edit the report. SSWG members discussed each item listed in the report draft and proposed changes for content, style, grammar and flow.

The SSWG agreed to meet again on Thursday, October 1, 2009 at a time to be determined so the group can make final revisions of the final report due to the legislature.

With no further business to discuss, the meeting adjourned at 1:40 p.m.

Sports Safety Work Group
Meeting Minutes
October 1, 2009

KHSAA Commissioner Brigid DeVries convened the seventh meeting of the Sports Safety Work Group ("SSWG") on Thursday, October 1, 2009 at 4:30 p.m. at the KHSAA office in Lexington. Commissioner DeVries welcomed the members of the committee and provided an overview of the agenda and materials for the meeting.

Members of the SSWG present were Brigette Combs Stacy and Darryl Thompson from the Kentucky Department of Education; Dorie Combs from the Kentucky Board of Education; Certified Athletic Trainers Bob Barton, Greg Rose, Tom Steltenkamp and Sheri McNew; KHSAA Board of Control member Lea Wise Prewitt; Dr. Pete Bowles, Dr. Philip Hurley and Dr. Michael Miller; Notre Dame Academy Soccer Coach Sara Raaker and Mayfield Independent Schools Superintendent Lonnie Burgett. Also in attendance were KHSAA Assistant Commissioners Michael Barren, Julian Tackett, Butch Cope and Darren Bilberry; as well as KHSAA Sports Information Director Elden May. The following committee members were unable to attend: Michael Dailey from the Kentucky Department of Education; Austin Moss and Dorie Combs from the Kentucky Board of Education; Anderson County Head Football Coach Mark Peach, KHSAA Board of Control president Dave Weedman; Jefferson County Public Schools Director of Athletics and Activities Jerry Wyman; Warren County Schools Superintendent Dale Brown and Dr. Ben Kibler. Attending as a guest was Jon Akers, Executive Director of the Kentucky Center for School Safety.

The SSWG heard a presentation from Jon Akers, Executive Director of the Kentucky Center for School Safety. Mr. Akers discussed existing Emergency Preparation Plans for Kentucky public school districts. One of his concerns was the fact that their emphasis was on coverage dealing with situations that may occur through the course of the normal school day, but don't normally address after school activities, including athletics. Details for coverage of extra-curricular activities and crisis situations that may arise are not covered in most plans. Mr. Akers said Kentucky is collaborating with other states and entities including the National Center of Sport and Spectator Safety (Mississippi), which has helped to develop emergency plans for every NCAA Division I and I-AA institution. This collaboration will allow the Kentucky Center for School Safety to study possible ways to develop new plans for after school activities and athletics to cover such situations at Kentucky high schools. He also said the University of Southern Mississippi has taken the lead in the field of Emergency Preparedness and is working with collaboration partners for grant funding through the US Department of Homeland Security.

The next agenda item included an extensive review of the preliminary draft and format for the October 30, 2009, report due to the co-chairs of the Interim Joint Committee on Education. Ms. DeVries addressed the group and explained the changes that have been made to the draft since the last meeting and solicited suggestions from the committee for additional information, as well as revisions to the existing draft.

The SSWG then had a chance to review, discuss and edit the report. SSWG members discussed each item listed in the report draft and proposed changes for content, style, grammar and flow.

With no further business to discuss, the meeting adjourned at 7 p.m.

CATASTROPHIC

SPORTS INJURY RESEARCH

TWENTY-FIFTH ANNUAL REPORT

FALL 1982 - SPRING 2007

WWW.UNC.EDU/DEPTS/NCCSI

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National Federation of State High School Associations

Introduction

In 1931 the American Football Coaches Association initiated the First Annual Survey of Football Fatalities and this research has been conducted at the University of North Carolina at Chapel Hill since 1965. In 1977 the National Collegiate Athletic Association initiated a National Survey of Catastrophic Football Injuries, which is also conducted at the University of North Carolina. As a result of these research projects important contributions to the sport of football have been made. Most notable have been the 1976 rule changes, the football helmet standard, improved medical care for the participants, and better coaching techniques.

Due to the success of these two football projects the research was expanded to all sports for both men and women, and a National Center for Catastrophic Sports Injury Research was established in 1982. The decision to expand the research was based on the following factors:

1. Research based on reliable data is essential if progress is to be made in sports safety.
2. The paucity of information on injuries in all sports.
3. The rapid expansion and lack of injury information in women's sports.

For the purpose of this research the term catastrophic is defined as any severe injury incurred during participation in a school/college sponsored sport. Catastrophic will be divided into the following three definitions:

1. **Fatality**
2. **Non-Fatal** - permanent severe functional disability.
3. **Serious** - no permanent functional disability but severe injury. An example would be fractured cervical vertebra with no paralysis.

Sports injuries are also considered direct or indirect. The definition for direct and indirect is as follows:

Direct - Those injuries that resulted directly from participation in the skills of the sport.

Indirect - Those injuries that were caused by systemic failure as a result of exertion while participating in a sport activity or by a complication that was secondary to a non-fatal injury.

Data Collection

Data were complied with the assistance of coaches, athletic trainers, athletic directors, executive officers of state and national athletic organizations, a national newspaper clipping service and professional associates of the researchers. Data collection would not have been possible without the support of the National Collegiate Athletic Association (NCAA) the National Federation of State High School Associations (NFHS), and the American Football Coaches Association (AFCA). Upon receiving information concerning a possible catastrophic sports injury, contact by telephone, personal letter and questionnaire was made with the injured player's coach or athletic director. Data collected included background information on the athlete (age, height, weight, experience, previous injury, etc.), accident information, immediate and post-accident medical care, type injury and equipment involved. Autopsy reports are used when available.

In 1987, a joint endeavor was initiated with the Section on Sports Medicine of the American Association of Neurological Surgeons. The purpose of this collaboration was to enhance the collection of medical data. Dr. Robert C. Cantu, Chairman, Department of Surgery and Chief, Neurosurgery Service, Emerson Hospital, in Concord, MA, has been responsible for evaluating the medical data. Dr. Cantu is also a Past-President of the American College of Sports Medicine.

Summary

Fall Sports (Tables I - VIII)

Football

As indicated in Tables I through VIII, football is associated with the greatest number of catastrophic injuries. For the 2006 football season there was a total of 20 high school direct catastrophic injuries, which is an increase of nine over 2005. College football was associated with six direct catastrophic injuries in 2006, which is an increase of five over the 2005 data.

In 1990, as shown in the **Annual Survey of Football Injury Research 1931-2007**, there were no fatalities directly related to football. The 1990 football report is historic in that it is the first year, and the only year, since the beginning of the research in 1931 that there has not been a direct fatality in football at any level of play. This clearly illustrates that this type of data collection and constant analysis of the data is important and plays a major role in injury prevention. The 1994 data shows zero fatalities at the high school level and one at the college level, with a slight rise in high school football in 1995 to four. These numbers are very low when one considers that there were 36 football direct fatalities in 1968.

In addition to the direct fatalities in 2006 there were also 14 indirect fatalities. Twelve of the indirect fatalities were at the high school level and two were at the college level. The causes of the high school indirect deaths were three heat stroke, , eight heart related, and one related to sickle cell trait.. The college indirect deaths were one heat stroke and one related to sickle cell trait.

In addition to the fatalities there were 17 permanent disability injuries in 2006. Ten were cervical spine injuries and seven were brain injuries. This number is an increase of nine when compared to the 2005 data. Fifteen of the injuries were at the high school level and two at the college level.

Serious football injuries with no permanent disability accounted for eight injuries at the high school and college levels in 2006 – four at each level.

' This decrease in catastrophic football injuries illustrates the importance of data collection and being sure that the information is passed on to those responsible for conducting football programs. A return to the injury levels of the 1960's and 1970's would be detrimental to the game and the participants.

Cross Country

Cross-country was not associated with any direct injuries in 2006. There were two indirect deaths at the high school level. For the 25 years indicated in Tables I through VIII, cross-country was associated with one direct non-fatal injury and 24 indirect fatalities at the high school level and one indirect fatality at the college level. Twenty-three of the indirect fatalities were heart related, one was caused by a seizure, and the cause of one was unknown. Autopsy reports revealed congenital heart disease in four of these cases.

Soccer

Table I shows that high school soccer had no direct catastrophic injury in 2006 and a total of 16 direct catastrophic injuries for the past 25 seasons. The three direct catastrophic injuries in 1992 were the highest number in the past 25 years. There were no high school soccer indirect fatalities in 2006. In 2006 college soccer was not associated with any direct or indirect catastrophic injuries.

Concussion injuries related to heading is a controversial area in soccer. There are helmet manufacturers that are now making soccer helmets to protect the participants from brain injuries while heading, even though the research indicates that concussion injuries during heading are related to head-to-head contact and not ball contact. In a special edition of the Journal of Athletic Training, July-September 2001, an article by Donald Kirkendall and William Garrett, Jr. the authors stated that it is difficult to blame purposeful heading for the reported cognitive deficits when actual heading exposure and details of the nature of head-ball impact are unknown. They go on to say that concussions are a common head injury in soccer (mostly from head-head or head-ground impact) and a factor in cognitive deficits and are probably the mechanism of the reported dysfunction. In October 2001 the Institute of Medicine at the National Academy of Sciences held a one-day conference. Experts on head injuries discussed the potential risk of heading, but reached no firm conclusions. The American Academy of Pediatrics issued the following recommendation in March 2000: "The potential for permanent cognitive impairment from heading the ball needs to be explored further. Currently, there seems to be insufficient published data to support a recommendation that young soccer players completely refrain from heading the ball. However, adults who supervise participants in youth soccer should minimize the use of the technique of heading the ball until the potential for permanent cognitive impairment is further delineated." In July of 2003 the National Federation of State High School Associations approved a rule that will allow soccer players to wear a head guard. Prior to this rule only goalkeepers could wear such a device. The National Center will keep abreast of this controversial area.

In 2005 there was another case of a child being struck by the goal post and dying. A 15 year old male was struck in the head by a goal post that fell over and struck him in the head. This type of accident should never happen. The Consumer Product Safety Commission has stated that there have been at least 34 deaths and 51 injuries from falling soccer goal posts between 1979 and 2008. The latest was an eight year-old boy who was hit by the goal post cross bar. Most occurred with moveable goal posts and resulted from errors in moving the structures or anchoring them. Soccer goal posts should be anchored to the ground and only moved by responsible adults. Players should not climb on the goal posts or hang on the crossbars.

Field Hockey

In 1988 field hockey was associated with its first catastrophic injury since the study began in 1982. It was listed as a serious injury at the college level. The athlete was struck by the ball after a free hit. She received a fractured skull, had surgery and has recovered from the injury. The 1996 data showed two field hockey direct injuries at the high school level. Both injuries involved being hit by the ball and resulted in a head and an eye injury. The 1999 data show one non-fatal injury at the high school level and one serious injury at the college level. The high school injury involved the loss of an eye after being hit with the stick during a drill, and the college injury resulted in a fractured skull after being hit by a ball. There were no direct catastrophic injuries in high school or college field hockey during the 2006 season. There have been no indirect catastrophic injuries in field hockey since the beginning of the study in 1982.

Water Polo

In 1992-93 high school water polo was associated with its first indirect fatality and in 1988-89 college water polo had its first indirect fatality. There have been a total of four high school indirect fatalities in water polo and one at the college level. There were no water polo fatalities in 2006..

Fall Summary

In summary, high school fall sports in 2006 were associated with 20 direct catastrophic injuries. All twenty were associated with football. Football had one fatality, fifteen involved permanent disability, and four were considered serious. For the 25-year period 1982-2006, high school fall sports had 623 direct catastrophic injuries and 603, or 96.8%, were related to football participants. In 2006 high school fall sports were also associated with twelve football indirect fatalities and two in cross country for a total of fourteen indirect fatalities. For the period from 1982-2006 there was a total of 231 indirect fall high school catastrophic injuries. Two-hundred and thirty of the indirect injuries were fatalities and 171 were related to football. Fifteen of the indirect fatalities involved females – six soccer players, one water polo player, and eight cross-country athletes. Females were also associated with four direct catastrophic injuries – three in field hockey and one in soccer

During the 2006 college fall sports season there were six direct catastrophic injuries- all in football. For the 25 years, 1982-2006, there was a total of 139 college direct fall sport catastrophic injuries, and 133 were associated with football. Three were associated with soccer and three with field hockey. There were two indirect college fatalities during the fall of 2006 and they were associated with football. From 1982 through the 2006 fall season there were a total of 49 college fall sport indirect catastrophic injuries, and 48 of them were fatalities. Forty-one of the indirect fatalities were associated with football.

High school football accounted for the greatest number of direct catastrophic injuries for the fall sports, but high school football was also associated with the greatest number of participants. There are approximately 1,500,000 high school and middle school football players participating each year. As illustrated in Table II, the 25-year rate of direct injuries per 100,000 high school and middle school football participants was 0.30 fatalities, 0.75 non-fatal injuries and 0.72 serious injuries. These catastrophic injury rates for football are higher than those for both cross-country and soccer, but all three classifications of catastrophic football injuries have an injury rate of less than one per 100,000 participants. Table IV shows that the indirect fatality rates for high school football, soccer and cross country are similar and are also less than one per 100,000 participants. Water polo rates are higher, but are based on only fifteen years of data, and water polo has approximately 24,000 male and female participants each year.

College football has approximately 75,000 participants each year and the direct injury rate per 100,000 participants is higher than the other fall sports. The rate for the 25-year period indicated in Table VI, for college football fatalities is less than one per 100,000 participants, but the rate increases to 1.89 per 100,000 for non-fatal injuries and 4.80 per 100,000 participants for serious injuries.

Indirect fatality rates are similar in college cross-country and soccer, increase in football, with water polo being associated with the highest indirect fatality rate. Based on 19 years of data, water polo has approximately 1700 participants each year (Table VIII).

There were four college female athletes receiving a direct catastrophic injury in a fall sport for this 25-year period of time. There was one non-fatal injury and two serious injuries in field hockey, and one non-fatal injury in soccer. There were also three female indirect deaths and all three were in soccer.

Incidence rates are based on 25-year participation figures received from the National Federation of State High School Associations and the National Collegiate Athletic Association. (Figure I)

Winter Sports (Tables IX - XVI)

As shown in Table IX, high school winter sports were associated with four direct catastrophic injuries in 2006-2007.Basketball was associated with one serious, and wrestling had two non-fatal and one serious..

High school winter sports were also associated with three indirect fatalities during the 2006-2007 school year (Table XI). Basketball was associated with all three fatalities.

College winter sports, Tables XIII - XVI, were not associated with any direct catastrophic injuries during the 2006-2007 school year. During this same time period there were three indirect fatalities. Two of the indirect fatalities were associated with basketball, and one in swimming. The swimming fatality was a female.

A summary of high school winter sports, 1982-1983 – 2006-2007, show a total of 123 direct catastrophic injuries (8 fatalities, 66 non-fatal, and 49 serious) and 149 indirect. Wrestling was associated with 58 or 47.2 % of the direct injuries. Gymnastics was associated with 13, or 10.6%, of the direct injuries. Basketball was associated with 19 (15.4%), ice hockey was associated with 19 (15.4%), swimming was associated with 13 (10.6%) direct injuries, and volleyball one (0.81%). Basketball accounted for the greatest number of indirect fatalities with 112, or 75.2%, of the winter total.

College winter sports from 1982-1983 – 2006-2007 were associated with a total of 30 direct catastrophic injuries. Gymnastics was associated with six (20.0%), ice hockey 12 (40.0%), basketball nine (30.0%), swimming one (3.3%), skiing one (3.3%) and wrestling one (3.3%). There were also 43 indirect injuries (41 fatalities) during this time period. Twenty-nine, or 67.4%, were associated with basketball, three in wrestling, two in ice hockey, six in swimming, one in skiing, one in gymnastics, and one in volleyball.

High school wrestling accounted for the greatest number of winter sport direct injuries, but the injury rate per 100,000 participants was less than one for all three categories. High school wrestling has averaged approximately 239,000 male and 1,600 female participants each year. High school basketball and swimming were also associated with low direct injury rates. As shown in Table X, ice hockey and gymnastics were associated with the highest injury rates for the winter sports. Gymnastics has averaged approximately 3,800 males and 24,000 female participants during the past twenty-five years. Ice hockey averages 27,000 male and 2,556t female participants each year. A high percentage of the ice hockey injuries involve a player being hit by an opposing player, usually from behind, and striking the skate rink boards with the top of his/her head.

Indirect high school catastrophic injury rates, as indicated in Table XII, are all below one per 100,000 participants.

Catastrophic direct injury rates for college winter sports are higher when compared to high school figures. Gymnastics had five non-fatal and one serious injury for the past twenty-five years, but the injury rate is 20.07 per 100,000 participants for non-fatal male injuries, and 5.35 per 100,000 for female non-fatal injuries. Participation figures show approximately 597 male and 1,493 female gymnastic participants each year.

College ice hockey was associated with eight serious and four non-fatal injuries in twenty-five years, but the injury rate is 4.18 per 100,000 male participants for non-fatal and 7.32 for male serious injuries. There are approximately 3,800 male ice hockey participants each year. The first female college ice hockey player received a direct serious injury during the 1999-2000 season. The serious injury rate for females was 6.49 injuries per 100,000 participants and females averaged approximately 616 participants per year for the past 25 years. Swimming non-fatal incidence rates were not as high as gymnastics or ice hockey, but could be totally eliminated if swimmers would not use the racing dive into the shallow end of pools during practice or meets. In fact there has not been a direct injury in college swimming since the one non-fatal injury in 1982-1983.

College wrestling had only one direct catastrophic injury from the fall of 1982 to the spring of 2007. For this period of time there were 169,043 participants in college wrestling for an average of approximately 6761 per year. The injury rate for this twenty-five year period of time was 0.59 per 100,000 participants. College skiing has approximately 580 female participants each year and the one fatality in 1989-1990 produced an eighteen-year injury rate of 6.89 per 100,000 participants. This was the only skiing direct fatality since the study was initiated.

Injury rates for male college indirect fatalities were high when compared to the high school rates. Basketball had an injury rate of 6.99 fatalities per 100,000 male participants, skiing 6.11, ice hockey 1.05, and swimming 2.57. The year 1997-98 was the first year there were any indirect fatalities in wrestling. There were three deaths due to heat stroke associated with wrestlers trying to make weight for a match. The indirect injury rate for wrestling was 1.77 per 100,000 participants.

The female indirect injury rate for basketball was 0.96 per 100,000 participants, 0.60 per 100,000 for volleyball, 0.45 for swimming and 2.68 for gymnastics.

Spring Sports (Tables XVII - XXIV)

High school spring sports were associated with five direct catastrophic injuries in 2007. There were three catastrophic injuries in baseball, one in lacrosse, and one in track. High school spring sports were also associated with seven indirect fatalities in 2007. Three of the indirect fatalities were in lacrosse and four in track.

College spring sports were not associated with any direct catastrophic injuries in 2007. - There were also no indirect fatalities in college spring sports..

From 1983 through 2007, high school spring sports were associated with 118 direct catastrophic injuries (Table XVII). Thirty-three were listed as fatalities, 39 as catastrophic non-fatal and 46 as serious. Baseball accounted for 47, track 59, lacrosse nine, and softball three. Injury rates were less than one per 100,000 participants for each sport in all categories. There were seven direct injuries to females in track, three in softball, and one in lacrosse. There were also 59 indirect fatalities in high school spring sports during this time span (Table XIX). Thirty-four were related to track, 14 in baseball, seven in lacrosse and three in tennis. There was also one serious indirect injury in golf. Six of the indirect fatalities involved female track athletes.

As illustrated in Table XXI, college spring sports were associated with 35 direct catastrophic injuries from 1983 to 2007. Eleven of these injuries resulted in fatalities, 13 were listed as non-fatal and 11 were listed as serious. Baseball accounted for twelve injuries, lacrosse eleven, track ten, softball one, and equestrian one. College females were associated with two non-fatal injuries in lacrosse, one in track, and one fatality in equestrian. Table XXIII shows that there were also ten indirect fatalities in college spring sports during this time. Two indirect fatalities were associated with tennis, one was associated with track, two in baseball, three in rowing, and two in lacrosse. There was one female fatality in tennis.

Injury rates for high school spring sport direct injuries were low as illustrated in Table XVIII. Baseball participation reveals an average of approximately 417,000 male players and 900 female players each year, track 506,000 males and 409,000 females, and tennis 139,000 males and 145,000 females. The baseball figures do not include the 310,000 female softball participants each year (plus 1,100 males).. Lacrosse has approximately 31,000 male and 21,000 female participants each year. Injury rates, as shown in Table XX, for high school indirect injuries are also low.

College spring sports, Table XXII, are related to low injury rates for direct injuries, with the exception of equestrian and men's lacrosse. Men's lacrosse had four fatalities, three non-fatal and two serious injuries and the injury rates were higher than the other college spring sports. Female lacrosse players were associated with two non-fatal injuries and female track (pole vault) was associated with one non-fatal injury. Equestrian was associated with a female fatality. Participation figures reveal approximately 5,696 men and 3,972 women lacrosse players each year. The 1991 and 2003 injuries were to female lacrosse players.

Rates for indirect college fatalities in baseball, tennis, and track are low with lacrosse being slightly higher. There were two indirect tennis fatalities, one male and one female, but participation figures are low. Men average approximately 7,600 and women 7,800 participants each year. Rowing had the highest indirect injury rate at 25.65 injuries per 100,000 male participants and 0.00 for female participants. There are approximately 1,950 male rowers and 6,700 female rowers each year.(Table XXIV)

Discussion

Football is associated with the greatest number of catastrophic injuries for all sports, but the incidence of injury per 100,000 participants is higher in both gymnastics and ice hockey. There have been dramatic reductions in the number of football fatalities and non-fatal catastrophic injuries since 1976 and the 1990 data illustrated an historic decrease in football fatalities to zero. This is a great accomplishment when compared to the 36 fatalities in 1968. This dramatic reduction can be directly related to data collected by the American Football Coaches Association Committee on Football Injuries (1931-2007) and the recommendations that were based on that data. Non-fatal football injuries, permanent disability, decreased to one for college football in 1995, 1999, 2004, and 2005. There was a dramatic reduction in high school football from 13 in 1990 and 1993 to six in 2002 and five in 2005. There was an increase to eleven in 1995 and 1996, and 14 in 1997. The 2006 data shows 15 non-fatal injuries (head and neck combined) and one fatality in high school football. The 15 non-fatal injuries is the highest number since the 1989 season when there were 18. Fifteen is a dramatic increase over the six high school non-fatal injuries in 2005. Permanent disability injuries in football have seen dramatic reductions when compared to the data from the late 1960's and early 1970's, but a continued effort must be made to eliminate these injuries. In addition, there were four serious injuries in high school football in 2006 . All of the serious cases involved head or neck injuries and in a number of these cases excellent medical care saved the athlete from permanent disability or death. College football in 2006 was associated with a total of six catastrophic injuries – zero fatalities, two non-fatal, and four serious.

Football catastrophic injuries may never be totally eliminated, but progress has been made. Emphasis should again be focused on the preventive measures that received credit for the initial reduction of injuries.

1. The 1976 rule change which prohibited initial contact with the head in blocking and tackling. There must be continued emphasis in this area by coaches and officials.
2. The NOCSAE football helmet standard that went into effect at the college level in 1978 and at the high school level in 1980. There should be continued research in helmet safety.
3. Improved medical care of the injured athlete. An emphasis on placing certified athletic trainers in all high schools and colleges. There should be a written emergency plan for catastrophic injuries both at the high school and college levels.

4. Improved coaching technique when teaching the fundamental skills of blocking and tackling.

Keeping the head out of blocking and tackling!

A major concern in football fatalities has been the number of indirect deaths due to heat stroke, both at the college and high school levels. During the past ten years there have been 25 heat stroke deaths in football. This number is unacceptable since heat stroke deaths are preventable with the proper precautions. Every effort should be made to continuously educate coaches concerning the proper procedures and precautions when practicing or playing in the heat. In the Annual Survey of Football Injury Research – 1931-2006 there are recommendations for safety during football activity in hot weather. New regulations by the National Collegiate Athletic Association for volunteer summer conditioning programs and pre-season football practice went into effect during the 2003 season and it will be very interesting to see how they effect heat related injuries at the college level.

It should be noted that from 1979 to 2008, according to the Consumer Product Safety Commission, there have been 34 deaths and 51 injuries from movable soccer goals. The most recent case involved an eight year-old male playing on a soccer goal when it tipped over and hit his head, causing his death. There has been one fatality in this study, which involved a college athlete hanging on a soccer goal and the goal falling and striking the victim's head.

On May 4, 1999, the Consumer Product Safety Commission and the soccer goal industry announced the development of a new safety standard that will reduce the risk of soccer goal tip-over. The 'Provisional Safety Standard and Performance Specification for Soccer Goals" (ASTM-PS-75-99) requires that movable soccer goals, except very lightweight goals, not tip over when the goal is weighted in a downward or horizontal direction. The standard also specifies warning labels must be attached to the goal, such as: "Warning: Always anchor goal. Unsecured goal can fall over causing serious injury or death." For a free copy of : "Guidelines for Movable Soccer Goal Safety," send a postcard to CPSC, Washington, DC 20207. Also available online: http:cpsc.gov.

A Loss Control Bulletin from K & K Insurance Group, Inc., Fort Wayne, IN, suggests the following safeguards:

1. Keep soccer goals supervised and anchored.
2. Never permit hanging or climbing on a soccer goal.
3. Always stand to the rear or side of the goal when moving it - NEVER to the front.
4. Stabilize the goal as best suits the playing surface, but in a manner that does not create other hazards to players.
5. Develop and follow a plan for periodic inspection and maintenance (e.g., dry rot, joints hooks).
6. Advise all field maintenance persons to re-anchor the goal if moved for mowing the grass or other purposes.
7. Remove goals from field no longer in use for the soccer program as the season progresses.
8. Secure goals well from unauthorized access when stored.
9. Educate and remind all players and adult supervisors about the past tragedies of soccer goal fatalities.

There is also a list of guidelines available for movable soccer goal safety and warning labels. To obtain a copy contact the following:

The Coalition to Promote Soccer Goal Safety
C/O Soccer Industry Council of America
200 Castlewood Drive
North Palm Beach, FL 33408

High school wrestling, gymnastics, ice hockey, baseball and track should receive close attention. Wrestling has been associated with 58 direct catastrophic injuries during the past twenty-five years. Due to the fact that college wrestling was only associated with one catastrophic injury during this same time period, continued research should be focused on the high school level. High school wrestling coaches should be experienced in the teaching of the proper skills of wrestling and should attend coaching clinics to keep up-dated on new teaching techniques and safety measures. They should also have experience and training in the proper conditioning of their athletes. These measures are important in all sports, but there are a number of contact sports, like wrestling, where the experience and training of the coach is of the utmost importance. Full speed wrestling in physical education classes is a questionable practice unless there is proper time for conditioning and the teaching of skills. The physical education teacher should also have expertise in the teaching of wrestling skills. It should also be emphasized that wrestling coaches need to be aware of the dangers associated with athletes making weight. Improper weight reduction can lead to serious injuries and death. During the 1997-1998 academic year there were three college wrestlers that died while trying to make weight for a match. All three died of heat stroke complications. These were the first wrestling deaths associated with weight reduction; however, there is no information on the number of wrestlers who had medical problems associated with weight loss, but recovered. All three of these wrestlers were trying to lose large amounts of weight in a short period of time. All three were also working out in areas of high heat, and were all wearing sweat clothes or rubber suits. Making weight has always been a part of the wrestling culture, but it is dangerous and life threatening. New rule changes went into effect for the 1998-99 high school and college seasons, and hopefully, making weight will be a thing of the past and will never result in the deaths of young high school or college athletes. A significant rule change approved by the NFHS Board of Directors in April 2005, states that in 2006-07 stronger guidelines discouraging rapid weight loss will take effect. The revised rule includes a specific gravity not to exceed 1.025, a body fat assessment no lower than 7 percent (males)/12 percent (females) and a monitored, weekly weight loss plan not to exceed 1.5% a week.

There is also a national trend for an increased number of females participating in wrestling. In 2006-2007 there were 5,048 females in high school wrestling.

Men's and women's gymnastics and ice hockey were associated with higher injury rates at both the high school and college levels. Gymnastics needs additional study at both levels of competition. Both levels have seen a dramatic participation reduction and this trend may continue with the major emphasis being in private clubs. Lacrosse also had a higher injury rate at the college level.

Ice hockey injuries are low in numbers but the injury rate per 100,000 participants is high when compared to other sports. Ice hockey catastrophic injuries usually occur when an athlete is struck from behind by an opponent, slides across the ice in a prone position, and makes contact with the crown of his/her head and the boards surrounding the rink. The results are usually fractured cervical vertebrae with paralysis. Research in Canada has revealed high catastrophic injury rates with similar results. After an in-depth study of ice hockey catastrophic injuries in Canada, Dr. Charles Tator has made the following recommendations concerning prevention:

1. Enforce current rules and consider new rules against pushing or checking from behind
2. Improve strength of neck muscles.
3. Educate players concerning risk of neck injuries.
4. Continued epidemiological research.

Catastrophic injuries in swimming were all directly related to the racing dive in the shallow end of pools. There has been a major effort by both schools and colleges to make the racing dive safer and the catastrophic injury data support that effort. There has not been a college injury for the past 24 years. High school swimming has been associated with 13 catastrophic injuries and the racing dive in the shallow end of the pool has been involved in all cases. It is a fact that the swimming community has been made aware of the problem with the racing dive into the shallow end of the pool, and hopefully along with rule changes and coach's awareness, the number of direct catastrophic injuries in swimming will be reduced. The competitive racing start has changed and now involves the swimmer getting more depth when entering the water. Practicing or starting competition in the deep end of the pool or being extremely cautious could eliminate catastrophic injuries caused by the swimmer striking his/her head on the bottom of the pool. The National Federation of State High School Associations Swimming and Diving Rules Book (Rule 2-7-2) states that in pools with water depth less than three and one-half feet at the starting end, swimmers will have to start the race in the water. The rules read that in four feet or more of water, swimmers may use a starting platform up to a maximum of 30 inches above the water, and the pool depth shall be measured for a distance of 16 feet, 5 inches from the end wall. Between three and one-half and less than four feet, swimmers start from the pool deck or in the water The National Collegiate Athletic Association and USA Swimming have or are in the process of moving standards for use of starting blocks to a minimum depth of five feet. In April 1995 the National Federation revised rule 2-7-2, which now states that starting platforms shall be securely attached to the deck/wall in pools with water depth of four feet or more in the starting end. If they are not, they shall not be used and deck or in-water starts will be required. These new rules point out the importance of constant data collection and analysis. Rules and equipment changes for safety reasons must be based on reliable injury data. The National Center has not received any information concerning high school or college direct catastrophic swimming injuries during the 2006-2007 season.

High school spring sports have been associated with low incidence rates during the past twenty-five years, but baseball was associated with 47 direct catastrophic injuries and track 59. A majority of the baseball injuries have been caused by the head first slide or by being struck with a thrown or batted ball. If the headfirst slide is going to be used, proper instruction should be involved. Proper protection for batting practice should be provided for the batting practice pitcher and he/she should always wear a helmet. This should also be true for the batting practice coach. During the 2007 baseball season three high school pitchers were stuck in the head with batted balls. One pitcher recovered, one injury was non-fatal at the time of this writing, and one died One injury took place in a scrimmage game, one in batting practice, and one in a batting cage. A new rule in fast pitch soft ball will require players to wear batting helmets equipped with NOCSAE approved facemasks/guards. The rule went into effect January 1, 2006.

The pole vault was associated with a majority of the fatal track injuries. There have been 18 high school and college fatal pole-vaulting injuries from 1983 to 2006. This includes the high school coach who was demonstrating in 1998, bounced out of the pit, struck his head on concrete, and died. In addition to the fatalities there were also eleven permanent disability (8 high school and 3 college) and seven serious injuries (5 high school, one college, and one middle school). All 36 of these accidents involved the vaulter bouncing out of or landing out of the pit area. The three pole vaulting deaths in 1983 were a major concern and immediate measures were taken by the National Federation of State High School Associations. Beginning with the 1987 season all individual units in the pole vault landing area had to include a common cover or pad extending over all sections of the pit.

In 2001 there was a pole vaulting injury to a female college athlete. The athlete was vaulting indoors, bounced out of the pit, and hit her head on the floor. She had an epidural hematoma and a posterior skull fracture. At the time of the accident it was not possible to determine the extent of any long-term disability. There was one pole vaulting injury in 2005 and none in 2006 and 2007

Whenever there is a pole vaulting death there are more proponents of eliminating the event. The crux of the opposition appears to be the potential liability and also the lack of qualified coaches to teach the pole vault. Additional recommendations in the 1991 rule book included stabilizing the pole-vault standards so they cannot fall into the pit, pad the standards, remove all hazards from around the pit area, and control traffic along the approach. Obvious hazards like concrete or other hard materials around the pit should be eliminated. In the National Federation of State High Schools Track and Field Rules Book, Section 4, Article10, it states as follows: Hard or unyielding surfaces, such as but not limited to concrete, metal, wood or asphalt around the landing pad, or between the planting box and the landing pad, shall be padded or cushioned with a minimum of two (2) inches of dense foam or other suitable material. It is also recommended that any excess material such as asphalt or concrete that extends out from beneath the landing pad be removed.

Due to the numbers of pole vaulting injuries there have also been a number of recommendations stating that pole vaulters should wear helmets. The National Federation of State High School Associations has made the following statement concerning pole vaulting helmet use: The NFHS has been asked if it would be permissible for high school students to wear some type of helmet while pole vaulting and they stated that it would be permissible for an athlete to wear a helmet of his/her choosing without violating the NFHS rules. A helmet designed exclusively for pole vault, the KDMax, was released in October 2004. Six state high school associations already require some type of helmet for pole vaulters, and 30 states indicated on the 2004 NFHS track and field survey that they would support mandatory helmet use if a national standard was in place. In the NCAA helmets will continue to be an option for pole vaulters.

It has been estimated that there are approximately 25,000 high school pole vaulters annually. If this number were correct, the catastrophic injury rate for high school pole vaulters would be higher than any of the sports included in the research. High school coaches and officials should be aware of the National Federation rules pertaining to the pole vault.

There have also been 23 accidents in high school track involving participants being struck by a thrown discus, shot put or javelin. In 1992, a female athlete was struck by a thrown discus in practice and died. In 1993, a track manager was struck in the neck by a javelin, but he was lucky and completely recovered from the accident. In 1994, a female track athlete was struck in the face by a javelin and will recover. In 1995, a male athlete was struck in the head by a shot put during warm-ups and had a fractured skull. In 1997, a male athlete was struck by a discus and died. In 1998 a female athlete was struck by a discus and died, and a male athlete was struck in the head by a shot-put and recovered. In 1999 a male athlete was struck by a javelin and a female athlete was struck by a discus. In 2000 a junior high school athlete was struck in the head by a discus and has permanent disability. In 2001 a high school athlete was struck in the cheek with a javelin during practice. In 2002 there were three athletes struck by a shot putt and one by a discus. In 2002 there was also a coach that was struck by a shot putt. In 2004 a male track athlete was hit in the head with a shot putt and was in critical condition. In 2005 a track athlete was impaled with a javelin in the shoulder. In 2006 a male track athlete was hit in the head with a javelin which went four inches into his brain. He was very lucky and recovered. In 2007 a female track athlete was struck in the ankle by a javelin and needed a bone graft. There have also been spectators struck by the discus during high school meets. On June 23, 2005, a 77 year old official died after being struck in the head by a shot put while athletes were practicing for the US championships. Safety precautions must be stressed for these events in both practice and competitive meets with the result being the elimination of this type of accident. The National Federation of State High School Associations put a new rule in for the 1993 track season that fenced off the back and sides of the discus circle to help eliminate this type of accident. Good risk management should eliminate these types of accidents. These types of injuries are not acceptable and should never happen.

The fatality in high school lacrosse during the 1987 season was associated with a player using his head to strike the opponent. He struck the opponent with the top or crown of his helmet. This technique is prohibited by the lacrosse rules and should be strictly enforced. In 2002 a high school lacrosse player was also blocking and suffered permanent paralysis. Lacrosse has been a fairly safe sport when considering the fact that high school lacrosse has been involved with nine direct catastrophic injuries in twenty-five years. A possible new area of concern is the recent lacrosse deaths being associated with players being struck in the chest with the ball and causing death (commotio cordis). There have been seven cases (6 deaths) (two high school, one high school club, three college, and one lacrosse summer camp) in the past nine years. The most recent commotio cordis death happened when the player was struck in the chest with the opponents stick. Currently there is research being funded by the National Operating Committee for Standards in Athletic Equipment that is studying chest protectors to help reduce commotio cordis fatalities. The lacrosse community will have to keep a close watch on these types of deaths and possibly carry out in-depth evaluations of these injuries.

There was a female college lacrosse player in 1993 that was hit in the eye with a ball and had permanent vision damage. In the spring of 2004 protective eyewear was required for all high school participants in states that follow NFHS rules, and for all competitors at the NCAA championships. In 2005, the requirement was extended to the entire season for all NCAA teams. Early reports indicate a major reduction in eye injuries for female lacrosse players.

College spring sports are also associated with a low injury incidence. Injury rates are slightly higher in lacrosse but the participation figures are so low that even one injury will increase the incidence rate dramatically. It is important to point out that there have been nine college male and two female lacrosse catastrophic injuries during the past twenty-five years. The college death in 2005 involved a male player being struck in the neck by a ball. In a college club lacrosse game on October 15. 2005, there was a non-fatal catastrophic injury to a male participant. He was hit with a point blank range shot off of his helmet. The injury was a subdural hematoma and the athlete had surgery. There have been questions concerning the particular helmet the player was wearing at the time. There were no direct or indirect college lacrosse injuries in the 2006-2007 school year. It should be mentioned that there is general concern about concussion injuries in lacrosse, and according to a study from Temple University, female lacrosse players have the highest percentage of concussions during a game, followed by women's soccer.

For the twenty-five year period from the fall of 1982 through the spring of 2007 there have been 1068 direct catastrophic injuries in high school and college sports. High school sports were associated with 149 fatalities, 369 non-fatal and 346 serious injuries for a total of 864. College sports accounted for 22 fatalities, 63 non-fatal and 119 serious injuries for a total of 204. During this same twenty-five year period of time there have been a total of 541 indirect injuries and all but eleven resulted in death. Four hundred and thirty-nine of the indirect injuries were at the high school level and 102 were at the college level. It should be noted that high school annual athletic participation (for sports with catastrophic injuries) for 2006-2007 includes approximately 7,445,742, athletes (4,605,347 males and 2,840,395 females). National Collegiate Athletic Association participation (for those sports with catastrophic injuries) for 2006-2007 was 404,728athletes. There were 245,512 males and 159,216 females.

During the twenty- five year period from the fall of 1982 through the spring of 2007 there have been 147,115,293 high school athletes participating in the sports covered by this report. Using these participation numbers would give a high school direct catastrophic injury rate of 0.59 per 100,000 participants. The indirect injury rate is 0.30 per 100,000 participants. If both direct and indirect injuries were combined the injury rate would be 0.89 per 100,000. This means that approximately one high school athlete out of every 100,000 participating would receive some type of catastrophic injury. The combined fatality rate would be 0.39 per 100,000, the non-fatal rate 0.25, and the serious rate 0.24.

During this same time period there were approximately 8,029,283 college participants with a total direct catastrophic injury rate of 2.54 per 100,000 participants. The indirect injury rate is 1.27 per 100,000 participants. If both indirect and direct injuries were combined the injury rate would be 3.81. The combined fatality rate would be 1.51, the non-fatal rate 0.81, and the serious rate 1.49.

Female Catastrophic Injuries

There have been a total of 112 direct and 60 indirect catastrophic injuries to high school and college female athletes from 1982-83 – 2006-2007, which includes cheerleading. Eighty of these were direct injuries at the high school level and 32 at the college level. The 80 high school direct injuries included nine in gymnastics, 44 in cheerleading, five in swimming, four in basketball, seven in track, three in softball, three in field hockey, two in ice hockey, one in lacrosse, one in soccer, and one in volleyball. The 50 high school indirect fatalities included twelve in basketball, eight in swimming, six in track, six in soccer, eight in cross country, two in volleyball, one in water polo, and seven in cheerleading. The 32 college direct injuries were associated with cheerleading(19), gymnastics(2), field hockey(3), soccer(1), skiing(1), ice hockey(1), track (pole vault)(1), equestrian(1), softball(1), and lacrosse(2). The ten college indirect fatalities included one in tennis, three in basketball, three in soccer, one in gymnastics, one in swimming, and one in volleyball. Catastrophic injuries to female athletes have increased over the years. As an example, in 1982-83 there was one female catastrophic injury and during the past 25 years there has been an average of 6.94 per year. A major factor in this increase has been the change in cheerleading activity, which now involves gymnastic type stunts. If these cheerleading activities are not taught by a competent coach and keep increasing in difficulty, catastrophic injuries will continue to be a part of cheerleading. High school cheerleading accounted for 55.0% of all high school direct catastrophic injuries to female athletes (two males not included) and 59.4% at the college level (four males not included). Of the 112 direct catastrophic injuries to high school and college female athletes from 1982-83 – 2006-2007, cheerleading was related to 63 or 56.3%. The cheerleading numbers have been updated from previous reports and male cheerleaders were not included. Read the special section on cheerleading.

Athletic administrators and coaches should place equal emphasis on injury prevention in both female and male athletics. Injury prevention recommendations are made for both male and female athletes.

Athletic catastrophic injuries may never be totally eliminated, but with reliable injury data collection systems and constant analysis of the data these injuries can be dramatically reduced.

TABLE 1

HIGH SCHOOL FEMALE DIRECT CATASTROPHIC INJURIES

1982-83 – 2006-07

SPORT	FATALITY	NON-FATAL	SERIOUS	TOTAL
Cheerleading*	2	13	29	44
Gymnastics	0	6	3	9
Track	1	1	5	7
Swimming	0	4	1	5
Basketball	0	1	3	4
Ice Hockey	0	0	2	2
Field Hockey	0	3	0	3
Softball	1	2	0	3
Lacrosse	0	0	1	1
Soccer	0	1	0	1
Volleyball	0	1	0	1
TOTAL	**4**	**32**	**44**	**80**

* Cheerleading does not include two males

TABLE 2

HIGH SCHOOL FEMALE INDIRECT CATASTROPHIC INJURIES

1982-83 – 2006-07

SPORT	FATALITY	NON-FATAL	SERIOUS	TOTAL
Basketball	11	0	1	12
Swimming	7	0	1	8
Cheerleading	7	0	0	7
Cross Country	8	0	0	8
Soccer	6	0	0	6
Track	6	0	0	6
Volleyball	1	1	0	2
Water Polo	1	0	0	1
TOTAL	**47**	**1**	**2**	**50**

TABLE 3

COLLEGE FEMALE DIRECT CATASTROPHIC INJURIES

1982-82 – 2006-07

SPORT	FATALITY	NON-FATAL	SERIOUS	TOTAL
Cheerleading*	1	5	13	19
Field hockey	0	1	2	3
Lacrosse	0	2	0	2
Gymnastics	0	2	0	2
Equestrian	1	0	0	1
Soccer	0	1	0	1
Ice Hockey	0	0	1	1
Skiing	1	0	0	1
Track (Pole Vault)	0	1	0	1
Softball	0	0	1	1
TOTAL	**3**	**12**	**17**	**32**

*Cheerleading does not include four males

TABLE 4

COLLEGE FEMALE INDIRECT CATASTROPHIC INJURIES

1982-83 – 2006-07

SPORT	FATALITY	NON-FATAL	SERIOUS	TOTAL
Soccer	3	0	0	3
Basketball	3	0	0	3
Tennis	1	0	0	1
Volleyball	1	0	0	1
Gymnastics	1	0	0	1
Swimming	1	0	0	1
TOTAL	**10**	**0**	**0**	**10**

Recommendations for Prevention

1. Mandatory medical examinations and a medical history taken before allowing an athlete to participate.
2. All personnel concerned with training athletes should emphasize proper, gradual and complete physical conditioning in order to provide the athlete with optimal readiness for the rigors of the sport.
3. Every school should strive to have a certified athletic trainer who is a regular member of the faculty and is adequately prepared and qualified. There should be a written emergency procedure plan to deal with the possibility of a catastrophic injury.
4. There should be an emphasis on employing well trained athletic personnel, providing excellent facilities and securing the safest and best equipment available.
5. There should be strict enforcement of game rules and administrative regulations should be enforced to protect the health of the athlete. Coaches and school officials must support the game officials in their conduct of the athletic contests.
6. Coaches should know and have the ability to teach the proper fundamental skills of the sport. This recommendation includes all sports, not only football. The proper fundamentals of blocking and tackling should be emphasized to help reduce head and neck injuries in football. **Keep the head out of blocking and tackling.**
7. There should be continued safety research in athletics (rules, facilities, equipment).
8. Strict enforcement of the rules of the game by both coaches and game officials will help reduce serious injuries.
9. When an athlete has experienced or shown signs of head trauma (loss of consciousness, visual disturbance, headache, inability to walk correctly, obvious disorientation, memory loss) he/she should receive immediate medical attention and should not be allowed to return to practice or game without permission from the proper medical authorities. It is important for a physician to observe the head injured athlete for several days following

the injury. Coaches should encourage athletes to let them know if they have any of the above mentioned symptoms (that can't be seen by others, such as headaches) and why it is important.

10. Athletes and their parents should be warned of the risks of injuries.
11. Coaches should not be hired if they do not have the training and experience needed to teach the skills of the sport and to properly train and develop the athletes for competition.
12. Weight loss in wrestling to make weight for a match can be dangerous and cause serious injury or death. Coaches should be aware of safety precautions and rules associated with this practice.

*****SPECIAL NOTE*****

All of the information has been thoroughly checked and the data cleaned. Some of the numbers in Tables I - XXIV have been changed due to this process. All of the data in this report now meet the stated definition of injury for high school and college sports. It is important to note that information is constantly being updated due to the fact that catastrophic injury information may not always reach the center in time to be included in the current final report. The report includes data that is reported to the NCCSIR by the NCAA, the NFHS, a national newspaper clipping service, colleagues, coaches, and athletic trainers. There may be additional catastrophic injuries that are not reported to the Center.

References

1. TATOR CH, EDMONDS VE: National Survey of Spinal Injuries in Hockey Players, Canada Medical Association 1984; 130: 875-880.

CASE STUDIES

FOOTBALL

High school and college case studies in football are not duplicated for this report. They are included in the football reports on the www site – www.unc.edu/depts/nccsi

CROSS COUNTRY

HIGH SCHOOL

A 16 year-old high school junior died during a practice session on October 6, 2006. He had just completed running a warm-up mile and was walking off the track when he collapsed. Cause of death was related to a congenital heart problem.

A 16 year-old high school female collapsed and died on August 15, 2006. She collapsed shortly after the start of practice. Cause of death was a congenital heart defect. CPR was given to the victim by the coaches and paramedics, but she did not respond. A defibrillator was not available.

SOCCER

NONE

FIELD HOCKEY

COLLEGE
NONE

ICE HOCKEY

HIGH SCHOOL
NONE

SWIMMING

COLLEGE

A 19 year-old female college swimmer was found unconscious at the bottom of the pool during a practice session on 12/16/06. Circumstances and cause of death were not clear at the time of this writing. It was noted that the swimmer did have epilepsy. The swimmer was not feeling well during the practice and was told to get out of the water. No one saw her re-enter or fall into the water until she was seen at the bottom of the pool.

BASKETBALL

HIGH SCHOOL

A 14 year-old eighth grader collapsed while playing in a middle school game in the fall of 2006. The athlete died and the autopsy was inconclusive. The school did not have an automated external defibrillator, but the victim was given CPR.

An 18 year-old high school basketball player collapsed and died during a practice session on 11/29/06. Death was heart related. The victim's mother died of a genetic heart condition in November 2007.

A 15 year old high school ninth grader collapsed during a practice session on 12/6/06 and died on 12/13/06. Cause of death was a heart infection which resulted in a coma and loss of brain function.

A 17 year-old high school basketball player was undercut while going for a lay-up during a game in January 2007. He hit his head on the floor with the result being a fractured skull and a blood clot on the brain. He had surgery and a full recovery was expected.

UPDATE 2003 – Athlete was playing in a freshman game and was undercut going for a rebound. The accident took place in December of 2003. He fractured his lower spine and had eight hours of surgery in August of 2004. He has recovered and is playing football again.

COLLEGE

A college freshman collapsed in the locker room during halftime of a game on February 14, 2007. He died later at the hospital. An automated external defibrillator was on the campus but no one knew where it was. Cause of death was heart related.

A 21 year-old college basketball player collapsed during conditioning drills in October of 2006. He died later at the hospital. A preliminary autopsy showed a ruptured blood vessel to the heart. He received CPR on-site until the ambulance arrived.

WRESTLING

HIGH SCHOOL

A high school junior wrestler was injured in a match on January 12, 2007. He landed on his head and injured his neck when taken down. He was in the hospital and had paralysis from the chest down.

A high school wrestler fractured a cervical vertebra during a match 0n January 28, 2007. His opponent performed a barrel roll and drove the victim's head into the mat. He had a full recovery.

A 17 year old high school wrestler was injured during a match on March 10, 2007. He fractured cervical vertebrae 5-6 and had surgery. He was injured when taken down to the mat onto his head. At the present time he is paralyzed and is not expected to walk again.

LACROSSE

HIGH SCHOOL

A 14 year-old eighth grade lacrosse player collapsed during a non-contact drill and later died at the hospital. No other information was available.

An 18 year-old high school lacrosse player was hit in the chest by a hard shot on May 7, 2007. He was a defensive player and the shot hit him in the left lateral chest. He immediately collapsed, was not breathing, but did have a pulse on the initial first aid evaluation. Coaches tried to start CPR but could not get the mouth open. With CPR player coughed and spit out blood, started breathing, and seemed to feel fine. Was down for 5 to 6 minutes. Diagnosed with heart and lung contusion. Player has recovered.

A 14 year-old high school lacrosse player died from what was first believed to be a ball to the head during pre-game activity. He died of a cerebral artery aneurysm with no indication that he was struck with a lacrosse ball.

A 15 year-old high school lacrosse player collapsed during running drills and later died. Cause of death was cardiac sudden death.

A high school club lacrosse player died of commotio cordis after being hit with a legal stick check to the chest. Commotio cordis is a sudden disturbance of the heart's electrical rhythm usually caused by a blunt impact to the chest. The accident took place on 11/28/06 and he died on 11/30/06.

BASEBALL

HIGH SCHOOL

A 14 year-old high school baseball player was hit in the head by a line drive off of a metal bat. He was pitching varsity batting practice. Injuries included a fractured skull and bleeding in the brain. He was behind a safety screen at the time of the accident. At the present time he has impaired ability to speak and recovery is incomplete. Recovery is expected in the future.

A high school baseball player was injured on January 1, 2007 while pitching in a scrimmage game. He was hit in the right temple by a line drive and received a fractured skull, fractured bone behind the eye, fractured cheek bone, and a blood clot. He is recovering, but will have to wear protective face/head gear when he returns to play. Bat was metal.

A 17 year-old high school baseball player was injured on February 23, 2007 and died on February 25, 2007, after being hit by a line drive while pitching to a teammate in a batting cage. The ball was hit from another batting cage and went through both nets and hit the victim in the back of the head.

TRACK

HIGH SCHOOL

A 13 year-old female seventh grader became ill at track practice, collapsed, and later died of cardiac arrhythmia.

A high school track athlete collapsed during practice in April 2007 and later died. His death was thought to be heart related.

A high school track athlete was struck by lightning shortly before a track meet. He was 18 years old. Coaches and others tried to revive him, but he died by the time he reached the hospital.

An 18 year-old track athlete collapsed and died while running sprints with other athletes during practice. He did have asthma, but the cause of death was unknown.

A 14 year-old female track athlete was impaled by a javelin during a meet. She was going to get her javelin after a throw and was hit in the ankle by another thrower's javelin. She was walking outside the danger area when hit. She required a bone graft, but will recover.

VOLLEYBALL

HIGH SCHOOL

NONE

GOLF

HIGH SCHOOL

NONE

FIELD HOCKEY

HIGH SCHOOL AND COLLEGE

NONE

SOFTBALL

COLLEGE – 2006 UPDATE

A college softball player was hit in the face by a line drive while pitching in a game on March 9, 2006. She had a number of facial fractures and had surgery. She has recovered and returned to play in 2007.

A 12 year-old female was playing in a non-school traveling softball team practice when she was hit in the head by a ground ball. She was unconscious after being hit, and never regained consciousness.

TENNIS

HIGH SCHOOL AND COLLEGE

NONE

WATER POLO

HIGH SCHOOL AND COLLEGE

NONE

GYMNASTICS

HIGH SCHOOL AND COLLEGE

NONE

ROWING

HIGH SCHOOL AND COLLEGE

NONE

EQUESTRIAN

HIGH SCHOOL AND COLLEGE

NONE

Special Section on Cheerleading

The Consumer Product Safety Commission reported an estimated 4,954 hospital emergency room visits in 1980 caused by cheerleading injuries. By 1986 the number had increased to 6,911, in 1994 the number increased to approximately 16,000, in 1999 the number increased to 21,906, and in 2004 the number increased to 28,414. Granted, the number of cheerleaders has also increased dramatically during this time frame. It is important to stress that catastrophic injuries have also been a part of cheerleading during the last 25 years and coaches and administrators should be aware of the situation.

The National Center for Catastrophic Sports Injury Research has been collecting cheerleading catastrophic injury data during the past twenty-five years, 1982-83 – 2006-2007 (see Tables 5 and 6). There was one high school cheerleading catastrophic injury during the 2006-2007 school year. The athlete fractured cervical vertebrae six and seven, and had surgery. College cheerleaders were involved in two accidents during 2006-2007. Both cheerleaders fractured cervical vertebrae during a routine and had a full recovery.

Following is a sample review of the data:

1. In the early 1980's a female college cheerleader fractured her skull after falling from a human pyramid. She recovered and returned to cheerleading after several weeks in the hospital.
2. In 1983 two female college cheerleaders received concussions within a period of five days in the same gymnasium. One struck her head on the floor after falling from a pyramid and the second cheerleader struck her head on the floor after falling backward from the shoulders of a male partner.
3. In the summer of 1984 a female high school cheerleader was injured at practice when she fell from a pyramid. She was partially paralyzed.
4. A male college cheerleader was injured in a tumbling accident during a basketball game in December 1983. He fractured and dislocated several cervical vertebrae and was paralyzed. He received his injuries after diving over a mini-trampoline and several

cheerleaders. The stunt is called a dive into a forward roll. He has made progress and can now walk unaided for several blocks and is able to feed himself.

5. In 1985 a female high school cheerleader was paralyzed from the chest down after attempting a back flip off the back of another cheerleader.
6. In 1985 a female college cheerleader fractured her skull after a fall from the top of a pyramid striking her head on the gym floor. She was in critical condition for a period of time but has made progress and is back in school. She is now involved in occupational therapy.
7. A male college cheerleader was paralyzed after a fall in practice. He was attempting a front flip from a mini-trampoline. He dislocated several cervical vertebrae and is now quadriplegic.
8. In 1986 a female college cheerleader fell from a pyramid and was knocked unconscious after striking the floor. Her status was unknown at the time of this writing.
9. In 1986 a college female cheerleader died from injuries suffered in a cheerleading accident. She suffered multiple skull fractures and massive brain damage after falling from the top of a pyramid type stunt and striking her head on the gym floor.
10. In 1987 a 17-year-old high school cheerleader fell from a pyramid. She was tossed into the air by two other cheerleaders and was supposed to flip backwards and land on the shoulders of two other girls. Her spinal cord was not severed but she is paralyzed from the waist down.
11. During the 1987-1988 school year a female cheerleader suffered a fractured collarbone, a damaged eardrum and a basal skull fracture. She was practicing a pyramid and was six feet off the gym floor with no spotters. She has suffered partial hearing loss and has to wear special glasses for reading.
12. In January 1988 a female cheerleader fell from a pyramid and landed on her face and shoulder. She suffered a fractured collarbone and head injuries. She was in a light coma in the hospital but complete recovery is expected.

13. In January 1989 a high school cheerleader fractured a cervical vertebra after falling from a mount in practice. She will recover with no permanent disability.
14. On July 11, 1989 a 16-year-old high school cheerleader fractured a cervical vertebra and is quadriplegic. She slipped while doing a series of back flips on damp grass.
15. On March 10, 1990 a female high school cheerleader was thrown into the air by two other cheerleaders. She fell to the floor onto her neck and was in the hospital for one week. The routine was called a basket toss. She has recovered and is back in school.
16. On March 1, 1990 a 21-year-old male college cheerleader was injured at practice. In attempting to do a back flip he hit his head against a wall. He was taken to the hospital by ambulance. He has since recovered and the injuries were not serious.
17. In June of 1991 a 15-year-old cheerleader suffered injuries to the head. She was struck in the head by her falling partner and also after striking the ground. The injury took place in a cheerleading camp. The cheerleader was taken to the hospital but her condition is not known at this time.
18. A middle school cheerleader was injured in October 1991 and died the next week. She fell from a double level cheerleading stance during practice. She hit her head on the gym floor.
19. A 20-year-old college cheerleader suffered a head injury while practicing a cheerleading stunt in which she was thrown into the air but was not caught by her teammates. She landed on the gym floor. She was in critical condition but has been upgraded to serious and is expected to recover.
20. In May of 1992 a college cheerleader was doing a tumbling sequence when she landed on her back and fractured T-12. The practice was not supervised. There was a complete recovery.
21. A high school cheerleader was injured during a basketball game doing a back handspring tuck. She hit her head on the floor. She had surgery to remove a blood clot. Her condition is not known at this time.

22. A high school cheerleader was tossed in the air during a routine, was not caught, and fell hitting her face on the basketball floor. She remained motionless for approximately 30 minutes. She is expected to recover. The accident happened in December 1993.
23. A high school cheerleader fell and hit her head on the basketball floor while being lifted by the feet by two other cheerleaders. She was taken to the hospital for observation and is expected to recover. The accident happened in December 1993.
24. A college cheerleader was doing a tumbling run when he lost control and fell on his head. He fractured a cervical vertebra and is expected to recover. The accident happened in August 1994.
25. A college cheerleader was injured in a cheerleading competition in April 1994. She struck another cheerleader while doing a backflip and fell to the floor. She suffered a fractured cervical vertebra and is expected to recover.
26. A female college cheerleader received a fractured skull during warm-ups for a performance of stunts for a Christmas parade. She was injured in a four man back tuck basket toss. She landed on her head. There was no permanent disability, but she was in rehabilitation for memory. The injury occurred in November 1994.
27. A high school cheerleader was kicked in the face by a teammate who was falling from the top of a pyramid. The injured cheerleader suffered convulsions and was transported to the hospital. She was in stable condition and was expected to recover. The injury occurred in January 1995.
28. A high school cheerleader received a closed head injury in March 1995 during a basket toss stunt. She landed on a hard rubberized basketball court. There was no permanent disability.
29. A college cheerleader was paralyzed in April 1995 after being injured while performing a double flip during a basket toss. At the present time she is quadriplegic.

30. A high school cheerleader was injured during a stunt when a fellow cheerleader fell on her head. She has had permanent medical problems since the accident. This was an update from November 1993.
31. In 1997, a high school cheerleader suffered a 15-foot fall. She had spinal cord trauma and is paralyzed. No other information was available.
32. A college cheerleader was injured in 1997 during a tumbling routine and is now quadriplegic. She was attempting a back handspring into a single back tuck during practice and landed on her head.
33. In 1997, two cheerleaders collapsed and died - one during a game and one in tryouts. Cause of death was heart related.
34. A high school junior cheerleader was doing a warm-up for a stunt in a state cheerleading competition. The stunt involved the cheerleader doing a flip off the hands of a teammate into the arms of several teammates. The teammates failed to catch her and she landed on her back. She suffered a fractured elbow, a concussion, and a back injury that later required spinal fusion. She was not able to return to school and had to be tutored her final high school years. (This case was a 1992 update)
35. On September 11, 1998 a 17-year-old high school cheerleader was cheering at a football game. She attempted a back flip, slipped on wet artificial turf, and landed on her head. She had spinal cord shock and temporary paralysis. Recovery was going to take approximately six months.
36. A 17-year-old high school cheerleader was injured in practice while practicing a pyramid formation. She fell and bruised her spinal column. She has recovered from the injury and is back cheering.
37. A 14-year-old high school cheerleader was injured while doing a dance routine at practice. She slipped on some water, fell and hit her head, and was taken to the hospital. She was in intensive care but has recovered.

38. A middle school cheerleader fell during a stunt while practicing with her squad before a game. She injured the ligaments around her spinal cord and was placed in a halo brace. She is prohibited from participating in contact sports, but will recover.
39. While cheerleading at a basketball game the athlete collided with a player chasing a loose ball. She received a fractured skull and had a blood clot removed. Full recovery was expected.
40. Squad was practicing a new stunt and the athlete was up in an extension of her partner's arm when she fell and landed on her head. She had a fractured skull and was on a ventilator for 12 hours. Full recovery was expected.
41. Athlete was on the third level of a pyramid during practice and fell on her head. She had a fractured skull and full recovery was expected.
42. During the 2001-2002 academic year three high school cheerleaders and one college cheerleader had catastrophic injuries. All four involved fractured skulls.
43. In August of 2005 a 14 year-old female high school cheerleader died after being thrown into the air and landing chest down in the arms of her teammates. She died of a lacerated spleen caused by blunt abdominal trauma.
44. A 16 year-old high school female cheerleader suffered spinal shock on 9/24/05 after fall onto her back from the shoulders of a teammate. She had a full recovery.
45. A 14 year old high school female cheerleader fell on her head during a cheerleading stunt on October 27, 2005, and was taken to the hospital. No other information was available.
46. A college female cheerleader fractured a cervical vertebra and suffered a concussion on March 5, 2006, performing a stunt during a basketball game. She fell 15 feet onto her head. A recovery was expected.
47. A male 18 year-old high school cheerleader landed on his neck after performing a standing back tuck on September 12, 2005. It was during a practice session. The injury was a fractured cervical vertebra and he is recovering. He was 6' 2" tall and weighed 215 pounds.

48. A 14 year-old female high school cheerleader suffered a fractured skull on November 15, 2005, when her teammates did not catch her during a stunt. She has recovered.
49. A female high school cheerleader fractured her skull on January 2, 2006, during a basket toss in the school cafeteria. She landed on her head and was taken to the hospital. She has recovered.
50. A 14 year-old female high school cheerleader collapsed and died during a cheerleading practice. She collapsed after being the flyer on a basket toss. Cause of death was cardiac arrest. A defibrillator was used after the accident.
51. In 2002 a 16 year-old male high school cheerleader was injured during a practice session. He fractured a cervical vertebra and is quadriplegic.
52. In January 2007 a 15 year-old high school cheerleader was performing a double front flip into a cushioned landing when she took an odd bounce and landed on her neck. She had damage to cervical vertebrae 6-7 and had a five hour surgery. She has a permanent titanium plate and screws along her spine. She has recovered, but will not participate in cheering again.
53. An 18 year-old college cheerleader fractured her neck in two places when she fell head first from a height of about 15 feet. She was a flyer during practice. She had a halo brace bolted to her skull for two months. She has recovered, but will not cheer again and her movements are highly restricted.
54. In March of 2007 a college cheerleader fractured her neck, had a concussion, and bruised a lung after falling 15 feet from a pyramid during a basketball game. She lost her balance and fell to the floor.

Cheerleading has changed dramatically in the past twenty-five years and now has two distinctive purposes; 1) of a service-oriented leader of Cheer on the sideline; and 2) as a highly skilled competing athlete. A number of schools, both high schools and colleges, across the country have limited the types of stunts that can be attempted by their cheerleaders. Rules and safety guidelines now apply to both practice and competition. As already stated in this report, high school and college cheerleaders account for over one-half of the catastrophic injuries to female athletes. Inexperienced and untrained coaches should not attempt to teach stunts with a higher level of difficulty than their team is capable of achieving or they have the knowledge and ability to teach.

The basic question that has to be asked is what is the role of the cheerleader? Approximately 20-25 states have a state championship for competitive cheer and it is not clear how many states consider cheerleading a sport. The 2006-2007 high school participation survey shows 95,177 females. There were also 2,147 male cheerleaders. College participation numbers are hard to find since cheerleading is not an NCAA sport. Is cheerleading an activity that leads the spectators in cheers or is it a sport? If the answer is to entertain the crowd and to be in competition with other cheerleading squads, then there must be safety guidelines initiated. Following are a list of sample guidelines that may help prevent cheerleading injuries:

1. Cheerleaders should have medical examinations before they are allowed to participate. Included would be a complete medical history.
2. Cheerleaders should be trained by a qualified coach with training in gymnastics and **partner stunting**. This person should also be trained in the proper methods for spotting and other safety factors.
3. Cheerleaders should be exposed to proper conditioning programs and trained in proper spotting techniques.
4. Cheerleaders should receive proper training before attempting gymnastic and partner type stunts and should not attempt stunts they are not capable of completing. A qualification system demonstrating mastery of stunts is recommended.
5. Coaches should supervise all practice sessions in a safe facility.
6. Mini-trampolines and flips or falls off of pyramids and shoulders should be prohibited.
7. Pyramids over two high should not be performed. Two high pyramids should not be performed without mats and other safety precautions.

8. If it is not possible to have a physician or certified athletic trainer at games and practice sessions, emergency procedures must be provided. The emergency procedure should be in writing and available to all staff and athletes.
9. There should be continued research concerning safety in cheerleading.
10. When a cheerleader has experienced or shown signs of head trauma (loss of consciousness, visual disturbances, headache, inability to walk correctly, obvious disorientation, memory loss) she/he should receive immediate medical attention and should not be allowed to practice or cheer without permission from the proper medical authorities.
11. Cheerleading coaches should have some type of safety certification. The American Association of Cheerleading Coaches and Advisors offers this certification.

According to the National Federation of State High School Associations, a primary purpose of sideline spirit groups (dance, pom, drill or cheer) is to serve as support groups for the interscholastic athletic programs within the school. A primary purpose for competitive spirit groups is to represent the school in organized competition. In January of 1993, 18 rules revisions were adopted for spirit groups. One of the major rules prohibits tumbling over, under, or through anything (people or equipment). All of the other rules were adopted to enhance the safety of the participants. Today, emphasis is placed not only on the stunting athlete, but also on the base and the spotter. Proper conditioning and attentiveness will help minimize the risk involved in a competition. Information concerning these new rules and updates are available from the National Federation of State High School Associations in Indianapolis, Indiana. The contact person is Susan Loomis.

On July 1, 2006, the Missouri State High School Activities Association no longer sanctioned cheerleaders to take part in regional or state competitions. The association will maintain jurisdiction over sideline cheerleading at school athletic events. Squads that want to compete must do so as a club. In the fall of 2007 the South Dakota High School Activities Association will sanction competitive cheerleading and dance, and compete for state championships. The decision was made from a student interest survey, and female four top sports were cheer, dance, softball, and soccer.

In July 2006 the National Collegiate Athletic Association (NCAA) and Varsity Brands have formed an alliance to enhance cheerleading safety at NCAA institutions by creating the College Cheerleading Safety Initiative. An important part of this program is the safety program developed by the American Association of Cheerleading Coaches and Administrators (AACCA). The latest addition of the AACCA Cheerleading Safety Manual was published in 2006 and is very informative for college coaches. All college coaches should have a copy of this safety manual and be familiar with its contents.

In 2005 the NCAA Insurance program stated that 25% of money spent on student athlete injuries resulted from cheerleading. The rate of cheerleaders to football players is 12 to 100.

It is the opinion of the authors that following cheerleading rules and safety manual guidelines that are written by cheerleading experts is an excellent way to help prevent cheerleading injuries. The new restrictions can be found on the AACCA web site www.aacca.org. The web site also has safety measures for high school cheerleading and other safety information. There is also a publication on the website called "A Parents Guide to Cheerleading Safety" which offers the five top questions parents should be asking when their child joins a school cheerleading squad.

TABLE 5
HIGH SCHOOL CHEERLEADING
DIRECT INJURIES

1982-83 – 2006-2007

SPORT	YEAR	FATALITIES	NON-FATAL	SERIOUS	TOTAL
CHEERLEADING	1982-1983	0	0	0	0
	1983-1984	0	0	0	0
	1984-1985	0	1	0	1
	1985-1986	0	1	0	1
	1986-1987	0	0	0	0
	1987-1988	0	2	1	3
	1988-1989	0	0	1	1
	1989-1990	0	1	1	2
	1990-1991	0	0	1	1
	1991-1992	1	1	0	2
	1992-1993	0	0	1	1
	1993-1994	0	0	2	2
	1994-1995	0	1	2	3
	1995-1996	0	0	0	0
	1996-1997	0	1	1	2
	1997-1998	0	0	0	0
	1998-1999	0	0	3	3
	1999-2000	0	0	3	3
	2000-2001	0	0	0	0
	2001-2002	0	3	2	5
	2002-2003	0	1	2	3
	2003-2004	0	2	2	4
	2004-2005	0	0	2	2
	2005-2006	1	0	5	6
	2006-2007	**0**	**0**	**1**	**1**
	TOTAL	2	14	30	46

** INCLUDES TWO MALE CHEERLEADERS

TABLE 6

COLLEGE CHEERLEADING

DIRECT INJURIES

1982-83 – 2006-2007

SPORT	YEAR	FATALITIES	NON-FATAL	SERIOUS	TOTAL
CHEERLEADING	1982-1983	0	1	1	2
	1983-1984	0	0	2	2
	1984-1985	0	1	0	1
	1985-1986	1	1	0	2
	1986-1987	0	0	1	1
	1987-1988	0	0	0	0
	1988-1989	0	0	0	0
	1989-1990	0	0	1	1
	1990-1991	0	0	0	0
	1991-1992	0	0	1	1
	1992-1993	0	0	0	0
	1993-1994	0	0	2	2
	1994-1995	0	1	1	2
	1995-1996	0	0	0	0
	1996-1997	0	1	1	2
	1997-1998	0	0	0	0
	1998-1999	0	0	0	0
	1999-2000	0	0	1	1
	2000-2001	0	0	0	0
	2001-2002	0	0	1	1
	2002-2003	0	0	0	0
	2003-2004	0	2	0	2
	2004-2005	0	0	0	0
	2005-2006	0	0	1	1
	2006-2007	**0**	**0**	**2**	**2**
	TOTAL	1	7	15	23

**INCLUDES FOUR MALE CHEERLEADERS

In 2008 the National Center for Catastrophic Sports Injury Research (NCCSIR) was contacted by Ms. Kimberly Archie, Director of the National Cheer Safety Foundation. The National Cheer Safety Foundation was created by parents for parents, and is interested in cheer safety and the collection of cheerleading injury data. Cheer injuries can be reported to www.cheerinjuryreport.com. Jessica Smith, a college cheerleader who had a serious injury while cheering, is the National Spokesperson.

The Foundation was interested in collecting cheerleading injury data from across the United States and was interested in collaborating with the NCCSIR. The NCCSIR was interested in working with the Foundation since it is always an asset to get as much injury data as possible for all sports from all sources. Ms. Archie sent me an initial list of 86 cheerleading injuries, of which NCCSIR had only a small number. After going through the list, a decision was made to include 30 of the injuries and to combine them with the NCCSIR data. A recommendation was also made to the Foundation as to the kinds of data that should be collected for catastrophic cheerleading injuries in the future. It is expected that future data will meet all of the requirements. As an example, the NCCSIR did not include concussion injuries unless they were severe brain injuries and created ongoing medical problems. The Center also did not include injuries that could not be verified. Catastrophic injuries as defined by the NCCSIR can be found in the introduction to this report.

The following Table (Table 7) illustrates the high school and college injuries that were accepted from the Foundation:

TABLE 7

CHEERLEADING CATASTROPHIC INJURIES

DATA FROM NATIONAL CHEER SAFETY FOUNDATION

1982 – 2007

LEVEL	FATALITIES	DISABILITY	SERIOUS	TOTAL
HIGH SCHOOL	0	8	15	23
COLLEGE	0	4	3	7
TOTAL	0	12	18	30

If the high school and college injury data from the National Cheer Safety Foundation were combined with the high school and college cheerleading injury data collected by the NCCSIR, the results would be as illustrated in the following tables (Tables 8-9).

TABLE 8

CHEERLEADING CATASTROPHIC INJURIES

HIGH SCHOOL COMBINED DATA

1882-1983 - 2006-2007

YEAR	FATALITY	NON-FATAL	SERIOUS	TOTAL_
1982-1983	0	0	0	0
1983-1984	0	0	0	0
1984-1985	0	2	0	2
1985-1986	0	1	0	1
1986-1987	0	0	1	1
1987-1988	0	2	1	3
1988-1989	0	0	1	1
1989-1990	0	1	1	2
1990-1991	0	1	1	2
1991-1992	1	1	0	2
1992-1993	0	0	1	1
1993-1994	0	0	2	2
1994-1995	0	2	2	4
1995-1996	0	0	1	1
1996-1997	0	1	1	2
1997-1998	0	1	0	1
1998-1999	0	0	5	5
1999-2000	0	0	4	4
2000-2001	0	1	1	2
2001-2002	0	4	3	7
2002-2003	0	2	2	4
2003-2004	0	3	3	6
2004-2005	0	0	4	4
2005-2006	1	0	9	10
2006-2007	0	0	2	2
TOTAL	2	22	45	69

TABLE 9

CHEERLEADING CATASTROPHIC INJURIES

COLLEGE COMBINED DATA

1982 – 2007

YEAR	FATALITY	NON-FATAL	SERIOUS	TOTAL
1982-1983	0	1	1	2
1983-1984	0	1	2	3
1984-1985	0	1	0	1
1985-1986	1	1	0	2
1986-1987	0	0	1	1
1987-1988	0	0	0	0
1988-1989	0	0	0	0
1989-1990	0	0	1	1
1990-1991	0	0	0	0
1991-1992	0	0	1	1
1992-1993	0	0	0	0
1993-1994	0	0	2	2
1994-1995	0	1	1	2
1995-1996	0	0	0	0
1996-1997	0	1	1	2
1997-1998	0	0	1	1
1998-1999	0	1	0	1
1999-2000	0	0	1	1
2000-2001	0	1	0	1
2001-2002	0	1	2	3
2002-2003	0	0	0	0
2003-2004	0	2	0	2
2004-2005	0	0	0	0
2005-2006	0	0	1	1
2006-2007	0	0	3	3
TOTAL	1	11	18	30

Table 10 illustrates high school female catastrophic injuries for the past 25 years, but the table now includes the combined cheerleading injury data from the National Cheer Safety Foundation and the NCCSIR. In the original table (Table 1) high school cheerleading accounted for 55.0% of all high school female sports catastrophic injuries. In Table 10, high school cheerleading accounts for 65.1% of all female high school sports catastrophic injuries.

TABLE 10

HIGH SCHOOL FEMALE DIRECT CATASTROPHIC INJURIES

1982-83 – 2006-07

SPORT	FATALITY	NON-FATAL	SERIOUS	TOTAL
Cheerleading*	2	21	44	67
Gymnastics	0	6	3	9
Track	1	1	5	7
Swimming	0	4	1	5
Basketball	0	1	3	4
Ice Hockey	0	0	2	2
Field Hockey	0	3	0	3
Softball	1	2	0	3
Lacrosse	0	0	1	1
Soccer	0	1	0	1
Volleyball	0	1	0	1
TOTAL	**4**	**40**	**59**	**103**

*Cheerleading combined data with Cheer Safety Foundation and NCCSIR

Table 11 illustrates college female catastrophic injuries for all sports for the past 25 years, but the table now includes the combined cheerleading injury data from the National Cheer Safety Foundation and the NCCSIR. In the original table (Table 3) college cheerleading accounted for 59.4% of all college female sports catastrophic injuries. In Table 11, college cheerleading accounts for 66.7% of all college female sports catastrophic injuries.

TABLE 11

COLLEGE FEMALE DIRECT CATASTROPHIC INJURIES

1982-82 – 2006-07

SPORT	FATALITY	NON-FATAL	SERIOUS	TOTAL
Cheerleading*	1	9	16	26
Field hockey	0	1	2	3
Lacrosse	0	2	0	2
Gymnastics	0	2	0	2
Equestrian	1	0	0	1
Soccer	0	1	0	1
Ice Hockey	0	0	1	1
Skiing	1	0	0	1
Track (Pole Vault)	0	1	0	1
Softball	0	0	1	1
TOTAL	**3**	**16**	**20**	**39**

*Cheerleading combined data with Cheer Safety Foundation and NCCSIR

The NCCSIR will continue to share data with the National Cheer Safety Foundation, and in future reports the cheerleading and female catastrophic injury tables will be combined into single tables.

ANNUAL SURVEY OF FOOTBALL INJURY RESEARCH

1931 - 2008

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INTRODUCTION

In 1931 the American Football Coaches Association initiated the First Annual Survey of Football Fatalities. The original survey committee was chaired by Marvin A. Stevens, M.D., of Yale University, who served from 1931-1942. Floyd R. Eastwood, Ph.D., Purdue University succeeded Dr. Stevens in 1942 and served through 1964. Carl S. Blyth, Ph.D., University of North Carolina at Chapel Hill was appointed in 1965 and served through the 1979 football season. In January 1980, Frederick O. Mueller, Ph.D., University of North Carolina at Chapel Hill was appointed by the American Football Coaches Association and the National Collegiate Athletic Association to continue this research under the new title, **Annual Survey of Football Injury Research**.

The primary purpose of the Annual Survey of Football Injury Research is to make the game of football a safer and, therefore, a more enjoyable sports activity. Because of these surveys the game of football has realized many benefits in regard to rule changes, improvement of equipment, improved medical care, and improved coaching techniques. The 1976 rule change that made it illegal to make initial contact with the head while blocking and tackling was the direct result of this research.

The 1990 report was historic in that it was the first year since the beginning of the research, 1931, that there was not a direct fatality in football at any level of play. This clearly illustrates that data collection and analysis is important and plays a major role in injury prevention.

Data Collection

Throughout the year, upon notification of a suspected football fatality, immediate contact is made with the appropriate officials (coaches, administrators, physicians, athletic trainers). Pertinent information is collected through questionnaires and personal contact.

Football fatalities are classified for this report as direct and indirect. The criteria used to classify football fatalities are as follows:

Direct - Those fatalities which resulted directly from participation in the fundamental skills of football.

Indirect - Those fatalities that are caused by systemic failure as a result of exertion while participating in football activity or by a complication which was secondary to a non-fatal injury.

In several instances of reported football fatalities, the respondent stated the fatality should not be attributed to football. Reasons for these statements are that the fatality was attributed to physical defects that were unrelated to football injuries.

Participation numbers were updated in the 1989 report. The National Federation of State High School Associations has estimated that there are approximately 1,500,000 high school, junior high school, and non-federation school football participants in the United States. The college figure of 75,000 participants includes the National Collegiate Athletic Association, the National Association of Intercollegiate Athletics, the National Junior College Athletic Association, and an estimate of schools not associated with any national organization. Sandlot and professional football have been estimated at 225,000 participants. These figures give an estimate of 1,800,000 total football participants in the United States for the 2008 football season.

Dr. Mueller compiled and prepared the survey report on college, professional, and sandlot levels, and Mr. Bob Colgate of the National Federation of State High School Associations assumed responsibility for collecting and preparing the senior and junior high school phase of the study. Sandlot is defined as non-school football, but organized and using full protective equipment.

At the conclusion of the football season, both reports are compiled into this **Annual Survey of Football Injury Research**. This report is sponsored by the American Football Coaches Association, the National Collegiate Athletic Association, and The National Federation of State High School Associations.

Acknowledgments

Medical data for the 2008 report were compiled by Dr. Robert C. Cantu, Chairman, Department of Surgery and Chief, Neurosurgery Service, Emerson Hospital, in Concord, MA. Dr. Cantu is a Past-President of the American College of Sports Medicine and is the Medical Director for the National Center for Catastrophic Sports Injury Research at the University of North Carolina at Chapel Hill.

Summary

1. There were seven fatalities directly related to football during the 2008 football season. All seven fatalities were in high school football. (Table I)

2. The rate of direct fatal injuries is very low on a 100,000 player exposure basis. For the approximately 1,800,000 participants in 2008, the rate of direct fatalities was 0.39 per 100,000 participants.

3. The rate of direct fatalities in high school and junior high school football was 0.47 per 100,000 participants. The rate of direct fatalities in college was 0.00 per 100,000 participants. (Table III)

4. Most direct fatalities usually occur during regularly scheduled games. In 2008 five direct fatalities occurred in games, one in practice, and one in a scrimmage game.

5. The 2008 survey shows that three of the injuries took place in August, three in September, and one in October.

6. The major activities in football would naturally account for the greatest number of fatalities. In 2008 three fatalities happened while tackling, one while being tackled, one being blocked, and two in a collision. Three of the brain fatalities involved tackling, one being tackled, and one being blocked. (Table V)

7. In 2008 five fatalities resulted from injuries to the brain, one to an abdominal injury, and one to a chest injury. (Table VI)

8. In many cases football cannot be directly responsible for fatal injuries (heat stroke, heart related and so forth). In 2008 there were 13 indirect fatalities. Seven were associated with high school football, three with college football, and three with sandlot football. The high school indirect deaths were four heat stroke and three heart related deaths. The three college indirect deaths were two heat related and one sickle cell death. All three of the sandlot deaths were heart related. (Table II)

Discussions And Recommendations

After a slight rise in the number of football fatalities during the 1986 season, the 1990 data revealed the elimination of direct football fatalities. That was the first time since 1931 that there have been no direct football fatalities. The 2008 data continues the trend of single digit direct fatalities that started in the 1978 football season. There was a decrease from nine direct fatalities in 2001 to six in 2002, three in 2003, five in 2004, three in 2005, one in 2006, four in 2007, and a slight rise in 2008 to seven. The data illustrates the importance of data collection and the analysis of this data in making changes in the game of football that help reduce the incidence of serious injuries. This effort must be continued in order to keep these numbers low and to strive for the elimination of football fatalities. Indirect injuries have been in double figures since 1999 with the exception of 2003 and 2007. The 2008 indirect injuries show an increase of four when compared to the 2007 data.

Head and Neck Injuries

Past efforts that were successful in reducing fatalities to the levels indicated from 1990 through 2008, and the elimination of direct fatalities in 1990, should again be emphasized. Rule changes for the 1976 football season that eliminated the head and face as a primary and initial contact area for blocking and tackling is of utmost importance. The original 1976 rule defined spearing as “the intentional use of the helmet (including the face mask) in an attempt to punish an opponent.” In the new 2005 definition in the rules “intentional” has been dropped. The new rule states “spearing is the use of the helmet (including the face mask) in an attempt to punish an opponent”. A 2006 point of emphasis covers illegal helmet contact and defines spearing, face tackling, and butt blocking. High school rule changes effective during 2006-07 stated that at least a 4-point chinstrap shall be required to secure the helmet, and all mouth guards must be colored, not white or clear. Also rules revisions regarding illegal helmet contact were made in February 2007. The committee placed butt blocking, face tackling, and spearing under the heading of “Helmet Contact – Illegal” to place more emphasis on risk-minimization concerns. Examples of illegal helmet contact that could result in disqualification include illegal helmet contact against an opponent lying on the ground, illegal helmet contact against an opponent held up by other players, and illegal helmet-to-helmet contact against a defenseless opponent. **Coaches who are teaching helmet or face to the numbers tackling and blocking are not only breaking the football rules, but are placing their players at risk for permanent paralysis or death. This type of tackling and blocking technique was the direct cause of 36 football fatalities and 30 permanent paralysis injuries in 1968. In addition, if a catastrophic football injury case goes to a court of law, there is no defense for using this type of tackling or blocking technique**. Since 1960 most of the direct fatalities have been caused by brain and neck injuries, and in fact since 1990 all but six of the head and neck deaths have been brain injuries. We must continue to reduce head and neck injuries.

Several suggestions for reducing head and neck injuries are as follows:

1. Athletes must be given proper conditioning exercises that will strengthen their necks so that participants will be able to hold their heads firmly erect when making contact.
2. Coaches should drill the athletes in the proper execution of the fundamental football skills, particularly blocking and tackling. **Contact should always be made with the head-up and never with the top of the head/helmet. Initial contact should never be made with the head/helmet or face mask**.
3. Coaches and officials should discourage the players from using their heads as

battering rams when blocking and tackling. The rules prohibiting spearing should be enforced in practice and in games. The players should be taught to respect the helmet as a protective device and that the helmet should not be used as a weapon.

4. All coaches, physicians, and trainers should take special care to see that the player's equipment is properly fitted, particularly the helmet.
5. When a player has experienced or shown signs of head trauma (loss of consciousness, visual disturbances, headache, inability to walk correctly, obvious disorientation, memory loss), he should receive immediate medical attention and should not be allowed to return to practice or game without permission from a physician.
6. A number of the players associated with brain trauma complained of headaches or had a previous concussion prior to their deaths. The team physician, athletic trainer, or coach should make players aware of these signs. Players should also be encouraged to inform the team physician, athletic trainer, or coach if they are experiencing any of the above mentioned signs of brain trauma.
7. Coaches should never make the decision whether a player returns to a game or active participation in a practice if that player experiences brain trauma.
8. Of the five brain injuries in 2008, two were diagnosed as second impact syndrome. Players with second impact syndrome received an initial concussion and returned to play before being fully healed.

Another important effort has been and continues to be the improvement of football protective equipment. It is imperative that old and worn equipment be properly renovated or discarded and continued emphasis placed on developing the best equipment possible. Manufacturers, coaches, trainers, and physicians should continue their joint and individual efforts toward this end.

The authors of this research are convinced that the current rules which eliminate the head in blocking and tackling, **coaches teaching the proper fundamentals of blocking and tackling**, the helmet research conducted by the National Operating Committee on Standards for Athletic Equipment (NOCSAE), excellent physical conditioning, proper medical supervision, and a good data collection system have played the major role in reducing fatalities and serious brain and neck injuries in football. This is best illustrated by Table IX and Graph I which shows the increase in both brain and cervical spine fatalities during the decade from 1965-1974. This time period was associated with blocking and tackling techniques that involved the head as the initial point of contact. The reduction in brain and cervical spine injuries is shown in the decade from 1975-1984. This decade was associated with the 1976 rule change that eliminated the head as the initial contact point in blocking and tackling. There is no doubt that the 1976 rule change has made a difference and that a continued effort should be made to keep the head out of the fundamental skills of football. Data from the decade 1985-1994 continues to illustrate the reduction in brain and neck fatalities. A concern is that the data from 1995-2004 shows an increase in brain fatalities over that of 1985-1994. There has been an increase of 11 brain deaths during the decade 1995-2004, which is an increase of 2.1% over 1985-1994. The decade from 2005-2014 will have to be watched closely.

Heat Stroke

A continuous effort should be made to eliminate heat stroke deaths associated with football. Since the beginning of the survey through 1959 there were five cases of heat stroke death reported. From 1960 through 2008 there have been 120 heat stroke cases that resulted in death (Table IV). **The 2008 data show four cases of heat stroke death at the high school level and two at the college level. The six heat stroke deaths accounted for the third highest number since the eight in 1970, and seven in 1972. There is no excuse for any number of heat stroke deaths since they are all preventable with the proper precautions. Since 1995 there have been 39 football players die from heat stroke (29 high school, 7 college, 2 professional, and one sandlot). Every effort should be made to continuously educate coaches concerning the proper procedures and precautions when practicing or playing in**

the heat. Since 1974 there has been a dramatic reduction in heat stroke deaths with the exception of 1978, 1995, 1998, when there were four each year, and 2000 and 2006 when there were five each year. There were no heat stroke deaths in 1991, 1993, 1994, 2002, and 2003. All coaches, trainers, and physicians should place special emphasis on eliminating football fatalities that result from physical activity in hot weather.

Heat stroke and heat exhaustion are prevented by careful control of various factors in the conditioning program of the athlete. When football activity is carried on in hot weather, the following suggestions and precautions should be taken:

1. Each athlete should have a complete physical examination with a medical history and an annual health history update. History of previous heat illness and type of training activities before organized practice begins should be included.
2. Acclimatize athletes to heat gradually by providing graduated practice sessions for the first seven to ten days and other abnormally hot or humid days. Obey the rules pertaining to when full football uniforms may be used.
3. Know both the temperature and the humidity since it is more difficult for the body to cool itself in high humidity. Use of a sling psychrometer is recommended to measure the relative humidity and anytime the wet-bulb temperature is over 78 degrees practices should be altered.
4. Adjust activity level and provide frequent rest periods. Rest in cool, shaded areas with some air movement and remove helmets and loosen or remove jerseys. Rest periods of 15-30 minutes should be provided during workouts of one hour.
5. Provide adequate **cold** water replacement during practice. **Water should always be available and in <u>unlimited quantities</u> to the athletes. <u>GIVE WATER REGULARLY</u>**. Athletes should drink water before, during, and after practice.
5. Salt should be replaced daily and liberal salting of the athletes' food will accomplish this purpose. Coaches should not provide salt tablets to athletes. Attention must be

directed to water replacement.

7. Athletes should weigh each day before and after practice and weight charts checked in order to treat the athlete who loses excessive weight each day. Generally, a three percent body weight loss through sweating is safe, and a five percent loss is in the danger zone.
8. Clothing is important and a player should avoid using long sleeves, long stockings and any excess clothing. Never use rubberized clothing or sweatsuits.
9. Some athletes are more susceptible to heat injury. These individuals are not accustomed to work in the heat, may be overweight, and may be the eager athlete who constantly competes at his capacity. Athletes with previous heat problems should be watched closely.
10. It is important to observe for signs of heat illness. Some trouble signs are nausea, incoherence, fatigue, weakness, vomiting, cramps, weak rapid pulse, flushed appearance, visual disturbances, and unsteadiness. Heat stroke victims, contrary to popular belief, may sweat profusely. If heat illness is suspected, seek a physician's immediate service. Recommended emergency procedures are vital. Plan should be in writing and all personnel should have copies.
11. An increasing number of medical personnel are using a treatment for heat illnesses that involves immersing the athlete in ice water. This technique will help bring down the body temperature and has proven to be effective. Some schools have plastic outdoor swim pools filled with ice water available at practice facilities.
12. The National Athletic Trainers Association also has a heat illness position statement on their web site with recommendations for prevention.

Recommendations

Specific recommendations resulting from the 2008 survey data are as follows:

1. Mandatory medical examinations and medical history should be taken before allowing

an athlete to participate in football. The NCAA recommends a thorough medical examination when the athlete first enters the college athletic program and an annual health history update with use of referral exams when warranted. If the physician or coach has any questions about the athlete's readiness to participate, the athlete should not be allowed to play. High school coaches should follow the recommendations set by their State High School Athletic Associations.

2. All personnel concerned with training football athletes should emphasize proper, gradual, and complete physical conditioning. Particular emphasis should be placed on neck strengthening exercises and acclimatization to hot weather.
3. A physician should be present at all games and practice sessions. If it is impossible for a physician to be present at all practice sessions, emergency measures must be provided. Written emergency procedures are recommended for both coaches and medical staff.
4. All personnel associated with football participation should be cognizant of the problems and safety measures related to physical activity in hot weather.
5. Each institution should strive to have a certified athletic trainer who is a regular member of the faculty and is adequately prepared and qualified.
6. Cooperative liaison should be maintained by all groups interested in the field of Athletic Medicine (coaches, trainers, physicians, manufacturers, administrators, and so forth).
7. There should be strict enforcement of game rules, and administrative regulations should be enforced to protect the health of the athlete. Coaches and school officials must support the game officials in their conduct of the athletic contests.
8. There should be a renewed emphasis on employing well-trained athletic personnel, providing excellent facilities, and securing the safest and best equipment possible.
9. There should be continued research concerning the safety factor in football (rules,

facilities, equipment, and so forth).

10. Coaches should continue to teach and emphasize the proper fundamentals of blocking and tackling to help reduce head and neck fatalities. **KEEP THE HEAD OUT OF FOOTBALL**.
11. Strict enforcement of the rules of the game by both coaches and officials will help reduce serious injuries. Be aware of the 2005 rule change to the 1976 definition of spearing, and to the 2007 high school rules concerning illegal helmet contact.
12. When a player has experienced or shown signs of head trauma (loss of consciousness, visual disturbances, headache, inability to walk correctly, obvious disorientation, memory loss), he should receive immediate medical attention and should not be allowed to return to practice or game without permission from the proper medical authorities.
13. The number of indirect heart related deaths has increased over the years and it is recommended that schools have automated external defibrillators (AED) available for emergency situations.

CASE STUDIES DIRECT FATALITIES

HIGH SCHOOL

A 17 year-old high school football player was injured on 8/22/08 during a practice session. He was making a one-on-one tackle at the time and contact was made with his head to the shoulder pads of his opponent. He was unconscious after the hit and was taken to the hospital. The accident took place on 8/22/08 and he was in a coma for four days and died on 8/26/08. Cause of death was a subdural hematoma.

A 15 year-old high school football player was injured during a game on 8/22/08. He was a linebacker and was blocked by a pulling lineman. Helmet to helmet contact was made by the pulling lineman. He was taken to a hospital, had surgery, and died on 8/24/08 after being taken off of life support. Cause of death was a subdural hematoma.

A 15 year-old high school football player was injured during a junior varsity game on 8/29/08 and died on 8/30/08. He was playing wide receiver at the time and was involved with a collision with two opposing players. The injury was a lacerated liver and he died of internal complications.

A 16 year-old high school football player was injured during a game scrimmage against another school. He was hit in the chest by an opponent and died a short time later at the hospital. Autopsy results failed to identify the cause of death.

A high school sophomore football player was injured during a game on 9/12/08 and died on 9/16/08. He was a defensive back tackling the ball carrier at the time of the injury. Contact was made with the legs of the ball carrier. Cause of death was a brain injury.

A 16 year-old high school football player was injured during a game on 9/19/08 and died later the same day. He collapsed on the sideline after being tackled while running the ball. He received a concussion in practice two days before the game and did not have clearance from a physician. Cause of death was a brain injury due to second impact syndrome.

A 16 year-old high school football player was injured during a game on 10/13/08 and died on 10/15/08. He was playing the linebacker position making a tackle during a junior varsity game. He suffered a concussion three weeks before the fatal injury. Cause of death was a subdural hematoma with possible second impact syndrome. He was cleared by a physician to return to play after the initial concussion.

CASE STUDIES INDIRECT FATALITIES

HIGH SCHOOL

A 17 year-old high school football player was injured on 8/14/08 and died on 8/15/08. He was participating in a practice session in full pads from 4:30 PM to 7:00 PM in 103 to 104 degree heat. He also participated in a light morning practice that same day. The county coroner ruled the death to be related to an electrolyte imbalance from drinking too much water after working in the heat for a long period. Actual cause of death is known as hyponatremia. He is listed in this report as a heat related death.

A 17 year-old high school football player died on 8/12/08 after participating in a high school football scrimmage against another high school. The autopsy report was still not available in December of 2008, but all indications are that the cause of death was heat related. There has been a long investigation going on at the high school and also with the local EMT who visited the athlete's home after a 911 call. This case will be updated as more information is available.

A 15 year-old high school junior varsity football player collapsed at practice on 5/28/08. Cause of death was congenital heart failure.

A 15 year-old high school football player collapsed after practice on 8/20/08. The temperature was 94 degrees and practice started at 4:30 PM and ended at 6:00 PM. The coach stated that they had three water breaks. The athlete's core temperature was 107 degrees. There was no autopsy, but the coroner called it a heat stroke death. Another player on the team also collapsed, but recovered after two days in the hospital.

A 16 year-old high school football player collapsed at the end of a team camp practice on 7/14/08. He died at the hospital. He was 5'11" tall and weighed 240 lbs. Cause of death was hypertrophic cardiomyopathy.

A 17 year-old high school football player collapsed and died after an off season workout on 5/15/08. Preliminary findings indicate it was a heart related death.

A 16 year old high school football player collapsed during a practice session on 8/26/08 and died on 8/31/08. Cause of death was heat stroke. He was 6'5" tall and weighed 360 lbs. His body temperature at the hospital was 108 degrees. On 8/1/08 he suffered from heat exhaustion and spent two days in the hospital;

COLLEGE

An 18 year-old college football player collapsed and died after the first practice of the year on 8/14/08. The temperature was 89 degrees and the athlete was 6'1" tall and weighed 240 lbs. The practice lasted 1 ½ hours and the players wore shorts and helmets, but no pads. Cause of death was heat related.

A 19 year-old college football player collapsed during an off-season workout on March 18, 2008 and later died at the hospital. Cause of death listed by the medical examiner was dysrhythmia due to acute exertional rhabdomyolysis with sickle cell trait. The case was controversial as related to the care he received after collapsing and to the intensity of the workout.

A 22 year-old college football player died after an off-season workout on May 28, 2008. Cause of death was heat stroke. School officials stated they were unaware of the athlete having sickle cell trait and have begun screening for the condition in light of the recent heat death. The athlete was 6'4" inches tall and weighed 280 lbs.

SANDLOT

A 13 year-old youth football player collapsed and died after running drills on 8/25/08. Cause of death was believed to be heart related.

A 12 year-old youth football player collapsed at practice and later died. Cause of death was heart related.

A 13 year-old youth football player collapsed during a practice session and later died on 7/28/08. He was 6'1" tall and weighed 231 lbs. Cause of death was an enlarged heart.

TABLE I

FATALITIES: DIRECTLY DUE TO FOOTBALL – 1931-2008*

YEAR	SANDLOT DIRECT	PRO AND SEMIPRO DIRECT	HIGH SCHOOL DIRECT	COLLEGE DIRECT	TOTAL DIRECT
**1931-1965	134	72	348	54	608
1966	4	0	20	0	24
1967	5	0	16	3	24
1968	4	1	26	5	36
1969	3	1	18	1	23
1970	3	0	23	3	29
1971	2	0	15	3	20
1972	3	1	16	2	22
1973	2	0	7	0	9
1974	0	0	10	1	11
1975	1	0	13	1	15
1976	3	0	15	0	18
1977	1	0	8	1	10
1978	0	0	9	0	9
1979	0	0	3	1	4
1980	0	0	9	0	9
1981	2	0	5	2	9
1982	2	0	7	0	9
1983	0	0	4	0	4
1984	1	0	4	1	6
1985	2	0	4	1	7
1986	0	0	11	1	12
1987	0	0	4	0	4
1988	0	0	7	0	7
1989	0	0	4	0	4

TABLE 1 CONTINUED

1990	0	0	0	0	0
1991	0	0	3	0	3
1992	0	0	2	0	2
1993	0	0	3	1	4
1994	0	0	0	1	1
1995	0	0	4	0	4
1996	0	0	5	0	5
1997	0	0	6	1	7
1998	0	0	6	1	7
1999	1	0	4	1	6
2000	0	0	3	0	3
2001	1	0	8	0	9
2002	1	1	3	1	6
2003	1	0	2	0	3
2004	1	0	4	0	5
2005	0	1	2	0	3
2006	0	0	1	0	1
2007	0	1	3	0	4
2008	**0**	**0**	**7**	**0**	**7**
TOTALS	**177**	**78**	**672**	**86**	**1013**

*No study in 1942 ** Yearly totals available from past reports

TABLE II

FATALITIES: INDIRECTLY DUE TO FOOTBALL - 1931-2008*

YEAR	SANDLOT INDIRECT	PRO AND SEMIPRO INDIRECT	HIGH SCHOOL INDIRECT	COLLEGE INDIRECT	TOTAL INDIRECT
**1931-1965	85	15	159	40	299
1966	0	0	6	2	8
1967	0	0	4	1	5
1968	2	0	8	2	12
1969	3	1	8	3	15
1970	0	0	12	2	14
1971	2	1	7	2	12
1972	0	0	10	1	11
1973	0	0	5	3	8
1974	0	0	5	3	8
1975	2	0	3	3	8
1976	1	0	7	2	10
1977	0	0	6	0	6
1978	0	0	8	1	9
1979	1	0	8	1	10
1980	0	0	4	0	4
1981	0	0	6	0	6
1982	1	0	7	3	11
1983	0	0	6	3	9
1984	0	0	3	0	3
1985	0	0	1	1	2
1986	0	0	6	1	7
1987	0	0	4	3	7
1988	1	0	10	0	11
1989	0	0	9	2	11

TABLE 11 CONTINUED

1990	0	0	3	3	6
1991	0	0	3	1	4
1992	1	0	9	1	11
1993	0	0	8	1	9
1994	1	0	2	2	5
1995	1	0	7	1	9
1996	0	1	10	1	12
1997	1	0	7	0	8
1998	1	0	6	1	8
1999	1	0	11	0	12
2000	0	0	11	2	13
2001	0	2	10	3	15
2002	1	0	7	3	11
2003	1	1	4	1	7
2004	0	0	7	3	10
2005	1	1	8	2	12
2006	2	0	12	2	16
2007	1	1	6	1	9
2008	**3**	**0**	**7**	**3**	**13**
TOTALS	**113**	**23**	**450**	**110**	**696**

* No study in 1942 ** Yearly totals available from past reports

TABLE III

DIRECT FATALITIES INCIDENCE PER 100,000 – 1931-2008*

YEAR	HIGH SCHOOL	COLLEGE
**1931-1959		
1960	1.78	1.53
1961	1.62	9.23
1962	1.94	0.00
1963	1.94	3.04
1964	2.23	4.56
1965	2.00	1.33
1966	2.00	0.00
1967	1.60	4.00
1968	2.60	6.60
1969	1.64	1.33
1970	1.92	4.00
1971	1.25	4.00
1972	1.33	2.67
1973	0.58	0.00
1974	0.83	1.33
1975	1.08	1.33
1976	1.00	0.00
1977	0.53	1.33
1978	0.60	0.00
1979	0.23	1.33
1980	0.69	0.00
1981	0.38	2.67
1982	0.54	0.00
1983	0.30	0.00
1984	0.30	1.33
1985	0.30	1.33
1986	0.84	1.33
1987	0.30	0.00
1988	0.46	0.00
1989	0.27	0.00

TABLE III CONTINUED

1990	0.00	0.00
1991	0.20	0.00
1992	0.14	0.00
1993	0.20	1.33
1994	0.00	1.33
1995	0.27	0.00
1996	0.33	0.00
1997	0.40	1.33
1998	0.40	1.33
1999	0.27	1.33
2000	0.20	0.00
2001	0.46	0.00
2002	0.20	0.00
2003	0.13	0.00
2004	0.27	0.00
2005	0.13	0.00
2006	0.07	0.00
2007	0.20	0.00
2008	0.47	0.00

* No study was made in 1942.

** Yearly totals available from past reports.

Based on 1,500,000 junior and senior high school players and 75,000 college players.

TABLE IV

HEAT STROKE FATALITIES 1931-2008*

YEAR	TOTAL
**1931-1954	0
1955	1
1956-1958	0
1959	4
1960-1964	15
1965	6
1966	1
1967	2
1968	5
1969	5
1970	8
1971	4
1972	7
1973	3
1974	1
1975	0
1976	1
1977	1
1978	4
1979	2
1980	1
1981	2
1982	2
1983	1
1984	3
1985	0
1986	0
1987	1
1988	2
1989	2
1990	1
1991	0
1992	1
1993	0
1994	0
1995	4
1996	2
1997	1
1998	4
1999	2

TABLE IV CONTINUED

2000	5
2001	3
2002	0
2003	0
2004	3
2005	2
2006	5
2007	2
2008	**6**
TOTALS	**125**

* No study was made in 1942.

TABLE V

DIRECT FATALITIES 2008: TYPE OF ACTIVITY ENGAGED IN

Type of Activity	Sandlot	Pro	High School	College	Total
Tackled Running Ball	0	0	1	0	1
Blocked	0	0	1	0	1
Tackling	0	0	3	0	3
Collision	0	0	2	0	2
TOTAL	**0**	**0**	**7**	**0**	**7**

TABLE VI

DIRECT FATALITIES 2008: CAUSE OF DEATH

Causes	Sandlot	Pro	High School	College	Total
Brain Injury	0	0	5	0	5
Neck Injury	0	0	0	0	0
Internal	0	0	2	0	2
TOTAL	**0**	**0**	**7**	**0**	**7**

TABLE VII

DIRECT FATALITIES 2008: POSITION PLAYED

Position	Sandlot	Pro	High School	College	Total
Running Back	0	0	2	0	2
Wide Receiver	0	0	1	0	1
Safety	0	0	1	0	1
Linebacker	0	0	2	0	2
Lineman	0	0	1	0	1
TOTAL	0	0	7	0	7

TABLE VIII

INDIRECT FATALITIES 2008: CAUSE OF DEATH

Causes	Sandlot	Pro	High School	College	Total
Heart Related	3	0	3	0	6
Heat Stroke	0	0	4	2	6
Sickle Cell	0	0	0	1	1
TOTAL	**3**	**0**	**7**	**3**	**13**

TABLE IX

HEAD AND CERVICAL SPINE FATALITIES

Year	Head		Cervical Spine	
	Frequency	Percent	Frequency	Percent
1945-1954	87	17.1	32	27.3
1955-1964	115	22.5	23	19.7
1965-1974	162	31.8	42	35.9
1975-1984	69	13.5	14	12.0
1985-1994	33	6.5	5	4.3
1995-2004	44	8.6	1	0.8
TOTALS	510	100.0	117	100.0

THE CENTER FOR INJURY RESEARCH AND POLICY
HIGH SCHOOL RIO™

Each year, over 7 million children pursue their athletic dreams by participating in high school sports. Unfortunately, these children suffer an alarming 1.4 million injuries, many of which could be prevented. Dr. R. Dawn Comstock, an epidemiologist and Principal Investigator in the Center for Injury Research and Policy, has developed an innovative injury surveillance system to capture important injury data to protect children from sports injuries.

This system is known as High School RIO™ (Reporting Information Online). It is one of many studies under the RIO™ umbrella designed to track both injury rates and patterns of injury. By studying and understanding the "What, why, and how" of high school sports injuries, Dr. Comstock and her team recommend strategies to make participation in sports safer, ultimately preventing injuries from occurring.

High School RIO™ study findings encourages:

- Safe Play
- Increased Activity
- Physical Fitness
- Life Long Healthy Behaviors

How the System Works

Certified athletic trainers from across the country serve as study reporters submitting injury and participation data weekly through an easily navigated website. This essential data is analyzed and allows researchers to track trends over time. We can then provide data to the National Federation of State High School (NFHS) Associations' Sports Medical Advisory and Rules Committees and other organizations to allow them to make evidence based decisions on injury prevention efforts and policies.

Potential injury prevention solutions include:

- Sport Specific Rule Changes
- Improved Protective Equipment
- Educational Programs

Sports Included

High School RIO™ is a completely adaptable program. It can be enhanced to include any number of sporting activities. Currently, the following popular high school sports are being tracked in the system:

Boys' Sports

- Football
- Soccer
- Basketball
- Wrestling
- Baseball
- Cheerleading
- Ice Hockey
- Lacrosse
- Volleyball
- Swimming & Diving
- Track & Field

Girls' Sports

- Soccer
- Volleyball
- Basketball
- Softball
- Field Hockey
- Cheerleading
- Gymnastics
- Lacrosse
- Swimming & Diving
- Track & Field

Sports Injuries Can Be Prevented

Healthy athletes are healthy children. As our country faces an increasing obesity crisis, it is crucial that we protect and encourage children's ability to be active. Injuries are not a price you must pay to play sports. We can improve equipment, change rules, and provide education to reduce the risk of injury. Protection can happen through effective change that stems from accurate data collected over a period of time.

High School RIO™ is the only injury surveillance tool currently available that tracks high school sports-related injuries nationwide. We invite you to support the continuation of High School RIO™ research to help prevent unnecessary sports injuries in our youth. Your donation will make a lasting positive difference in the way high school sports are played.

SUMMARY REPORT

NATIONAL HIGH SCHOOL SPORTS-RELATED INJURY SURVEILLANCE STUDY

2007-2008 School Year

Compiled by:

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Acknowledgements

We thank the certified athletic trainers (ATCs) for their hard work and dedication in providing us with complete and accurate data. Without their efforts, this study would not have been possible. We would like to thank the National Federation of State High School Associations (NFHS) for their support of this project. We would also like to acknowledge the generous research funding contributions of DonJoy Orthotics, EyeBlack, the Nationwide Children's Hospital Foundation, and the Centers for Disease Control and Prevention.

Note

The analyses presented here provide only a brief summary of collected data, with the feasibility of a more detailed presentation limited by the extensive breadth and detail contained in the dataset. The principal investigator, Dr. R. Dawn Comstock, is happy to provide further information or to discuss research partnership opportunities upon request.

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I. Introduction & Methodology

1.1 Project Overview

To combat the epidemic of obesity among youth in the United States (US), adolescents must be encouraged to get up off the couch and participate in physically active sports, recreation, and leisure activities. Participation in high school sports, one of the most popular physical activities among adolescents, has grown rapidly from an estimated 4.0 million participants in 1971-72 to an estimated 7.0 million in 2007-08. While the health benefits of a physically active lifestyle including participating in sports are undeniable, high school athletes are at risk of sports-related injury because a certain endemic level of injury can be expected among participants of any physical activity. The challenge to injury epidemiologists is to reduce injury rates among high school athletes to the lowest possible level without discouraging adolescents from engaging in this important form of physical activity. This goal can best be accomplished by investigating the etiology of preventable injuries; by developing, implementing, and evaluating protective interventions using such science-based evidence; and by responsibly reporting epidemiologic findings while promoting a physically active lifestyle among adolescents.

1.2 Background and Significance

High school sports play an important role in the adoption and maintenance of a physically active lifestyle among millions of US adolescents. Too often injury prevention in this population is overlooked as sports-related injuries are thought to be unavoidable. In reality, sports-related injuries are largely preventable through the application of preventive interventions based on evidence-based science. The morbidity, mortality, and disability caused by high school sports-related injuries can be reduced through the development of effective prevention strategies and through programmatic decisions based on injury prevention. However, such efforts rely upon accurate national estimates of injury incidence, injury rate calculations, and risk and protective factor data. Previously, no injury surveillance system capable of providing researchers with the needed quality of injury and exposure data for high school sports-related injuries existed.

Since the 2005-06 school year, Dr. R. Dawn Comstock has conducted the National High School Sports-Related Injury Surveillance System to monitor injuries among US high school athletes participating in boys' football, boys' and girls' soccer, girls' volleyball, boys' and girls' basketball, boys' wrestling, boys' baseball, and girls' softball. This surveillance has been conducted using the time- and cost-efficient RIO™ (Reporting Information Online) surveillance system. The first two study years were funded by the Centers for Disease Control, the Research Institute at Nationwide Children's Hospital, and The Ohio State University. Through the generous contributions of DonJoy Orthotics and EyeBlack, the National High School Sports-Related Injury Surveillance System was able to be continued during the 2007-08 school year.

1.3 Specific Aims

The continuing objectives of this study are to continue the National High School Sports-Related Injury Surveillance System among a nationally representative sample of US high schools. The specific aims of this study are:

A) To determine the incidence (number) of injuries among US high school boys' football, boys' and girls' soccer, girls' volleyball, boys' and girls' basketball, boys' wrestling, boys' baseball, and girls' softball athletes.

B) To calculate the rate of injuries per 1,000 athlete-competitions, per 1,000 athlete-practices, and per 1,000 athlete-exposures for US high school athletes in the 9 sports of interest.

C) To provide detailed information about the injuries sustained by US high school athletes including the type, site, severity, initial and subsequent treatment/care, outcome, etc.

D) To provide detailed information about the injury events including athlete demographics, position played, phase of play/activity, etc.

E) To identify potential risk or protective factors.

F) To compare injury rates and patterns from the 2005-06 through the 2007-08 school years.

1.4 Project Design

The National High School Sports-Related Injury Surveillance System defined an injury as:

A) An injury that occurred as a result of participation in an organized high school competition or practice and

B) Required medical attention by a team physician, certified athletic trainer, personal physician, or emergency department/urgent care facility and

C) Resulted in restriction of the high school athlete’s participation for one or more days beyond the day of injury and

D) Any fracture, concussion, or dental injury regardless of whether or not it resulted in restriction of the student-athlete's participation.

An athlete exposure was defined as one athlete participating in one practice or competition where he or she is exposed to the possibility of athletic injury. Exposure was expressed in two parts:

A) Number of athlete-practices = the sum of the number of athletes at each practice during the past week. For example, if 20 athletes practiced on Monday through Thursday and 18 practiced on Friday, the number of athlete-practices would equal 98.

B) Number of athlete-competitions = the sum of the number of athletes at each competition during the past week. For example, if 9 athletes played in a Freshman game, 12 in a JV game, and 14 in a Varsity game, the number of athlete-competitions would equal 35.

1.5 Sample Recruitment

All eligible schools (i.e., all US high schools with a National Athletic Trainers' Association (NATA) affiliated certified athletic trainer (ATC) willing to serve as a reporter) were categorized into 8 sampling strata by geographic location (northeast, midwest, south, and west) and high school size (enrollment ≤ 1,000 or > 1,000 students). Participant schools were then randomly selected from each substrata to obtain 100 study schools. To maintain a nationally representative sample, if a school dropped out of the study, another school from the same stratum was randomly selected for replacement. Participating ATCs were offered a $300 honorarium along with individualized injury reports following the study's conclusion.

1.6 Data Collection

Each ATC that enrolled their school in National High School Sports-Related Injury Surveillance System received an email every Monday throughout the study period reminding them to enter their school's data into the surveillance system. Each participating ATC was asked to complete 45 weekly exposure reports: one for each week from July 30, 2007 through June 8, 2008. Exposure reports collected exposure information (number of athlete-competitions and athlete-practices) and the number of reportable injuries sustained by student athletes of each sport that was currently in session at their school. For each reportable injury, the ATC was asked to complete an injury report. The injury report collected detailed information about the injured player (e.g., age, year in school, etc.), the injury (e.g. site, type, severity, etc.) and the injury event (e.g., position played, phase of play, etc.). This internet-based surveillance tool provided

ATCs with the ability to view all their submitted data throughout the study and update reports as needed (e.g., need for surgery, days till resuming play, etc.).

1.7 Data Management

In an effort to decrease loss-to follow up, a log of reporters' utilization of the internet-based injury surveillance system was maintained throughout the study period. Reporters who repeatedly failed to log on to complete the weekly exposure and injury reports or who had errors with their reporting were contacted by the study staff and either reminded to report, asked to correct errors, or assessed for their willingness to continue participating in the study.

1.8 Data Analysis

Data were analyzed using SAS software, version 9.0 and SPSS, version 15.0. Although fractures, concussions, and dental injuries resulting in <1 day time loss were collected, unless otherwise noted, analyses in this report excluded these injuries. With the exception of injury rates, data were weighted for all analyses to produce national estimates. For each sport in each stratum, weights account for the total number of US schools offering the sport and the average number of participating study schools reporting each week for that sport. For example, following is the algorithm used to calculate football weights for the small (enrollment ≤ 1,000) west stratum:

$$Weight = \frac{\text{national total \# of small, west US high schools}}{\text{average \# of small, west participating schools reporting football each week}}$$

Injury rates were calculated as the ratio of unweighted case counts per 1,000 athlete-exposures, and they were compared using rate ratios (RR) with 95% confidence intervals (CI).

Following is an example of the RR calculation comparing the rate of injury in boys' soccer to the rate of injury in girls' soccer:

$$RR = \frac{\text{\# boys' soccer injuries / total \# boys' soccer athlete-exposures}}{\text{\# girls' soccer injuries / total \# girls' soccer athlete-exposures}}$$

Injury proportions were compared using injury proportion ratios (IPR) and corresponding confidence intervals calculated using the Complex Samples module of SPSS in order to account for the sampling weights and the complex sampling design. Following is an example of the IPR calculation comparing the proportion of male soccer concussions to the proportion of female soccer concussions:

$$IPR = \frac{\text{\# boys' soccer concussions / total \# boys' soccer injuries}}{\text{\# girls' soccer concussions / total \# girls' soccer injuries}}$$

An RR or IPR >1.00 suggests a risk association while an RR or IPR <1.00 suggests a protective association. CI not including 1.00 were considered statistically significant. Injury rates over time were compared by running a linear regression and testing for trend.

II. Overall Injury Epidemiology

Table 2.1 Injury Rates by Sport and Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year*

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Overall total	**4,799**	**2,077,780**	**2.31**	**1,419,723**
Competition	**2,501**	**562,558**	**4.45**	**763,034**
Practice	**2,298**	**1,515,222**	**1.52**	**656,689**
Boys' football total	2,392	572,588	4.18	616,665
Competition	1,211	94,842	12.77	311,780
Practice	1,181	477,746	2.47	304,885
Boys' soccer total	355	202,650	1.75	159,351
Competition	219	60,258	3.63	99,785
Practice	136	142,392	0.96	59,566
Girls' soccer total	408	173,731	2.35	215,850
Competition	267	51,811	5.15	146,102
Practice	141	121,920	1.16	69,748
Girls' volleyball total	208	169,831	1.22	72,261
Competition	80	55,860	1.43	26,539
Practice	128	113,971	1.12	45,722
Boys' basketball total	348	249,849	1.39	82,612
Competition	166	74,446	2.23	36,766
Practice	182	175,403	1.04	45,846
Girls' basketball total	320	198,486	1.61	73,283
Competition	195	59,177	3.30	45,236
Practice	125	139,309	0.90	28,047
Boys' wrestling total	408	179,427	2.27	91,625
Competition	175	47,327	3.70	40,698
Practice	233	132,100	1.76	50,927
Boys' baseball total	173	186,264	0.93	44,760
Competition	92	67,167	1.37	22,803
Practice	81	119,097	0.68	21,957
Girls' softball total	187	144,954	1.29	63,316
Competition	96	51,670	1.86	33,325
Practice	91	93,284	0.98	29,991

*Only includes injuries resulting in ≥1 days time loss.

Table 2.2 Proportion of Injuries Resulting in Time Loss, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year*

	≥1 days time loss	<1 day time loss	Total
Overall	97.9%	2.1%	**100%**
Boys' football	97.1%	2.9%	**100%**
Boys' soccer	98.5%	1.5%	**100%**
Girls' soccer	99.1%	0.9%	**100%**
Girls' volleyball	99.3%	0.7%	**100%**
Boys' basketball	98.0%	2.0%	**100%**
Girls' basketball	97.9%	2.1%	**100%**
Boys' wrestling	98.0%	2.0%	**100%**
Boys' baseball	96.4%	3.6%	**100%**
Girls' softball	99.5%	0.5%	**100%**

*By study definition, non-time loss injuries were fractures, concussions, and dental injuries. Because they accounted for less than 2% of all injuries, they are not included in any other analyses.

Table 2.3 Demographic Characteristics of Injured Athletes by Sex, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year*

	Male	**Female**
Year in School		
Freshman	191,186 (19.4%)	93,256 (22.3%)
Sophomore	237,801 (24.1%)	110,440 (26.4%)
Junior	276,377 (28.0%)	112,030 (26.7%)
Senior	282,218 (28.6%	103,246 (24.6%)
Total†	**987,582 (100%)**	**418,972 (100%)**
Age (years)		
Minimum	13	13
Maximum	19	19
Mean (St. Dev.)	16.0 (1.2)	15.8 (1.2)
BMI		
Minimum	14.3	15.2
Maximum	48.7	46.2
Mean (St. Dev.)	25.2 (4.5)	22.2 (3.3)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 2.1 Injury Diagnosis by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

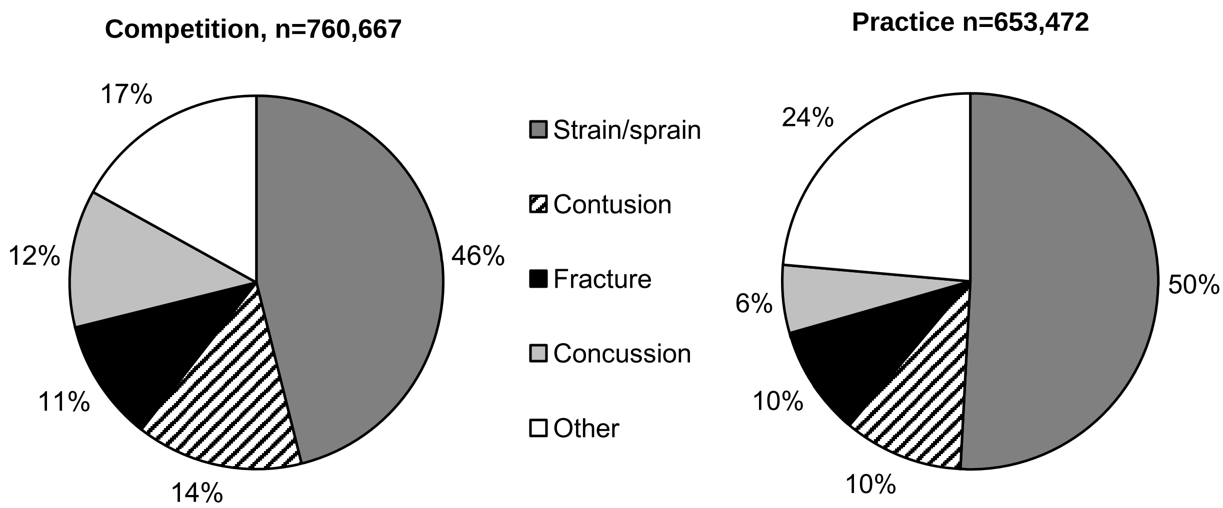


Table 2.4 Body Site of Injury by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Ankle	142,807	18.8%	117,836	18.0%	260,643	18.5%
Knee	123,796	16.3%	82,416	12.6%	206,212	14.6%
Head/face	122,912	16.2%	51,619	7.9%	174,532	12.4%
Hip/thigh/upper leg	61,674	8.1%	82,376	12.6%	144,050	10.2%
Hand/wrist	66,188	8.7%	76,160	11.7%	142,348	10.1%
Shoulder	64,828	8.6%	64,150	9.8%	128,978	9.1%
Trunk	41,623	5.5%	49,585	7.6%	91,208	6.5%
Lower leg	44,581	5.9%	35,629	5.5%	80,210	5.7%
Arm/elbow	40,366	5.3%	24,588	3.8%	64,953	4.6%
Foot	27,291	3.6%	31,403	4.8%	58,695	4.2%
Neck	12,305	1.6%	13,180	2.0%	25,485	1.8%
Other	10,203	1.4%	24,104	3.7%	34,307	2.4%
Total	**758,575**	**100%**	**653,047**	**100%**	**1,411,621**	**100%**

Table 2.5 Most Commonly Injured Ankle Structures, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Male		Female		Total	
	n	%	n	%	n	%
Ankle Ligament						
Anterior talofibular ligament	121,959	78.1%	87,581	83.8%	209,540	80.4%
Calcaneofibular ligament	45,626	29.2%	38,371	36.7%	83,996	32.2%
Anterior tibiofibular ligament	47,468	30.4%	27,768	26.6%	75,236	28.9%
Posterior talofibular ligament	17,414	11.2%	18,820	18.0%	36,234	13.9%
Posterior tibiofibular ligament	7,295	4.7%	4,436	4.2%	11,730	4.5%
Total	**156,101**	**100%**	**104,542**	**100%**	**260,643**	**100%**

*Multiple responses allowed per injury report.

Table 2.6 Most Commonly Injured Knee Structures, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Male		Female		Total	
	n	%	n	%	n	%
Knee Ligament						
Medial collateral ligament	45,892	33.8%	18,646	26.4%	64,538	31.3%
Patella/patellar tendon	37,217	27.4%	16,336	23.2%	53,553	26.0%
Anterior cruciate ligament	26,996	19.9%	17,683	25.1%	44,679	21.7%
Torn cartilage (meniscus)	24,922	18.4%	11,012	15.6%	35,935	17.4%
Lateral collateral ligament	7,787	5.7%	5,042	7.1%	12,829	6.2%
Posterior cruciate ligament	2,606	1.9%	1,057	1.5%	3,663	1.8%
Total	**135,693**	**100%**	**70,520**	**100%**	**206,212**	**100%**

*Multiple responses allowed per injury report.

Table 2.7 Ten Most Common Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition n=758,120		Practice n=652,534		Overall n=1,410,654	
	n	%	n	%	n	%
Diagnosis						
Ankle strain/sprain	133,168	17.6%	110,846	17.0%	244,013	17.3%
Head/face concussion	90,980	12.0%	38,456	5.9%	129,437	9.2%
Knee strain/sprain	71,506	9.4%	37,757	5.8%	109,263	7.8%
Hip/thigh/upper leg strain/sprain	39,542	5.2%	63,240	9.7%	102,783	7.3%
Knee other	35,049	4.6%	31,573	4.8%	66,622	4.7%
Shoulder other	33,114	4.4%	25,224	3.9%	58,338	4.1%
Hand/wrist fracture	27,422	3.6%	28,658	4.4%	56,079	4.0%
Hand/wrist strain/sprain	23,383	3.1%	30,362	4.7%	53,745	3.8%
Shoulder strain/sprain	21,087	2.8%	27,277	4.2%	48,364	3.4%
Trunk strain/sprain	18,696	2.5%	26,291	4.0%	44,988	3.2%

Figure 2.2 Time Loss by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

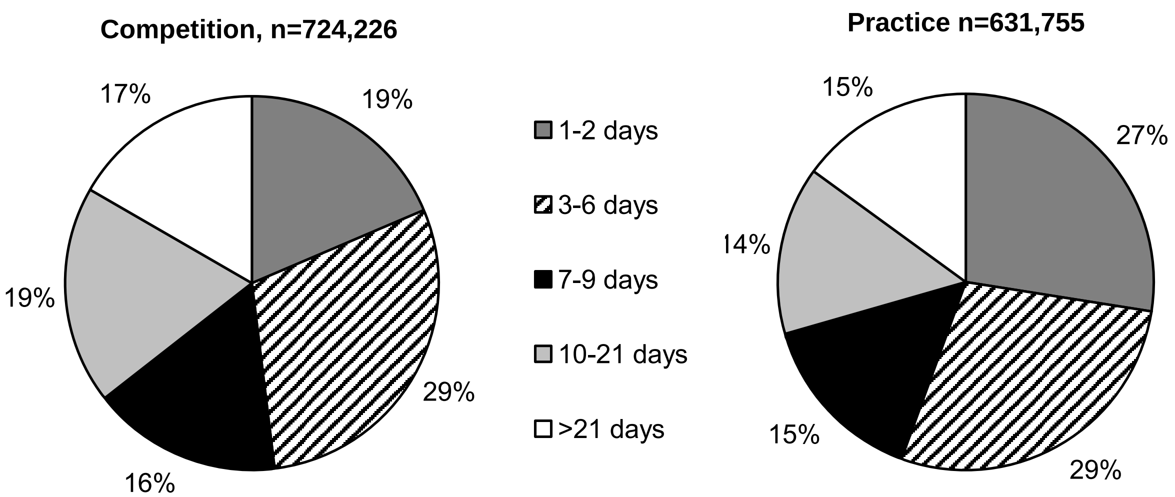


Table 2.8 Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	54,652	7.3%	29,550	4.7%	84,202	6.1%
Did not require surgery	690,718	92.7%	605,951	95.4%	1,296,670	93.9%
Total	**745,371**	**100%**	**635,502**	**100%**	**1,380,872**	**100%**

Figure 2.3 New and Recurring Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

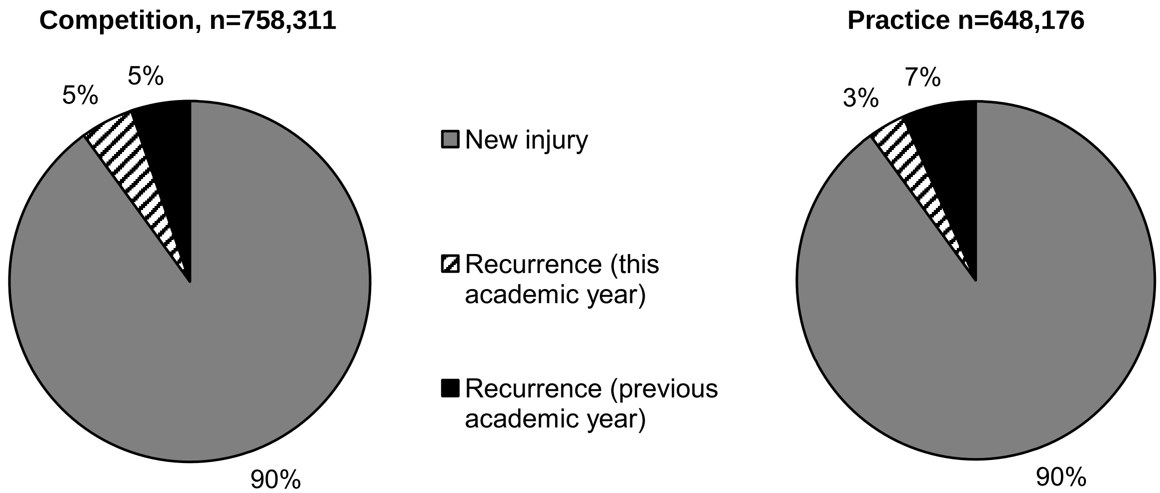


Table 2.9 Time during Season of Injury, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Season		
Preseason	353,992	24.9%
Regular season	1015875	71.6%
Post season	49,353	3.5%
Total	**1,419,220**	**100%**

Table 2.10 Competition-Related Variables, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Competition		
Warm-ups	17,331	2.3%
Beginning	115,230	15.2%
Middle	413,587	54.7%
End	207,443	27.4%
Overtime	2,262	0.3%
Total	**755,852**	**100**
Competition Location		
Home	363,458	47.8%
Away	368,658	48.5%
Neutral site	28,299	3.7%
Total	**760,415**	**100%**
Injury Related to Foul Play		
No	667,706	88.1%
Yes, and ruled foul play	28,078	3.7%
Yes, but not ruled foul play	37,867	5.0%
Unknown	23,855	3.1%
Total	**757,507**	**100%**

Table 2.11 Practice-Related Variables, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Practice		
First 1/2 hour	87,566	13.5%
Second 1/2 hour	173,989	26.9%
Third 1/2 hour	230,116	35.6%
Fourth 1/2 hour	120,219	18.6%
>2 hours into practice	34,565	5.3%
Total	**646,455**	**100%**
Practice Type		
Noncontact skills practice	145,908	22.5%
Noncontact partial numbers scrimmage	17,857	2.8%
Noncontact full scrimmage	16,547	2.6%
Partial contact skills practice	96,859	14.9%
Partial contact partial numbers scrimmage	29,381	4.5%
Partial contact full scrimmage	22,230	3.4%
Full contact skills practice	160,941	24.8%
Full contact partial numbers scrimmage	48,081	7.4%
Full contact full scrimmage	81,216	12.5%
Other	29,620	4.6%
Total	**648,640**	**100%**

Table 2.12 Methods for Injury Evaluation and Assessment, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
% of Injuries Evaluated by:*		
Certified athletic trainer	1,303,508	91.8%
Physician	790,104	55.7%
Dentist/oral surgeon	1,959	0.1%
Nurse practitioner	13,536	1.0%
Physician's assistant	16,196	1.1%
Other	44,920	3.2%
Total	**1,419,723**	**100%**
% of Injuries Assessed by:*		
Evaluation	1,359,583	95.8%
X-ray	587,317	41.4%
MRI	155,204	10.9%
CT-scan	48,581	3.4%
Surgery	19,063	1.3%
Blood work/lab test	17,720	1.2%
Other	27,905	2.0%
Total	**1,419,723**	**100%**

*Multiple responses allowed per injury report.

III. Boys' Football Injury Epidemiology

Table 3.1 Football Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**2,392**	**572,588**	**4.18**	**616,665**
Competition	1,211	94,842	12.77	311,780
Practice	1,181	477,746	2.47	304,885

Table 3.2 Demographic Characteristics of Injured Football Athletes, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year*

Year in School	
Freshman	126,565 (20.6%)
Sophomore	150,675 (24.6%)
Junior	171,178 (27.9%)
Senior	164,835 (26.9%)
Total†	**613,252 (100%)**
Age (years)	
Minimum	13
Maximum	19
Mean (St. Dev.)	15.9 (1.2)
BMI	
Minimum	15.1
Maximum	48.7
Mean (St. Dev.)	26.2 (4.6)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 3.1 Diagnosis of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

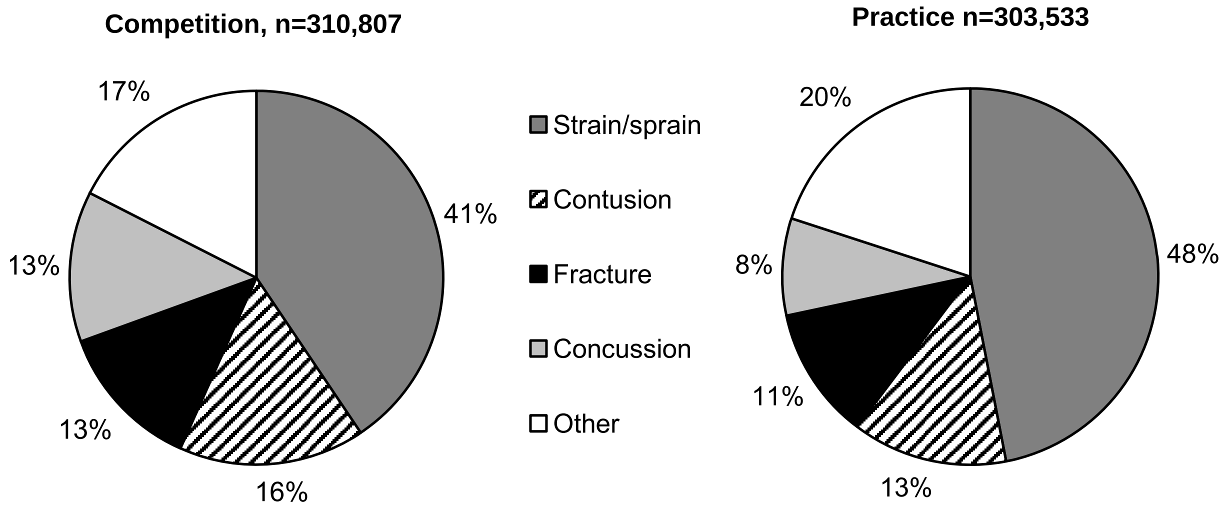


Table 3.3 Body Site of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Ankle	42,178	13.6%	42,059	13.9%	84,236	13.8%
Knee	47,320	15.3%	33,933	11.2%	81,253	13.3%
Head/face	44,407	14.4%	27,133	9.0%	71,540	11.7%
Hip/thigh/upper leg	20,264	6.6%	33,391	11.0%	53,655	8.8%
Hand/wrist	32,626	10.6%	44,509	14.7%	77,136	12.6%
Shoulder	39,566	12.8%	36,377	12.0%	75,944	12.4%
Trunk	21,380	6.9%	28,876	9.5%	50,256	8.2%
Lower leg	18,251	5.9%	12,843	4.2%	31,094	5.1%
Arm/elbow	20,111	6.5%	11,180	3.7%	31,291	5.1%
Foot	9,338	3.0%	10,180	3.4%	19,518	3.2%
Neck	8,007	2.6%	8,309	2.7%	16,316	2.7%
Other	5,922	1.9%	14,404	4.8%	20,327	3.3%
Total	**309,370**	**100%**	**303,194**	**100%**	**612,564**	**100%**

Table 3.4 Ten Most Common Football Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition n=309,293		Practice n=302,681		Total n=611,974	
	n	%	n	%	n	%
Diagnosis						
Ankle strain/sprain	39,362	12.7%	38,403	12.7%	77,765	12.7%
Head/face concussion	40,645	13.1%	24,760	8.2%	65,405	10.7%
Knee strain/sprain	31,023	10.0%	16,342	5.4%	47,364	7.7%
Hand/wrist fracture	16,717	5.4%	18,171	6.0%	34,888	5.7%
Hip/thigh/upper leg strain/sprain	10,784	3.5%	23,611	7.8%	34,394	5.6%
Shoulder other	21,828	7.1%	12,039	4.0%	33,867	5.5%
Shoulder strain/sprain	9,995	3.2%	16,212	5.4%	26,207	4.3%
Trunk strain/sprain	8,690	2.8%	15,630	5.2%	24,319	4.0%
Hand/wrist strain/sprain	7,093	2.3%	16,448	5.4%	23,541	3.9%
Knee other	10,211	3.3%	10,857	3.6%	21,068	3.4%

Figure 3.2 Time Loss of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

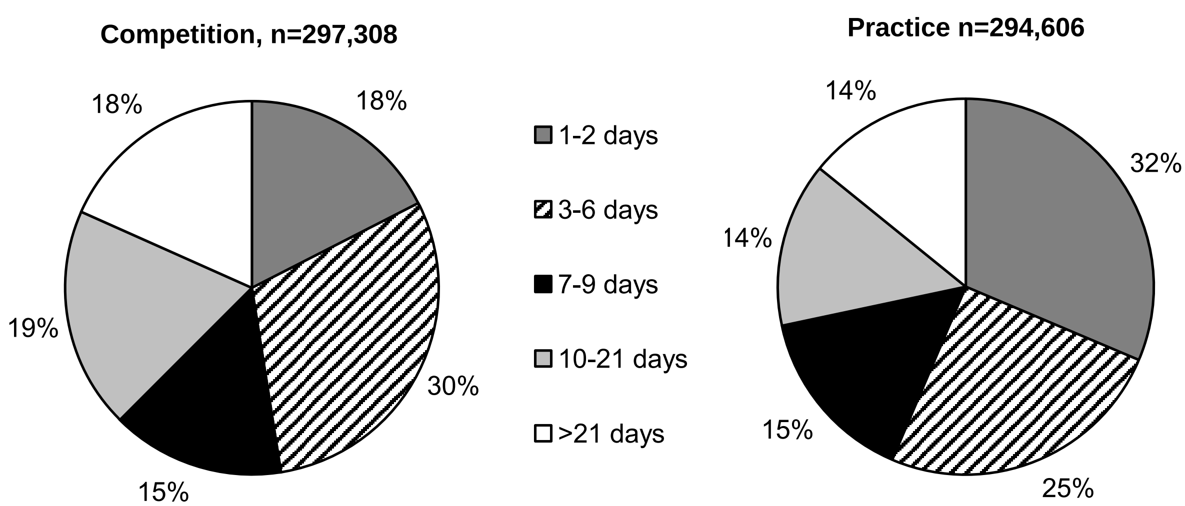


Table 3.5 Football Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	20,452	6.8%	14,085	4.8%	34,537	5.8%
Did not require surgery	281,673	93.2%	281,107	95.2%	562,780	94.2%
Total	**302,125**	**100%**	**295,192**	**100%**	**597,317**	**100%**

Figure 3.3 History of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

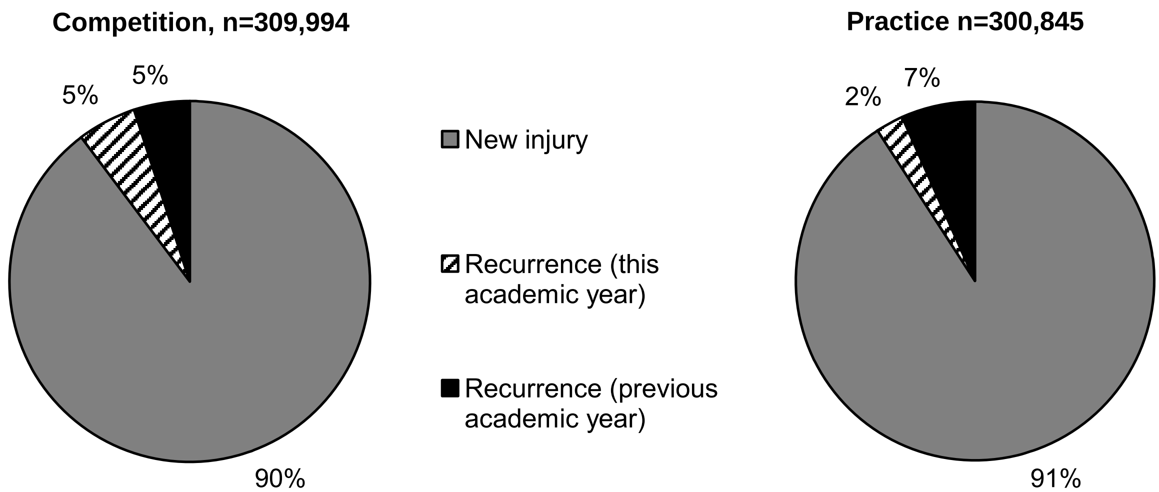


Table 3.6 Time during Season of Football Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Season		
Preseason	176,789	28.7%
Regular season	423,894	68.7%
Post season	15,904	2.6%
Total	**616,587**	**100%**

Table 3.7 Competition-Related Variables for Football Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Competition		
Warm-ups	6,355	2.1%
Beginning	50,158	16.2%
Middle	170,435	55.2%
End	81,737	26.5%
Overtime	77	0.0%
Total	**308,762**	**100%**
Competition Location		
Home	144,184	46.4%
Away	162,147	52.2%
Neutral site	4,554	1.5%
Total	**310,885**	**100%**
Injury Related to Foul Play		
No	290,569	93.8%
Yes, and ruled foul play	2,814	0.9%
Yes, but not ruled foul play	9,498	3.1%
Unknown	6,790	2.2%
Total	**309,670**	**100%**
Field Location		
Between the 20 yrd lines	243,180	80.2%
Red zone	50,874	16.8%
End zone	5,079	1.7%
Off the field	4,011	1.3%
Total	**303,144**	**100%**

Table 3.8 Practice-Related Variables for Football Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Practice		
First 1/2 hour	31,525	10.4%
Second 1/2 hour	80,045	26.5%
Third 1/2 hour	110,655	36.6%
Fourth 1/2 hour	61,084	20.2%
>2 hours into practice	19,060	6.3%
Total	**302,369**	**100%**
Practice Type		
Noncontact skills practice	40,382	13.3%
Noncontact partial numbers scrimmage	4,367	1.4%
Noncontact full scrimmage	1,737	0.6%
Partial contact skills practice	47,821	15.8%
Partial contact partial numbers scrimmage	9,506	3.1%
Partial contact full scrimmage	10,231	3.4%
Full contact skills practice	96,383	31.8%
Full contact partial numbers scrimmage	32,272	10.7%
Full contact full scrimmage	48,860	16.1%
Other	11,088	3.7%
Total	**302,648**	**100%**

Figure 3.4 Player Position of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

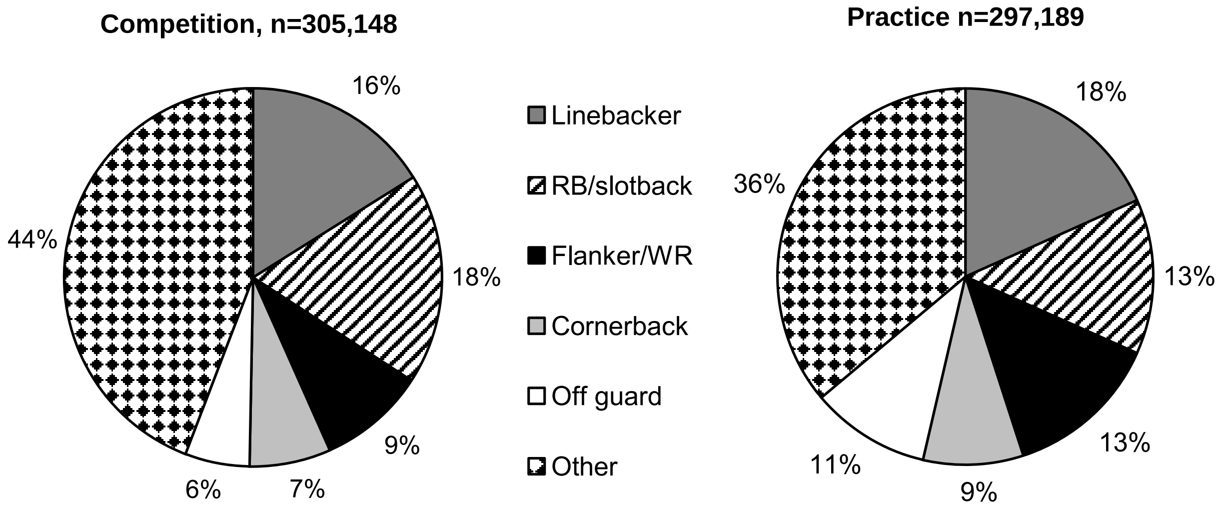
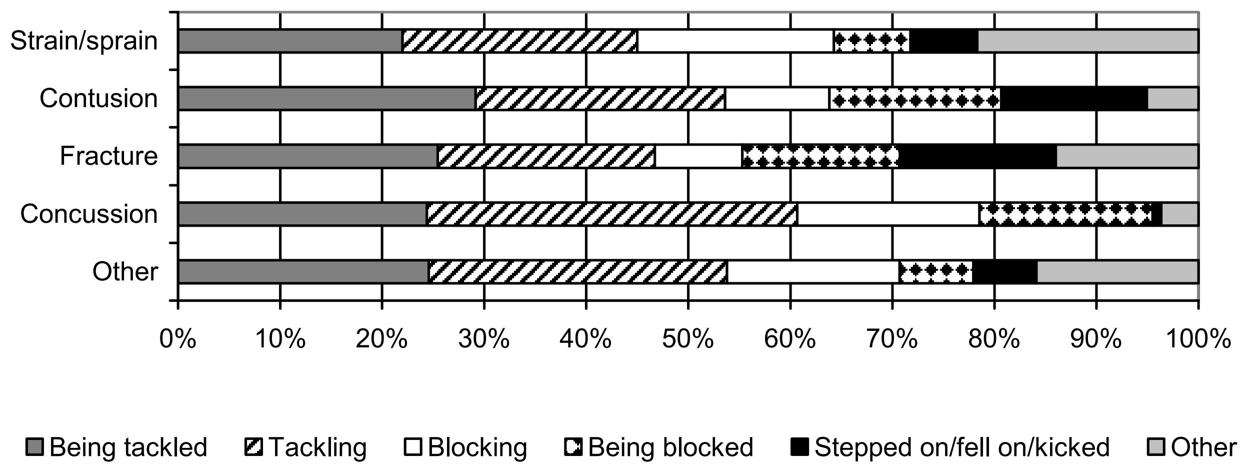


Table 3.9 Activities Leading to Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Activity						
Tackling	79,233	25.9%	62,647	20.9%	141,880	23.4%
Being tackled	84,592	27.7%	50,270	16.7%	134,862	22.3%
Blocking	40,863	13.4%	47,706	15.9%	88,569	14.6%
Being blocked	40,476	13.3%	21,105	7.0%	61,580	10.2%
N/A, chronic/overuse	7,960	2.6%	41,681	13.9%	49,641	8.2%
Stepped on/fell on/kicked	26,968	8.8%	18,559	6.2%	45,527	7.5%
Rotation around a planted foot	13,136	4.3%	20,263	6.7%	33,399	5.5%
Other	12,142	4.0%	38,133	12.7%	50,276	8.3%
Total	**309,370**	**100%**	**303,194**	**100%**	**612,564**	**100%**

Figure 3.5 Activity Resulting in Football Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year



IV. Boys' Soccer Injury Epidemiology

Table 4.1 Boys' Soccer Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**355**	**202,650**	**1.75**	**159,351**
Competition	219	60,258	3.63	99,785
Practice	136	142,392	0.96	59,566

Table 4.2 Demographic Characteristics of Injured Boys' Soccer Athletes, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year*

Year in School	
Freshman	23,026 (14.6%)
Sophomore	33,707 (21.4%)
Junior	45,741 (29.0%)
Senior	55,076 (35.0%)
Total†	**157,550 (100%)**
Age (years)	
Minimum	13
Maximum	18
Mean (St. Dev.)	16.2 (1.2)
BMI	
Minimum	17.5
Maximum	34.3
Mean (St. Dev.)	22.7 (2.8)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 4.1 Diagnosis of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

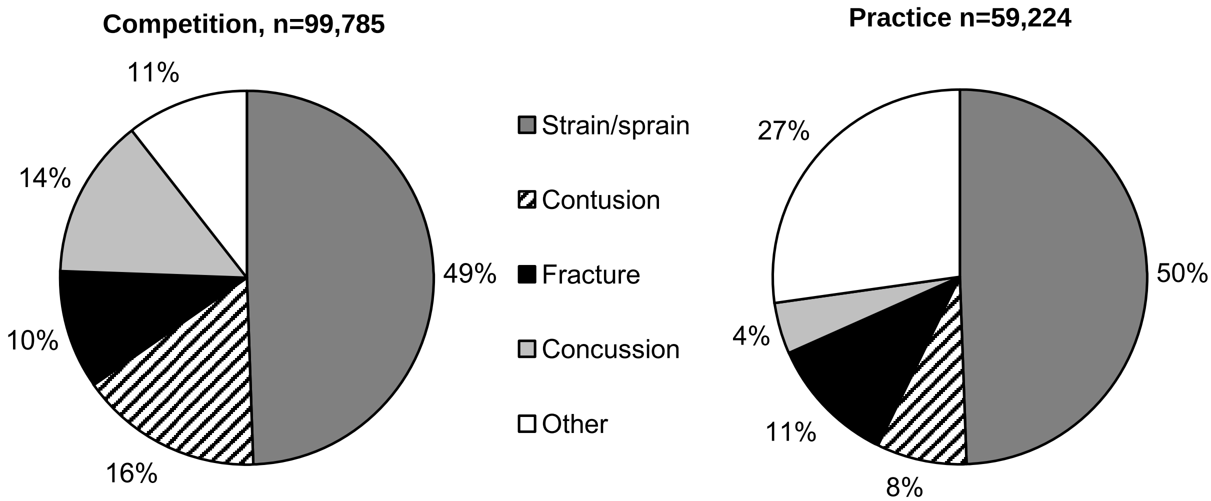


Table 4.3 Body Site of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Ankle	20,997	21.3%	12,353	20.9%	33,350	21.1%
Knee	12,156	12.3%	9,188	15.5%	21,344	13.5%
Head/face	22,399	22.7%	3,464	5.8%	25,863	16.4%
Hip/thigh/upper leg	13,379	13.5%	9,909	16.7%	23,288	14.7%
Hand/wrist	3,795	3.8%	1,260	2.1%	5,054	3.2%
Shoulder	3,408	3.5%	3,425	5.8%	6,833	4.3%
Trunk	6,492	6.6%	3,886	6.6%	10,378	6.6%
Lower leg	8,058	8.2%	4,929	8.3%	12,987	8.2%
Arm/elbow	1,784	1.8%	1,071	1.8%	2,855	1.8%
Foot	4,746	4.8%	6,591	11.1%	11,336	7.2%
Neck	84	0.1%	1,078	1.8%	1,162	0.7%
Other	1,455	1.5%	2,073	3.5%	3,528	2.2%
Total	**98,753**	**100%**	**59,224**	**100%**	**157,978**	**100%**

Table 4.4 Ten Most Common Boys' Soccer Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition n=98,754		Practice n=59,224		Total n=157,978	
	n	%	n	%	n	%
Diagnosis						
Ankle strain/sprain	19,570	19.8%	12,353	20.9%	31,923	20.2%
Hip/thigh/upper leg strain/sprain	9,977	10.1%	6,758	11.4%	16,735	10.6%
Head/face concussion	13,847	14.0%	2,529	4.3%	16,376	10.4%
Knee strain/sprain	9,422	9.5%	2,862	4.8%	12,285	7.8%
Knee other	1,455	1.5%	5,256	8.9%	6,712	4.2%
Head/face other	5,603	5.7%	229	0.4%	5,832	3.7%
Trunk strain/sprain	2,795	2.8%	2,369	4.0%	5,165	3.3%
Shoulder other	2,733	2.8%	2,431	4.1%	5,163	3.3%
Lower leg strain/sprain	3,098	3.1%	2,027	3.4%	5,125	3.2%
Trunk contusion	3,697	3.7%	707	1.2%	4,403	2.8%

Figure 4.2 Time Loss of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

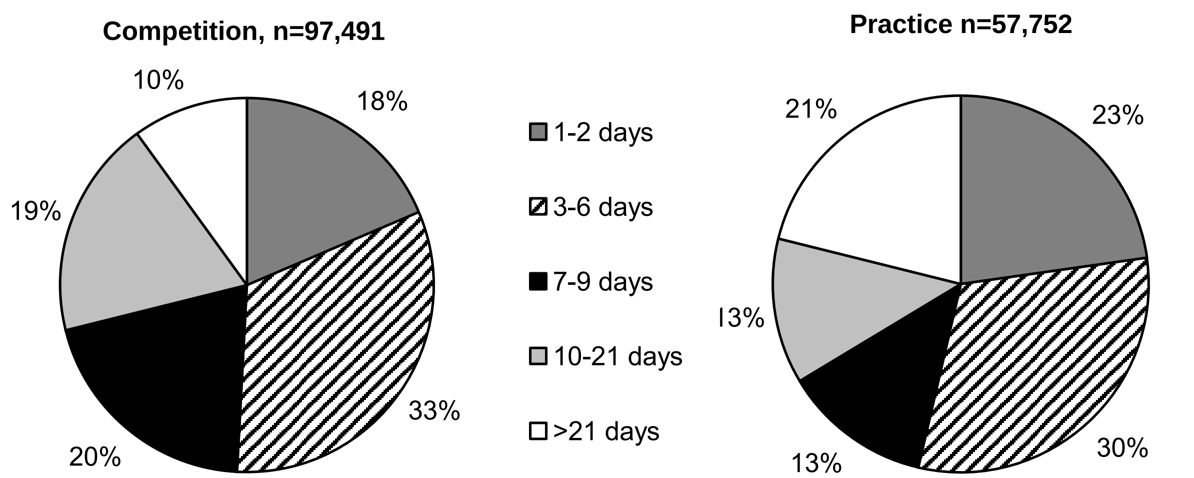


Table 4.5 Boys' Soccer Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	10,152	10.4%	821	1.4%	10,973	7.0%
Did not require surgery	87,141	89.6%	58,039	98.6%	145,181	93.0%
Total	**97,294**	**100%**	**58,860**	**100%**	**156,153**	**100%**

Figure 4.3 History of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

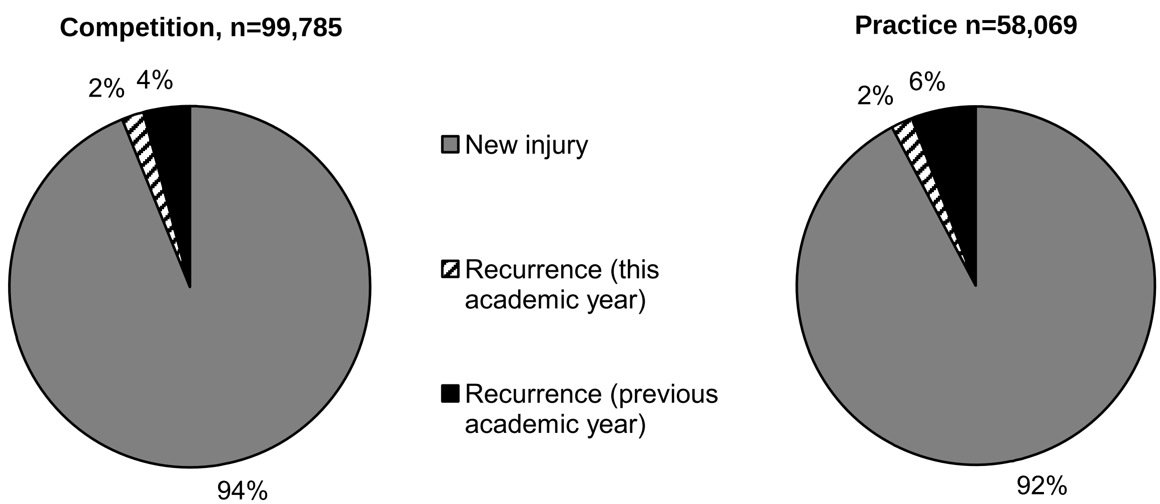


Table 4.6 Time during Season of Boys' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Season		
Preseason	38,128	24.0%
Regular season	111,399	70.1%
Post season	9,399	5.9%
Total	**158,926**	**100%**

Table 4.7 Competition-Related Variables for Boys' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Competition		
Warm-ups	1,432	1.5%
Beginning	16,689	17.0%
Middle	55,337	56.5%
End	23,117	23.6%
Overtime	1,358	1.4%
Total	**97,933**	**100%**
Competition Location		
Home	47,079	47.5%
Away	45,089	45.5%
Neutral site	6,910	7.0%
Total	**99,079**	**100%**
Injury Related to Foul Play		
No	76,020	76.2%
Yes, and ruled foul play	6,655	6.7%
Yes, but not ruled foul play	12,123	12.1%
Unknown	4,988	5.0%
Total	**99,785**	**100%**
Field Location		
Top of goal box extended to center line (offense)	33,212	35.3%
Top of goal box extended to center line (defense)	17,624	18.7%
Goal box (defense)	16,509	17.5%
Side of goal box (defense)	9,801	10.4%
Side of goal box (offense)	9,518	10.1%
Goal box (offense)	6,463	6.9%
Off the field	1,069	1.1%
Total	**94,196**	**100%**

Table 4.8 Practice-Related Variables for Boys' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Practice		
First 1/2 hour	9,748	16.8%
Second 1/2 hour	16,208	27.9%
Third 1/2 hour	21,739	37.4%
Fourth 1/2 hour	9,356	16.1%
>2 hours into practice	1,042	1.8%
Total	**58,093**	**100%**
Practice Type		
Noncontact skills practice	14,820	25.5%
Noncontact partial numbers scrimmage	1,701	2.9%
Noncontact full scrimmage	4,053	7.0%
Partial contact skills practice	11,060	19.0%
Partial contact partial numbers scrimmage	4,452	7.6%
Partial contact full scrimmage	2,308	4.0%
Full contact skills practice	7,038	12.1%
Full contact partial numbers scrimmage	5,949	10.2%
Full contact full scrimmage	5,695	9.8%
Other	1,155	2.0%
Total	**58,230**	**100%**

Figure 4.4 Player Position of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

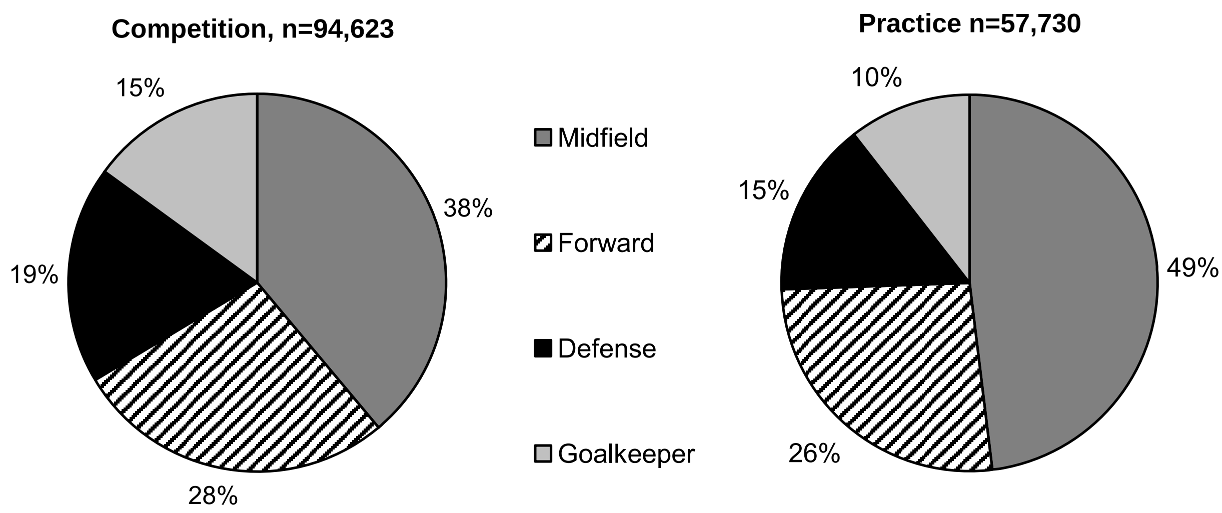
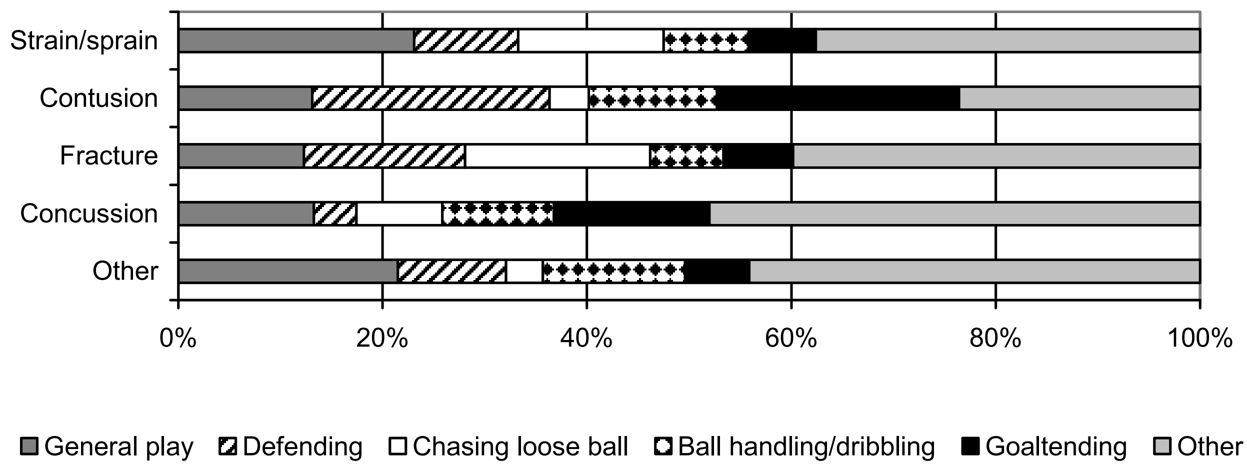


Table 4.9 Activities Leading to Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
General play	16,425	16.8%	13,877	23.9%	30,302	19.4%
Defending	13,591	13.9%	4,777	8.2%	18,368	11.8%
Chasing loose ball	11,292	11.6%	5,762	9.9%	17,054	10.9%
Ball handling/dribbling	9,735	10.0%	5,798	10.0%	15,533	10.0%
Goaltending	12,342	12.6%	2,491	4.3%	14,833	9.5%
Shooting (foot)	5,225	5.3%	7,075	12.2%	12,300	7.9%
Heading ball	11,480	11.7%	790	1.4%	12,270	7.9%
Passing (foot)	6,045	6.2%	4,328	7.5%	10,373	6.7%
Receiving pass	6,065	6.2%	4,199	7.2%	10,264	6.6%
Other	5,558	5.7%	8,975	15.5%	14,532	9.3%
Total	**97,757**	**100%**	**58,071**	**100%**	**155,828**	**100%**

Figure 4.5 Activity Resulting in Boys' Soccer Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year



V. Girls' Soccer Injury Epidemiology

Table 5.1 Girls' Soccer Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**408**	**173,731**	**2.35**	**215,850**
Competition	267	51,811	5.15	146,102
Practice	141	121,920	1.16	69,748

Table 5.2 Demographic Characteristics of Injured Girls' Soccer Athletes, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year*

Year in School	
Freshman	38,152 (17.9%)
Sophomore	58,120 (27.2%)
Junior	50,840 (23.8%)
Senior	66,417 (31.1%)
Total†	**213,528 (100%)**
Age (years)	
Minimum	13
Maximum	19
Mean (St. Dev.)	15.9 (1.2)
BMI	
Minimum	15.7
Maximum	34.4
Mean (St. Dev.)	21.9 (3.0)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 5.1 Diagnosis of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

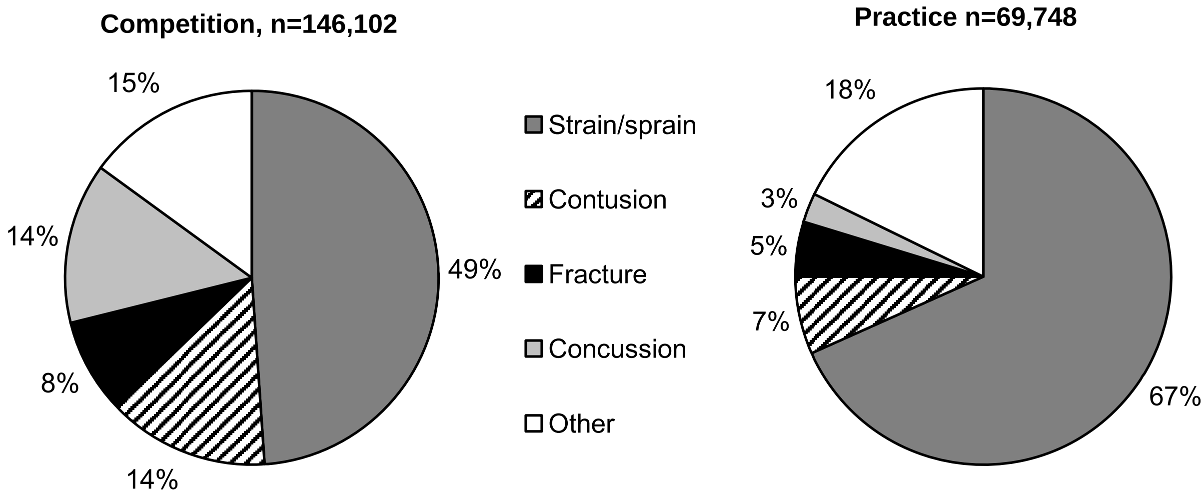


Table 5.3 Body Site of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Ankle	32,605	22.3%	17,697	25.4%	50,302	23.3%
Knee	35,768	24.5%	9,570	13.7%	45,338	21.0%
Head/face	25,003	17.1%	2,360	3.4%	27,363	12.7%
Hip/thigh/upper leg	14,925	10.2%	18,544	26.6%	33,470	15.5%
Hand/wrist	9,526	6.5%	4,864	7.0%	14,390	6.7%
Shoulder	1,640	1.1%	1,232	1.8%	2,871	1.3%
Trunk	1,801	1.2%	719	1.0%	2,520	1.2%
Lower leg	10,743	7.4%	5,947	8.5%	16,690	7.7%
Arm/elbow	3,692	2.5%	2,373	3.4%	6,064	2.8%
Foot	8,597	5.9%	3,291	4.7%	11,888	5.5%
Neck	1,803	1.2%	0	0.0%	1,803	0.8%
Other	0	0.0%	3,152	4.5%	3,152	1.5%
Total	**146,102**	**100%**	**69,748**	**100%**	**215,849**	**100%**

Table 5.4 Ten Most Common Girls' Soccer Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition n=146,102		Practice n=69,748		Total n=215,849	
	n	%	n	%	n	%
Diagnosis						
Ankle strain/sprain	31,802	21.8%	16,570	23.8%	48,372	22.4%
Hip/thigh/upper leg strain/sprain	8,815	6.0%	16,938	24.3%	25,752	11.9%
Knee strain/sprain	18,434	12.6%	6,762	9.7%	25,196	11.7%
Head/face concussion	20,319	13.9%	1,847	2.6%	22,166	10.3%
Knee other	12,782	8.7%	1,621	2.3%	14,403	6.7%
Hand/wrist strain/sprain	5,304	3.6%	4,505	6.5%	9,808	4.5%
Lower leg other	3,694	2.5%	4,235	6.1%	7,929	3.7%
Hip/thigh/upper leg contusion	5,752	3.9%	719	1.0%	6,470	3.0%
Knee contusion	3,833	2.6%	1,186	1.7%	5,020	2.3%
Foot contusion	4,618	3.2%	0	0.0%	4,618	2.1%

Figure 5.2 Time Loss of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

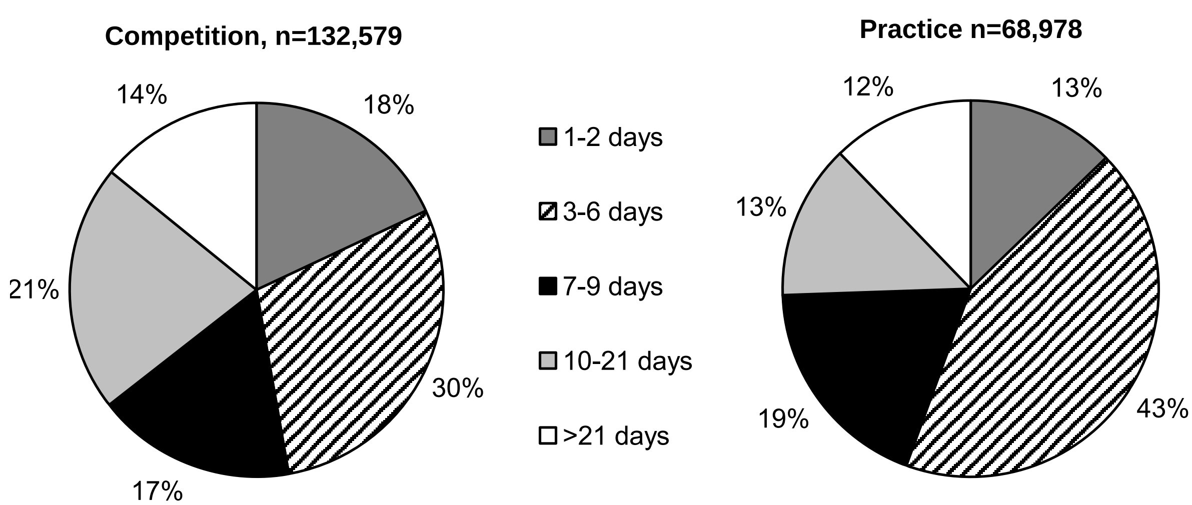


Table 5.5 Girls' Soccer Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Need for surgery						
Required surgery	8,721	6.0%	2,058	3.1%	10,779	5.1%
Did not require surgery	135,769	94.0%	63,875	96.9%	199,645	94.9%
Total	**144,491**	**100%**	**65,933**	**100%**	**210,424**	**100%**

Figure 5.3 History of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

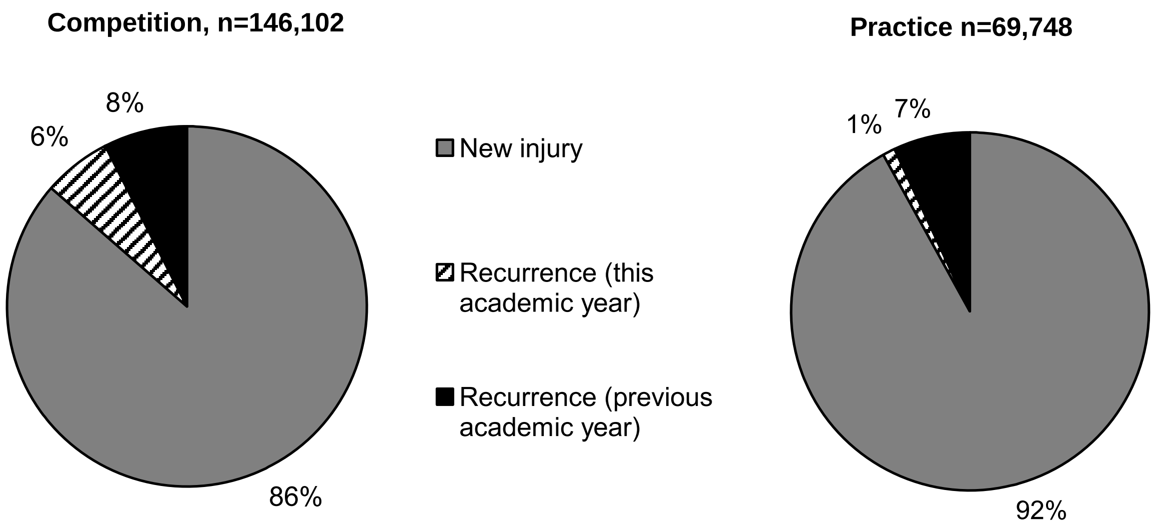


Table 5.6 Time during Season of Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Season		
Preseason	38,733	17.9%
Regular season	165,826	76.8%
Post season	11,291	5.2%
Total	**215,849**	**100%**

Table 5.7 Competition-Related Variables for Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Competition		
Warm-ups	3,332	2.3%
Beginning	20,275	13.9%
Middle	68,944	47.4%
End	52,885	36.4%
Total	**145,436**	**100%**
Competition Location		
Home	78,458	53.7%
Away	61,226	41.9%
Neutral site	6,418	4.4%
Total	**146,102**	**100%**
Injury Related to Foul Play		
No	117,502	81.2%
Yes, and ruled foul play	9,173	6.3%
Yes, but not ruled foul play	9,573	6.6%
Unknown	8,424	5.8%
Total	**144,672**	**100%**
Field Location		
Top of goal box extended to center line (offense)	38,337	27.1%
Goal box (defense)	34,058	24.0%
Top of goal box extended to center line (defense)	31,347	22.1%
Goal box (offense)	14,638	10.3%
Side of goal box (defense)	12,821	9.1%
Side of goal box (offense)	7,789	5.5%
Off the field	2,669	1.9%
Total	**141,659**	**100%**

Table 5.8 Practice-Related Variables for Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Practice		
First 1/2 hour	10,030	15.0%
Second 1/2 hour	18,013	26.9%
Third 1/2 hour	26,126	39.0%
Fourth 1/2 hour	11,520	17.2%
>2 hours into practice	1,384	2.1%
Total	**67,073**	**100%**
Practice Type		
Noncontact skills practice	17,091	24.7%
Noncontact partial numbers scrimmage	3,679	5.3%
Partial contact skills practice	16,398	23.7%
Partial contact partial numbers scrimmage	6,267	9.1%
Full contact skills practice	13,825	20.0%
Full contact partial numbers scrimmage	2,168	3.1%
Full contact full scrimmage	4,145	6.0%
Other	5,678	8.2%
Total	**69,251**	**100%**

Figure 5.4 Player Position of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

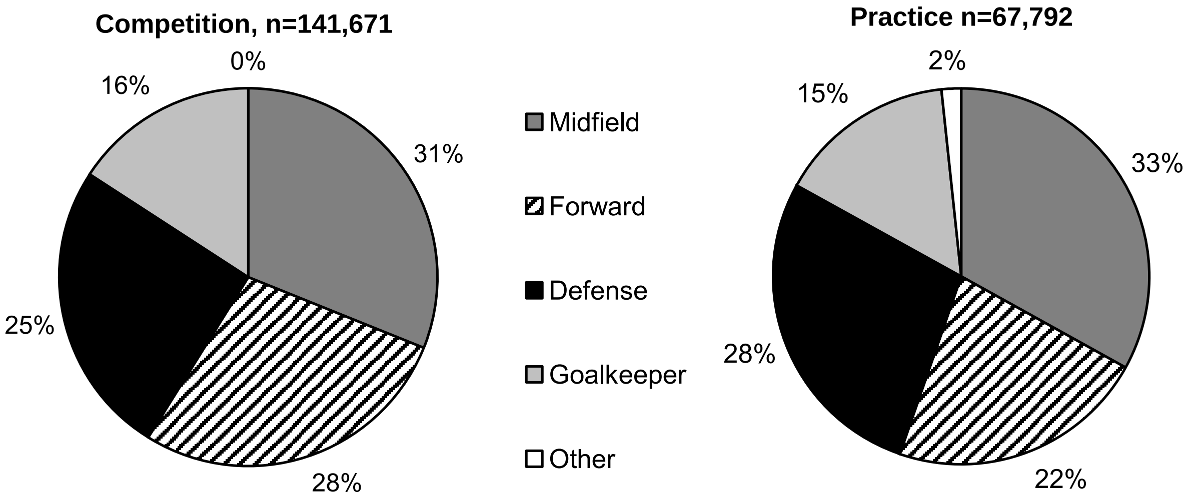
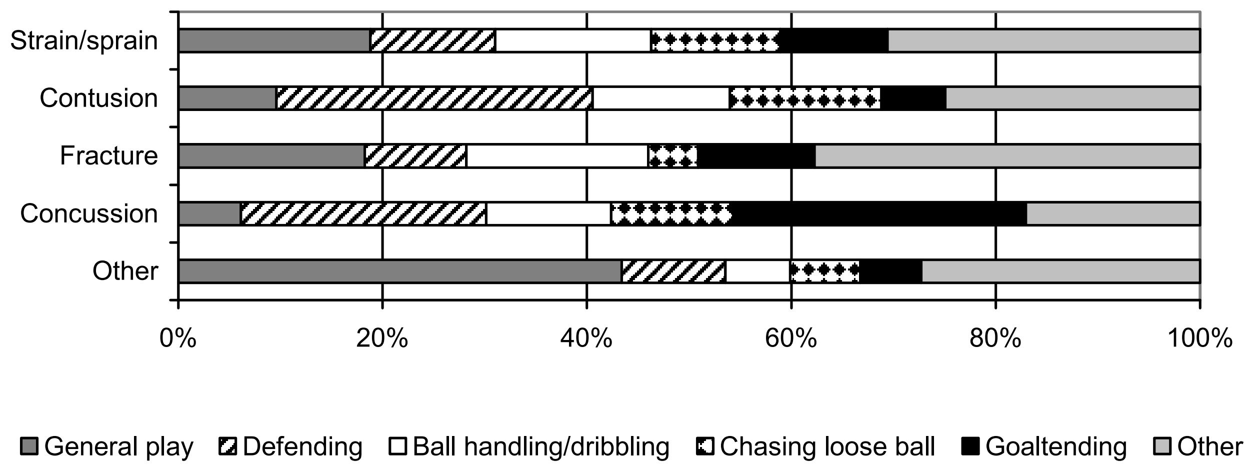


Table 5.9 Activities Leading to Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
General play	22,332	15.7%	20,953	30.1%	43,285	20.5%
Defending	25,561	18.0%	6,295	9.0%	31,856	15.1%
Ball handling/dribbling	19,854	14.0%	8,681	12.5%	28,535	13.5%
Chasing loose ball	22,616	15.9%	1,438	2.1%	24,054	11.4%
Goaltending	17,935	12.6%	5,541	8.0%	23,477	11.1%
Passing (foot)	7,181	5.1%	4,137	5.9%	11,319	5.3%
Blocking shot	5,972	4.2%	2,983	4.3%	8,955	4.2%
Receiving pass	6,350	4.5%	2,533	3.6%	8,883	4.2%
Conditioning	153	0.1%	7,296	10.5%	7,449	3.5%
Shooting (foot)	3,910	2.8%	3,491	5.0%	7,401	3.5%
Other	5601.9	3.9%	512.41	0.7%	6114.3	2.9%
Total	**142,030**	**100%**	**69,595**	**100%**	**211,625**	**100%**

Figure 5.5 Activity Resulting in Girls' Soccer Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year



VI. Volleyball Injury Epidemiology

Table 6.1 Volleyball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**208**	**169,831**	**1.22**	**72,261**
Competition	80	55,860	1.43	26,539
Practice	128	113,971	1.12	45,722

Table 6.2 Demographic Characteristics of Injured Volleyball Athletes, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year*

Year in School	
Freshman	18,674 (26.2%)
Sophomore	18,897 (26.5%)
Junior	17,790 (25.0%)
Senior	15,956 (22.4%)
Total†	**71,317 (100%)**
Age (years)	
Minimum	14
Maximum	18
Mean (St. Dev.)	15.6 (1.2)
BMI	
Minimum	15.2
Maximum	46.2
Mean (St. Dev.)	21.7 (3.2)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 6.1 Diagnosis of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

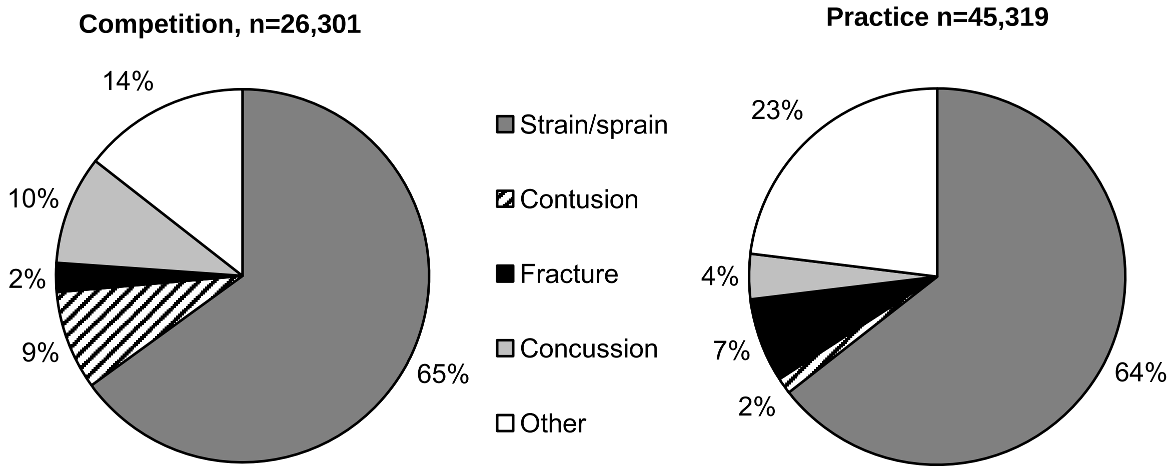


Table 6.3 Body Site of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Ankle	8,926	33.8%	14,531	32.1%	23,456	32.7%
Knee	3,119	11.8%	2,763	6.1%	5,882	8.2%
Head/face	2,924	11.1%	2,247	5.0%	5,171	7.2%
Hip/thigh/upper leg	1,544	5.8%	5,345	11.8%	6,890	9.6%
Hand/wrist	3,157	12.0%	3,741	8.3%	6,898	9.6%
Shoulder	2,298	8.7%	4,713	10.4%	7,011	9.8%
Trunk	2,386	9.0%	3,555	7.8%	5,940	8.3%
Lower leg	93	0.4%	3,753	8.3%	3,846	5.4%
Arm/elbow	1,048	4.0%	135	0.3%	1,182	1.6%
Foot	0	0.0%	2,922	6.4%	2,922	4.1%
Neck	0	0.0%	403	0.9%	403	0.6%
Other	910	3.4%	1,213	2.7%	2,123	3.0%
Total	**26,405**	**100%**	**45,319**	**100%**	**71,723**	**100%**

Table 6.4 Ten Most Common Volleyball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition n=26,301		Practice n=45,319		Total n=71,620	
	n	%	n	%	n	%
Diagnosis						
Ankle strain/sprain	8,523	32.4%	14,531	32.1%	23,053	32.2%
Hand/wrist strain/sprain	2,413	9.2%	1,887	4.2%	4,300	6.0%
Head/face concussion	2,521	9.6%	1,705	3.8%	4,227	5.9%
Shoulder strain/sprain	1,353	5.1%	2,791	6.2%	4,145	5.8%
Hip/thigh/upper leg strain/sprain	403	1.5%	3,433	7.6%	3,836	5.4%
Trunk strain/sprain	1,141	4.3%	2,046	4.5%	3,187	4.4%
Knee strain/sprain	1,937	7.4%	1,147	2.5%	3,084	4.3%
Shoulder other	944	3.6%	1,922	4.2%	2,866	4.0%
Trunk other	1,141	4.3%	1,509	3.3%	2,650	3.7%
Lower leg other	0	0.0%	2,151	4.7%	2,151	3.0%

Figure 6.2 Time Loss of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

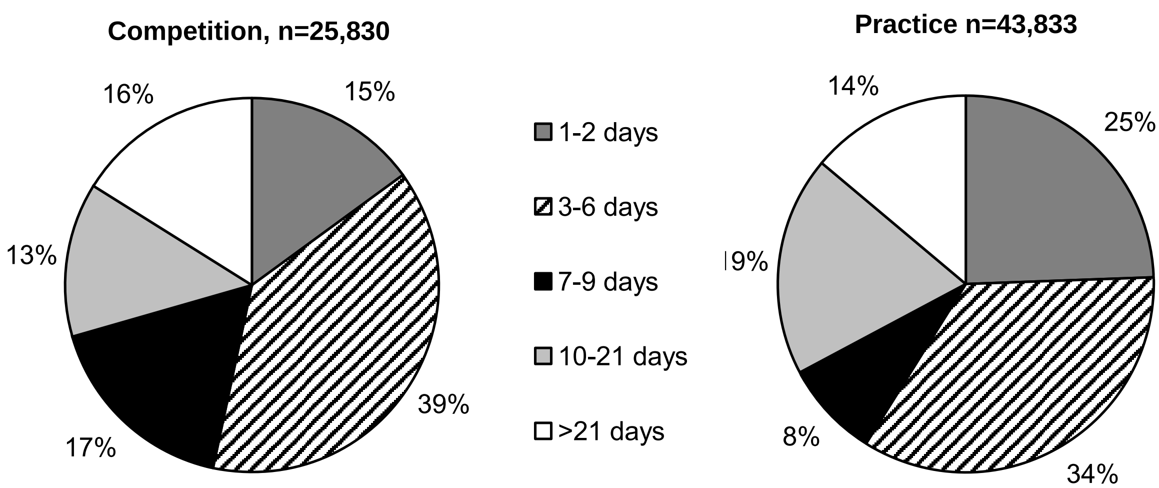


Table 6.5 Volleyball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	590	2.2%	238	0.5%	828	1.2%
Did not require surgery	25,577	97.8%	44,043	99.5%	69,620	98.8%
Total	**26,167**	**100%**	**44,281**	**100%**	**70,448**	**100%**

Figure 6.3 History of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

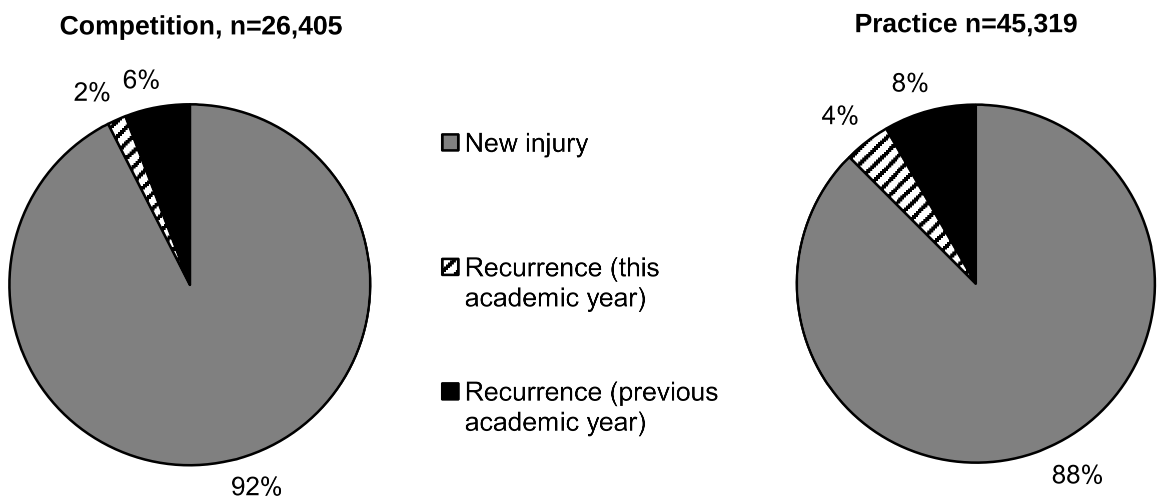


Table 6.6 Time during Season of Volleyball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Season		
Preseason	20,644	28.6%
Regular season	51,513	71.3%
Post season	103	0.1%
Total	**72,261**	**100%**

Table 6.7 Competition-Related Variables for Volleyball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Competition		
Warm-ups	2,230	8.4%
Beginning	1,514	5.7%
Middle	16,980	64.3%
End	5,680	21.5%
Total	**26,405**	**100%**
Competition Location		
Home	11,992	45.4%
Away	13,330	50.5%
Neutral site	1,083	4.1%
Total	**26,405**	**100%**
Injury Related to Foul Play		
No	25,598	98.4%
Yes, and ruled foul play	0	0.0%
Yes, but not ruled foul play	403	1.6%
Unknown	0	0.0%
Total	**26,002**	**100%**
Court Location		
Middle forward	8,441	34.3%
Right forward	4,919	20.0%
Left back	4,273	17.3%
Left forward	2,786	11.3%
Right back (server)	2,591	10.5%
Off the court	641	2.6%
Outside court (your side)	589	2.4%
Outside court (opponent's side)	403	1.6%
Total	**24,644**	**100%**

Table 6.8 Practice-Related Variables for Volleyball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Practice		
First 1/2 hour	6,210	13.7%
Second 1/2 hour	19,147	42.3%
Third 1/2 hour	8,911	19.7%
Fourth 1/2 hour	7,664	16.9%
>2 hours into practice	3,385	7.5%
Total	**45,319**	**100%**
Practice Type		
Noncontact skills practice	23,986	52.9%
Noncontact partial numbers scrimmage	4,368	9.6%
Noncontact full scrimmage	5,150	11.4%
Partial contact skills practice	3,126	6.9%
Partial contact partial numbers scrimmage	1,750	3.9%
Partial contact full scrimmage	93	0.2%
Full contact skills practice	2,900	6.4%
Full contact full scrimmage	2,494	5.5%
Other	1,451	3.2%
Total	**45,319**	**100%**

Figure 6.4 Player Position of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

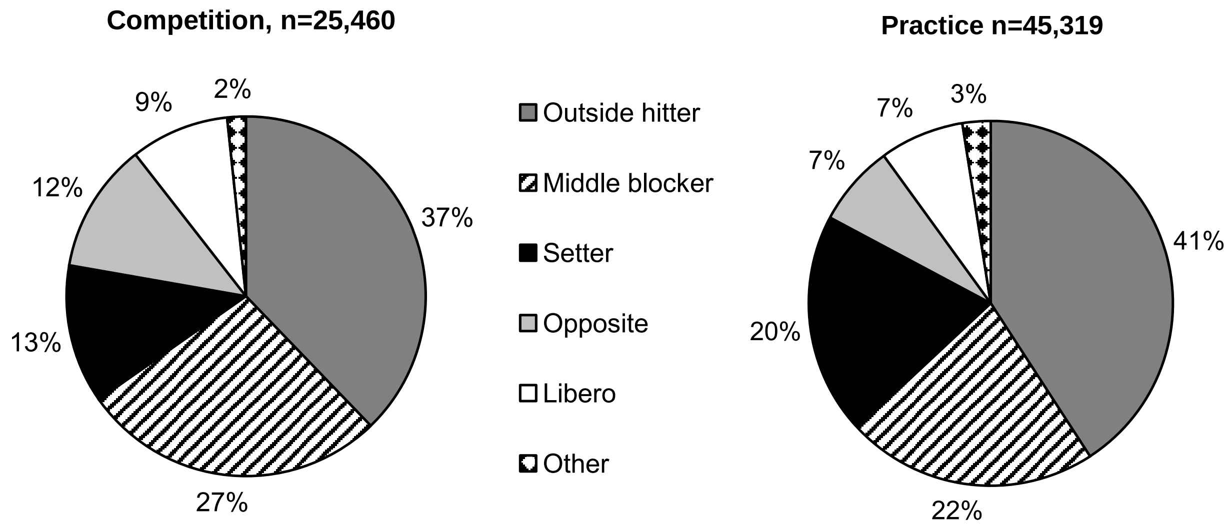
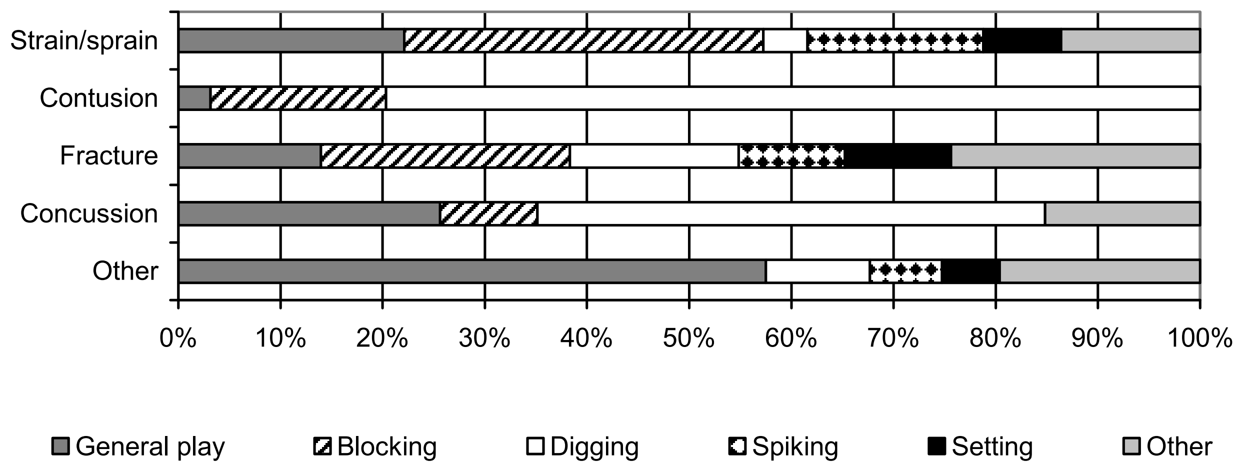


Table 6.9 Activities Leading to Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Activity						
General play	8,452	32.0%	11,663	25.9%	20,115	28.1%
Blocking	6,962	26.4%	11,177	24.8%	18,140	25.4%
Spiking	3,181	12.0%	6,159	13.7%	9,339	13.1%
Digging	5,259	19.9%	3,273	7.3%	8,531	11.9%
Conditioning	0	0.0%	5,077	11.3%	5,077	7.1%
Setting	541	2.1%	4,168	9.2%	4,709	6.6%
Serving	1,244	4.7%	1,747	3.9%	2,991	4.2%
Passing	362	1.4%	1,048	2.3%	1,411	2.0%
Other	403	1.5%	779	1.7%	1,182	1.7%
Total	**26,405**	**100%**	**45,091**	**100%**	**71,496**	**100%**

Figure 6.5 Activity Resulting in Volleyball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year



VII. Boys' Basketball Injury Epidemiology

Table 7.1 Boys' Basketball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**348**	**249,849**	**1.39**	**82,612**
Competition	166	74,446	2.23	36,766
Practice	182	175,403	1.04	45,846

Table 7.2 Demographic Characteristics of Injured Boys' Basketball Athletes, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year*

Year in School	
Freshman	15,876 (19.3%)
Sophomore	20,692 (25.2%)
Junior	21,378 (26.0%)
Senior	24,154 (29.4%)
Total†	**82,099 (100%)**
Age (years)	
Minimum	14
Maximum	19
Mean (St. Dev.)	16.2 (1.2)
BMI	
Minimum	16.3
Maximum	33.7
Mean (St. Dev.)	23.0 (2.9)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 7.1 Diagnosis of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

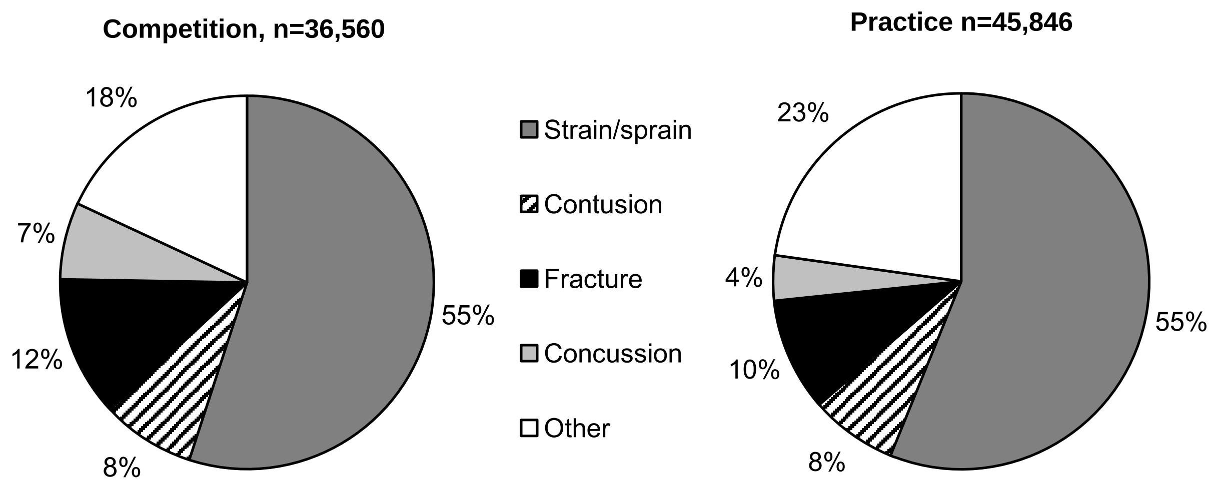


Table 7.3 Body Site of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Ankle	12,570	34.3%	14,801	32.3%	27,371	33.2%
Knee	5,672	15.5%	6,548	14.3%	12,220	14.8%
Head/face	4,651	12.7%	3,848	8.4%	8,499	10.3%
Hip/thigh/upper leg	1,430	3.9%	2,090	4.6%	3,520	4.3%
Hand/wrist	3,680	10.0%	6,652	14.5%	10,332	12.5%
Shoulder	1,099	3.0%	2,807	6.1%	3,906	4.7%
Trunk	1,534	4.2%	2,422	5.3%	3,955	4.8%
Lower leg	506	1.4%	505	1.1%	1,011	1.2%
Arm/elbow	2,211	6.0%	946	2.1%	3,157	3.8%
Foot	2,504	6.8%	3,841	8.4%	6,345	7.7%
Neck	85	0.2%	85	0.2%	169	0.2%
Other	703	1.9%	1,302	2.8%	2,005	2.4%
Total	**36,645**	**100%**	**45,846**	**100%**	**82,490**	**100%**

Table 7.4 Ten Most Common Boys' Basketball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition n=36,560		Practice n=45,846		Total n=82,406	
	n	%	n	%	n	%
Diagnosis						
Ankle strain/sprain	12,279	33.6%	14,197	31.0%	26,477	32.1%
Knee strain/sprain	1,884	5.2%	3,123	6.8%	5,006	6.1%
Knee other	2,433	6.7%	2,451	5.3%	4,884	5.9%
Hand/wrist fracture	1,670	4.6%	2,810	6.1%	4,481	5.4%
Head/face concussion	2,418	6.6%	1,761	3.8%	4,179	5.1%
Hand/wrist strain/sprain	1,562	4.3%	2,252	4.9%	3,814	4.6%
Foot strain/sprain	1,961	5.4%	1,015	2.2%	2,976	3.6%
Head/face other	1,803	4.9%	1,097	2.4%	2,900	3.5%
Foot other	0	0.0%	2,395	5.2%	2,395	2.9%
Shoulder strain/sprain	683	1.9%	1,704	3.7%	2,386	2.9%

Figure 7.2 Time Loss of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

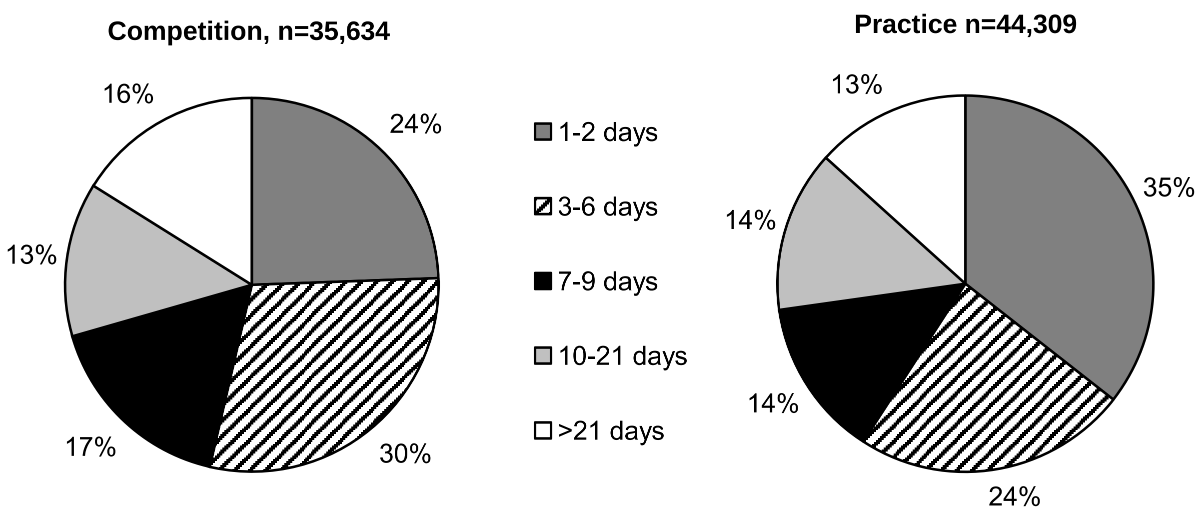


Table 7.5 Boys' Basketball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	1,563	4.3%	3,729	8.3%	5,292	6.5%
Did not require surgery	34,745	95.7%	41,156	91.7%	75,900	93.5%
Total	**36,308**	**100%**	**44,884**	**100%**	**81,192**	**100%**

Figure 7.3 History of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

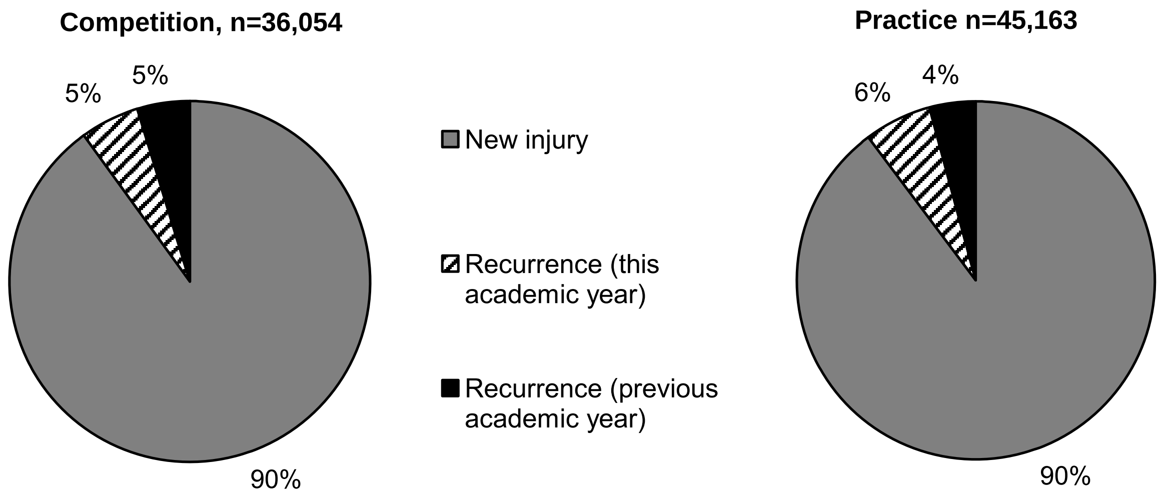


Table 7.6 Time during Season of Boys' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Season		
Preseason	16,039	19.4%
Regular season	62,042	75.1%
Post season	4,530	5.5%
Total	**82,612**	**100%**

Table 7.7 Competition-Related Variables for Boys' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Competition		
Warm-ups	252	0.7%
Beginning	5,098	13.9%
Middle	19,200	52.4%
End	12,095	33.0%
Total	**36,645**	**100%**
Competition Location		
Home	18,902	51.6%
Away	16,305	44.5%
Neutral site	1,438	3.9%
Total	**36,645**	**100%**
Injury Related to Foul Play		
No	29,701	81.1%
Yes, and ruled foul play	3,958	10.8%
Yes, but not ruled foul play	1,363	3.7%
Unknown	1,623	4.4%
Total	**36,645**	**100%**
Court Location		
Inside lane (offense)	8,563	23.7%
Inside lane (defense)	7,103	19.7%
Outside 3 point arc (offense)	5,546	15.3%
Outside 3 point arc (defense)	5,349	14.8%
Between 3 pt arc and lane (defense)	4,324	12.0%
Between 3 pt arc and lane (offense)	4,091	11.3%
Out of bounds	795	2.2%
Off the court	373	1.0%
Total	**36,144**	**100%**

Table 7.8 Practice-Related Variables for Boys' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Practice		
First 1/2 hour	6,118	13.5%
Second 1/2 hour	11,937	26.3%
Third 1/2 hour	16,723	36.9%
Fourth 1/2 hour	7,305	16.1%
>2 hours into practice	3,273	7.2%
Total	**45,356**	**100%**
Practice Type		
Noncontact skills practice	7,823	17.2%
Noncontact partial numbers scrimmage	206	0.5%
Noncontact full scrimmage	2,046	4.5%
Partial contact skills practice	5,105	11.2%
Partial contact partial numbers scrimmage	4,247	9.3%
Partial contact full scrimmage	4,959	10.9%
Full contact skills practice	6,308	13.9%
Full contact partial numbers scrimmage	5,235	11.5%
Full contact full scrimmage	8,059	17.7%
Other	1,526	3.4%
Total	**45,515**	**100%**

Figure 7.4 Player Position of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

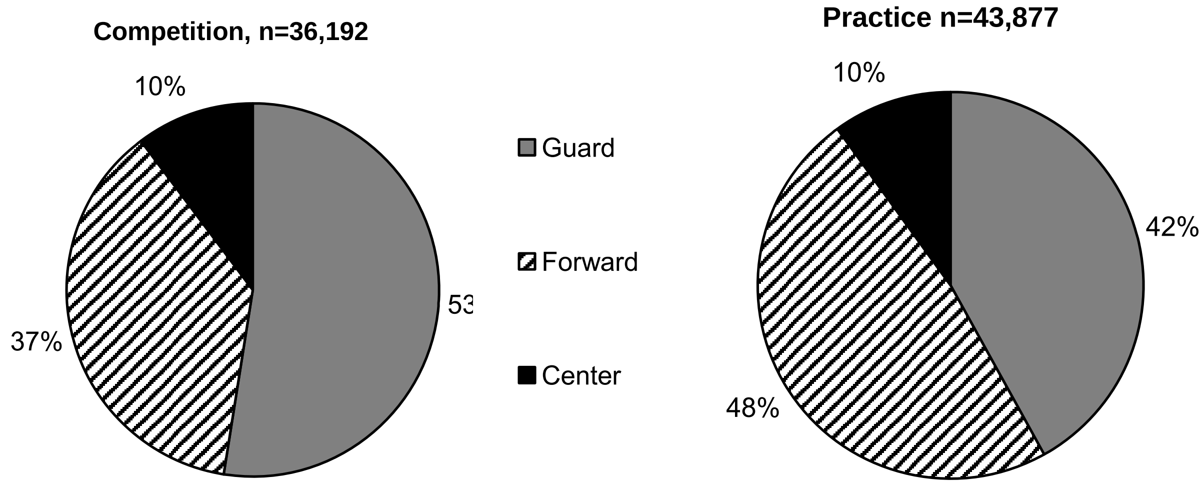
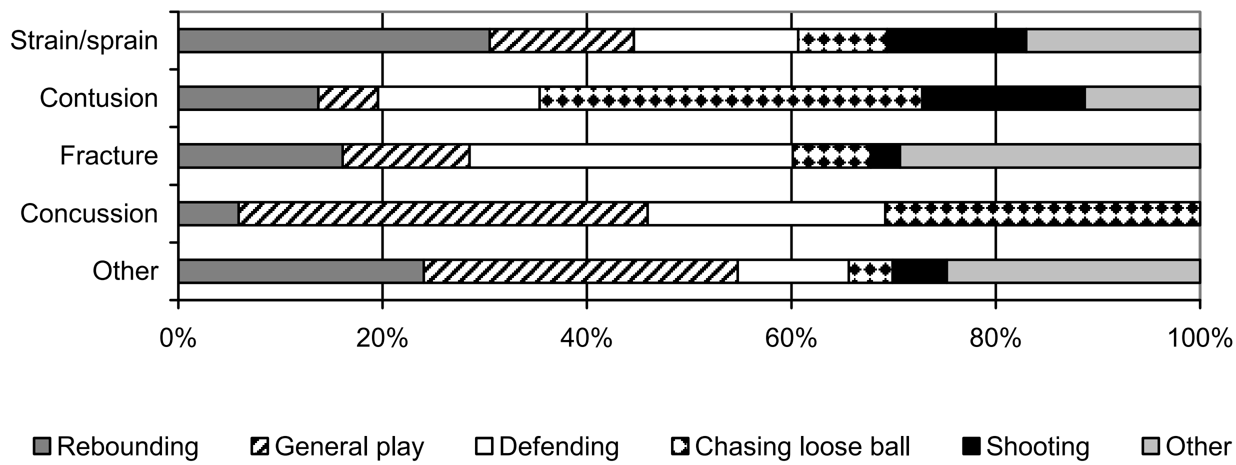


Table 7.9 Activities Leading to Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Activity						
Rebounding	8,875	24.4%	11,517	25.4%	20,392	25.0%
General play	5,382	14.8%	9,348	20.7%	14,731	18.1%
Defending	7,196	19.8%	6,706	14.8%	13,903	17.0%
Chasing loose ball	5,685	15.7%	3,331	7.4%	9,016	11.1%
Shooting	4,296	11.8%	4,038	8.9%	8,334	10.2%
Conditioning	434	1.2%	3,352	7.4%	3,786	4.6%
Ball handling/dribbling	2,058	5.7%	1,627	3.6%	3,685	4.5%
Receiving pass	885	2.4%	2,569	5.7%	3,454	4.2%
Other	1,502	4.1%	2,768	6.1%	4,270	5.2%
Total	**36,313**	**100%**	**45,258**	**100%**	**81,571**	**100%**

Figure 7.5 Activity Resulting in Boys' Basketball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year



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VIII. Girls' Basketball Injury Epidemiology

Table 8.1 Girls' Basketball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**320**	**198,486**	**1.61**	**73,283**
Competition	195	59,177	3.30	45,236
Practice	125	139,309	0.90	28,047

Table 8.2 Demographic Characteristics of Injured Girls' Basketball Athletes, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year*

Year in School	
Freshman	20,320 (28.6%)
Sophomore	18,614 (26.2%)
Junior	21,369 (30.0%)
Senior	10,827 (15.2%)
Total†	**71,129 (100%)**
Age (years)	
Minimum	13
Maximum	19
Mean (St. Dev.)	15.7 (1.2)
BMI	
Minimum	15.6
Maximum	36.1
Mean (St. Dev.)	22.0 (3.2)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 8.1 Diagnosis of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

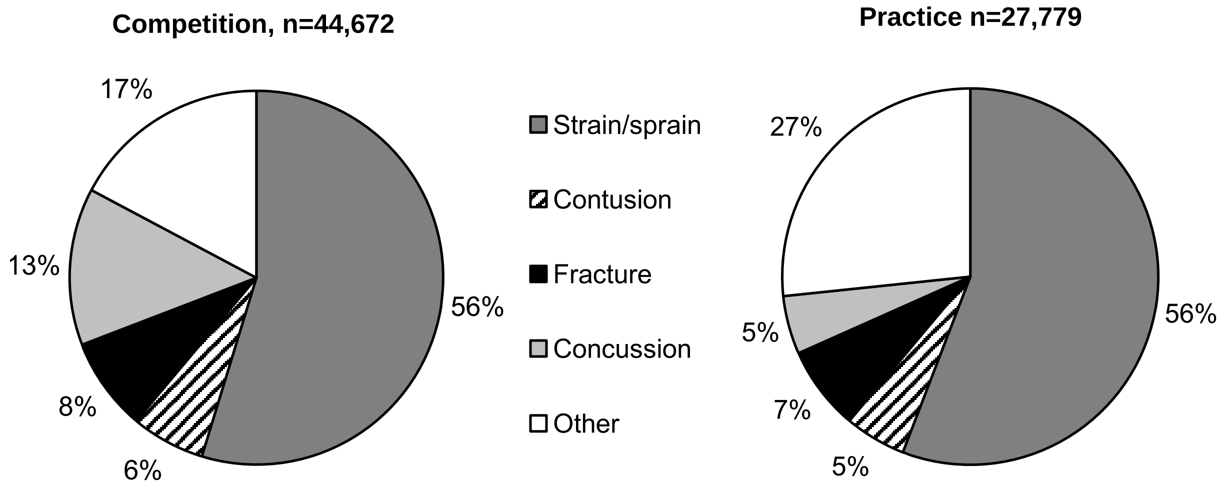


Table 8.3 Body Site of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Ankle	14,176	31.7%	7,553	27.2%	21,729	30.0%
Knee	8,204	18.4%	5,060	18.2%	13,263	18.3%
Head/face	9,003	20.2%	1,368	4.9%	10,370	14.3%
Hip/thigh/upper leg	1,208	2.7%	4,798	17.3%	6,006	8.3%
Hand/wrist	4,138	9.3%	2,774	10.0%	6,913	9.5%
Shoulder	1,758	3.9%	1,770	6.4%	3,528	4.9%
Trunk	1,811	4.1%	208	0.7%	2,019	2.8%
Lower leg	2,203	4.9%	1,230	4.4%	3,433	4.7%
Arm/elbow	379	0.8%	0	0.0%	379	0.5%
Foot	1,030	2.3%	2,614	9.4%	3,644	5.0%
Neck	321	0.7%	73	0.3%	395	0.5%
Other	442	1.0%	331	1.2%	773	1.1%
Total	**44,673**	**100%**	**27,779**	**100%**	**72,451**	**100%**

Table 8.4 Ten Most Common Girls' Basketball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition n=44,672		Practice n=27,779		Total n=72,451	
	n	%	n	%	n	%
Diagnosis						
Ankle strain/sprain	12,813	28.7%	7,111	25.6%	19,923	27.5%
Head/face concussion	6,021	13.5%	1,368	4.9%	7,389	10.2%
Knee strain/sprain	5,254	11.8%	1,705	6.1%	6,959	9.6%
Hip/thigh/upper leg strain/sprain	784	1.8%	4,356	15.7%	5,140	7.1%
Knee other	1,640	3.7%	2,595	9.3%	4,235	5.8%
Hand/wrist strain/sprain	2,178	4.9%	1,026	3.7%	3,204	4.4%
Foot other	822	1.8%	1,908	6.9%	2,730	3.8%
Hand/wrist fracture	1,289	2.9%	1,393	5.0%	2,682	3.7%
Shoulder other	1,048	2.3%	997	3.6%	2,045	2.8%
Lower leg other	746	1.7%	1,144	4.1%	1,889	2.6%

Figure 8.2 Time Loss of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

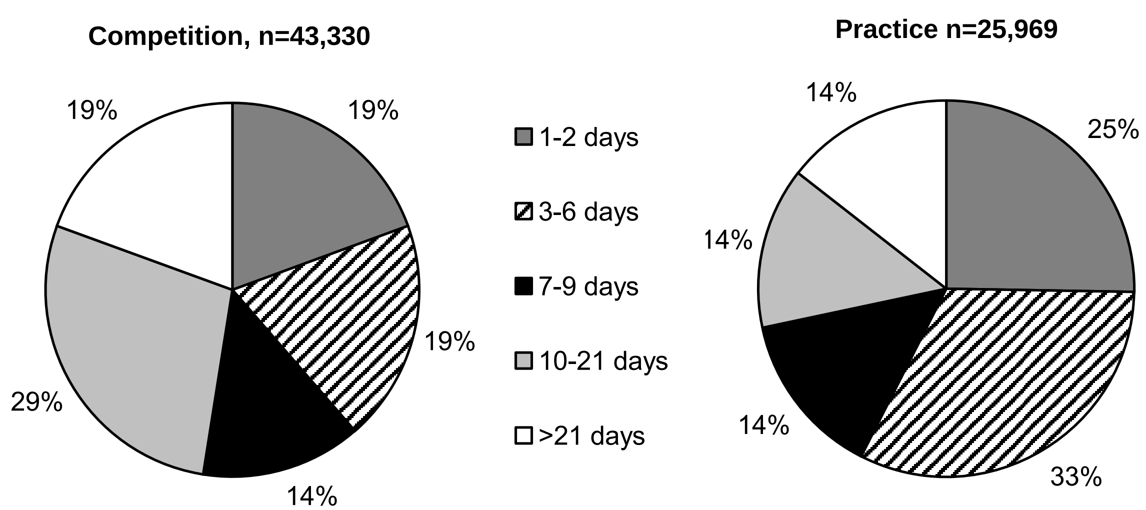


Table 8.5 Girls' Basketball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Need for surgery						
Required surgery	4,042	9.3%	1,081	4.0%	5,123	7.2%
Did not require surgery	39,424	90.7%	26,318	96.0%	65,743	92.8%
Total	**43,466**	**100%**	**27,400**	**100%**	**70,866**	**100%**

Figure 8.3 History of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

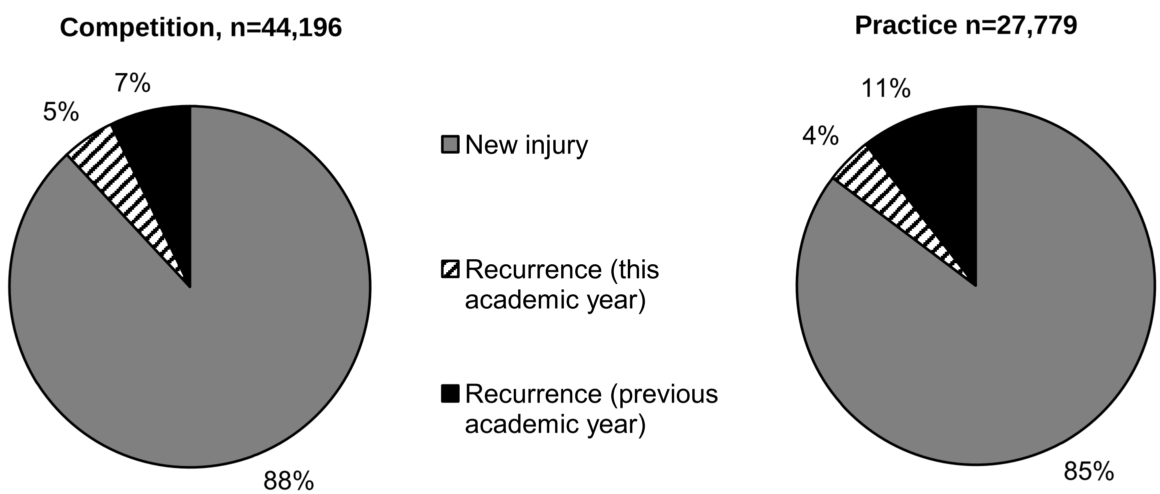


Table 8.6 Time during Season of Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	**%**
Time in Season		
Preseason	15,919	21.7%
Regular season	55,198	75.3%
Post season	2,166	3.0%
Total	**73,283**	**100%**

Table 8.7 Competition-Related Variables for Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Competition		
Warm-ups	1,630	3.7%
Beginning	7,679	17.2%
Middle	21,607	48.5%
End	13,610	30.6%
Total	**44,526**	**100%**
Competition Location		
Home	20,064	44.9%
Away	23,411	52.4%
Neutral site	1,197	2.7%
Total	**44,672**	**100%**
Injury Related to Foul Play		
No	38,665	86.6%
Yes, and ruled foul play	3,075	6.9%
Yes, but not ruled foul play	1,967	4.4%
Unknown	966	2.2%
Total	**44,672**	**100%**
Court Location		
Inside lane (offense)	8,812	20.2%
Inside lane (defense)	9,645	22.1%
Between 3 pt arc and lane (offense)	6,624	15.2%
Between 3 pt arc and lane (defense)	7,012	16.1%
Outside 3 point arc (offense)	5,324	12.2%
Outside 3 point arc (defense)	4,278	9.8%
Out of bounds	1,117	2.6%
Off the court	847	1.9%
Total	**43,660**	**100%**

Table 8.8 Practice-Related Variables for Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Practice		
First 1/2 hour	4,745	17.2%
Second 1/2 hour	5,914	21.4%
Third 1/2 hour	9,100	33.0%
Fourth 1/2 hour	5,866	21.3%
>2 hours into practice	1,959	7.1%
Total	**27,584**	**100%**
Practice Type		
Noncontact skills practice	7,656	27.6%
Noncontact partial numbers scrimmage	408	1.5%
Noncontact full scrimmage	1,847	6.7%
Partial contact skills practice	4,370	15.7%
Partial contact partial numbers scrimmage	1,371	4.9%
Partial contact full scrimmage	2,290	8.2%
Full contact skills practice	4,007	14.4%
Full contact partial numbers scrimmage	1,124	4.0%
Full contact full scrimmage	2,713	9.8%
Other	1,992	7.2%
Total	**27,779**	**100%**

Figure 8.4 Player Position of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

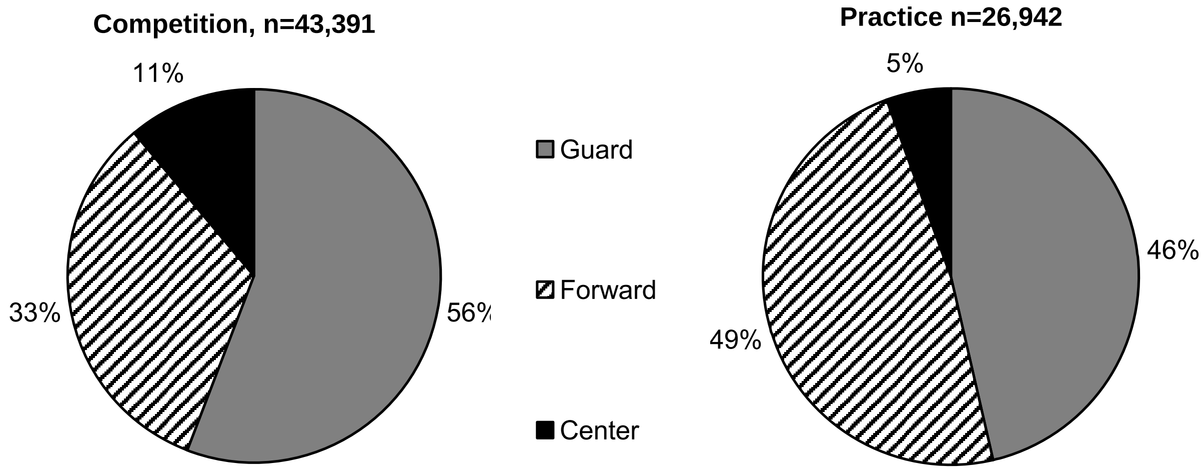
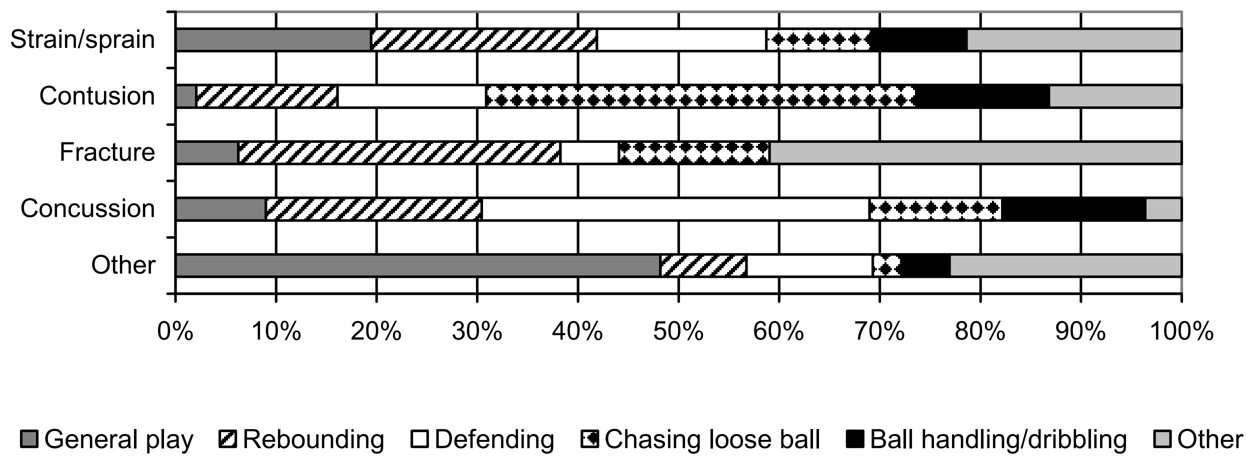


Table 8.9 Activities Leading to Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
General play	6,232	14.5%	9,475	34.6%	15,707	22.3%
Rebounding	10,115	23.5%	3,761	13.7%	13,877	19.7%
Defending	10,576	24.6%	1,486	5.4%	12,061	17.1%
Chasing loose ball	4,664	10.8%	3,380	12.3%	8,044	11.4%
Shooting	3,608	8.4%	2,952	10.8%	6,561	9.3%
Ball handling/dribbling	4,173	9.7%	1,759	6.4%	5,932	8.4%
Receiving pass	947	2.2%	1,606	5.9%	2,553	3.6%
Other	2,733	6.3%	2,965	10.8%	5,698	8.1%
Total	**43,050**	**100%**	**27,384**	**100%**	**70,434**	**100%**

Figure 8.5 Activity Resulting in Girls' Basketball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year



IX. Wrestling Injury Epidemiology

Table 9.1 Wrestling Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**408**	**179,427**	**2.27**	**91,625**
Competition	175	47,327	3.70	40,698
Practice	233	132,100	1.76	50,927

Table 9.2 Demographic Characteristics of Injured Wrestlers, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year*

Year in School	
Freshman	18,453 (20.3%)
Sophomore	22,602 (24.9%)
Junior	26,127 (28.8%)
Senior	23,673 (26.1%)
Total†	**90,856 (100%)**
Age (years)	
Minimum	13
Maximum	18
Mean (St. Dev.)	16.0 (1.2)
BMI	
Minimum	14.3
Maximum	47.9
Mean (St. Dev.)	23.7 (4.8)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 9.1 Diagnosis of Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

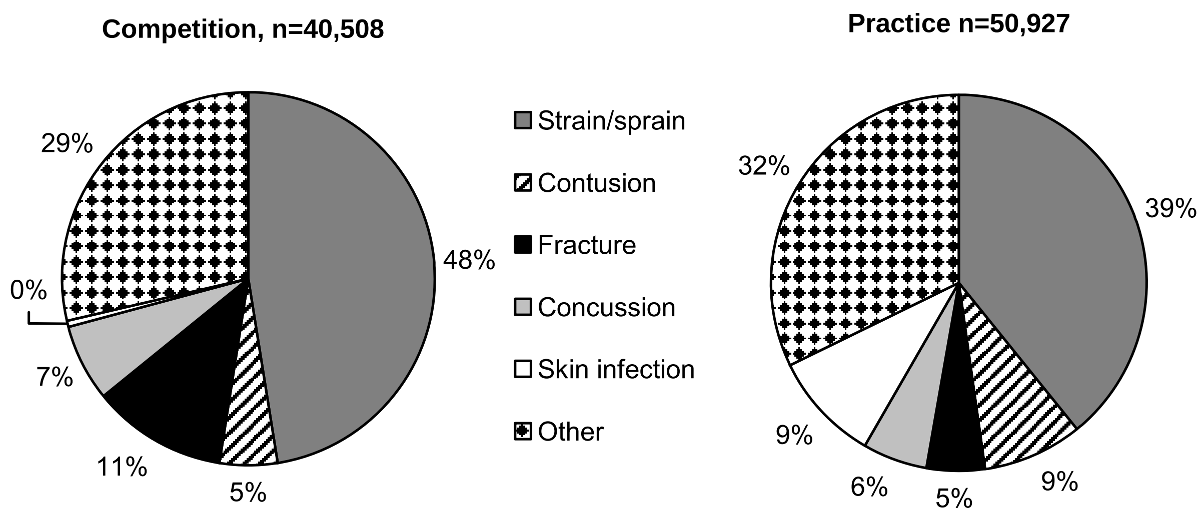


Table 9.3 Body Site of Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		**Practice**		**Overall**	
	n	**%**	**n**	**%**	**n**	**%**
Body Site						
Ankle	2,368	5.8%	2,631	5.2%	4,999	5.5%
Knee	7,120	17.5%	9,753	19.2%	16,872	18.4%
Head/face	5,476	13.5%	6,263	12.3%	11,739	12.8%
Hip/thigh/upper leg	984	2.4%	1,507	3.0%	2,491	2.7%
Hand/wrist	1,456	3.6%	4,749	9.3%	6,204	6.8%
Shoulder	9,742	23.9%	8,468	16.7%	18,211	19.9%
Trunk	5,402	13.3%	7,594	14.9%	12,996	14.2%
Lower leg	379	0.9%	879	1.7%	1,258	1.4%
Arm/elbow	4,899	12.0%	3,900	7.7%	8,798	9.6%
Foot	793	1.9%	742	1.5%	1,535	1.7%
Neck	1,941	4.8%	3,232	6.4%	5,174	5.7%
Other	138	0.3%	1,124	2.2%	1,262	1.4%
Total	**40,698**	**100%**	**50,841**	**100%**	**91,539**	**100%**

Table 9.4 Ten Most Common Wrestling Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition n=40,508		Practice n=50,841		Total n=91,349	
	n	%	n	%	n	%
Diagnosis						
Shoulder strain/sprain	5,642	13.9%	3,895	7.7%	9,538	10.4%
Knee other	3,737	9.2%	4,093	8.1%	7,830	8.6%
Knee strain/sprain	2,713	6.7%	4,487	8.8%	7,200	7.9%
Shoulder other	2,718	6.7%	3,487	6.9%	6,204	6.8%
Head/face concussion	2,784	6.9%	3,113	6.1%	5,896	6.5%
Trunk strain/sprain	2,604	6.4%	2,851	5.6%	5,455	6.0%
Trunk other	1,772	4.4%	2,749	5.4%	4,521	4.9%
Head/face other	1,744	4.3%	2,703	5.3%	4,447	4.9%
Ankle strain/sprain	1,921	4.7%	2,232	4.4%	4,154	4.5%
Arm/elbow strain/sprain	1,842	4.5%	2,073	4.1%	3,914	4.3%

Figure 9.2 Time Loss of Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

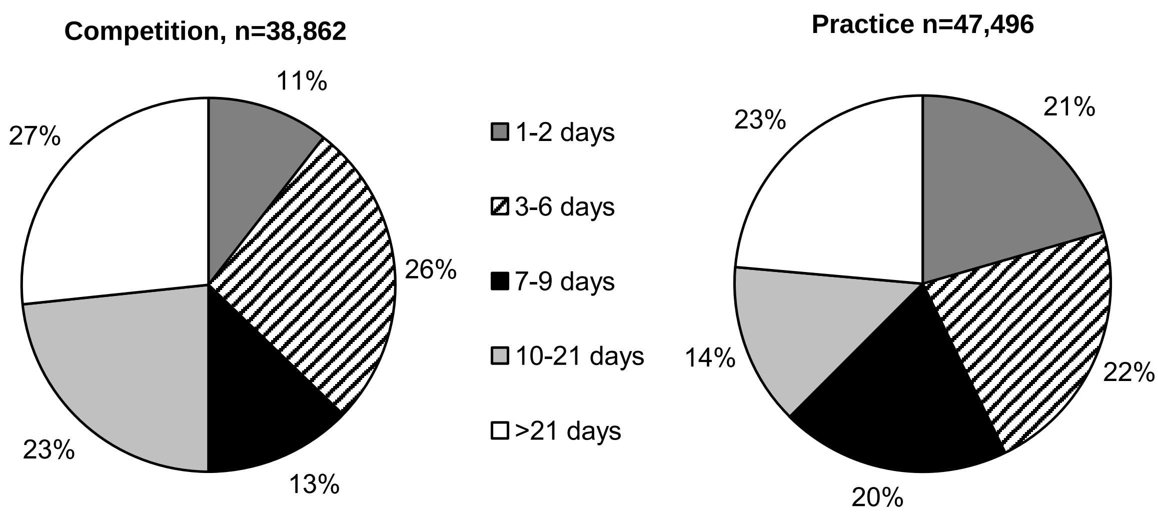


Table 9.5 Wrestling Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	4,864	12.0%	3,716	7.7%	8,579	9.7%
Did not require surgery	35,696	88.0%	44,463	92.3%	80,159	90.3%
Total	**40,560**	**100%**	**48,179**	**100%**	**88,739**	**100%**

Figure 9.3 History of Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

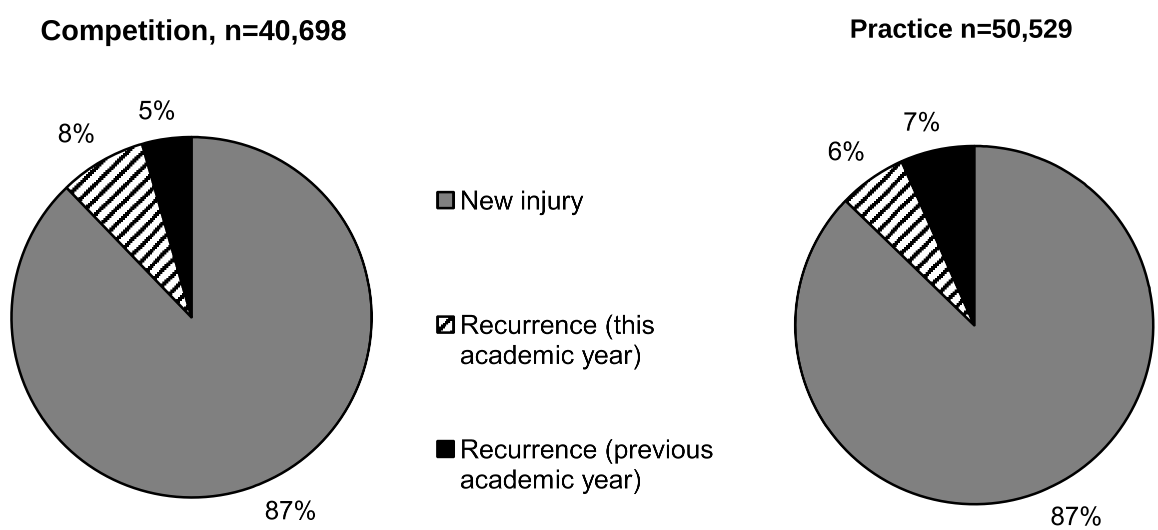


Table 9.6 Time during Season of Wrestling Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Season		
Preseason	14,324	15.6%
Regular season	73,573	80.3%
Post season	3,728	4.1%
Total	**91,625**	**100%**

Table 9.7 Competition-Related Variables for Wrestling Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Competition		
Warm-ups	876	2.2%
Beginning	5,889	14.5%
Middle	22,864	56.3%
End	10,983	27.0%
Total	**40,612**	**100%**
Competition Location		
Home	13,858	34.1%
Away	24,179	59.4%
Neutral site	2,660	6.5%
Total	**40,698**	**100%**
Injury Related to Foul Play		
No	35,521	87.3%
Yes, and ruled foul play	2,208	5.4%
Yes, but not ruled foul play	2,089	5.1%
Unknown	881	2.2%
Total	**40,698**	**100%**
Mat Location*		
Within circle	77,871	88.8%
Out of bounds	3,982	4.5%
Off mat	5,836	6.7%
Total	**87,689**	**100%**

*ATCs were asked to provide the mat location for both competition- and practice-related wrestling injuries.

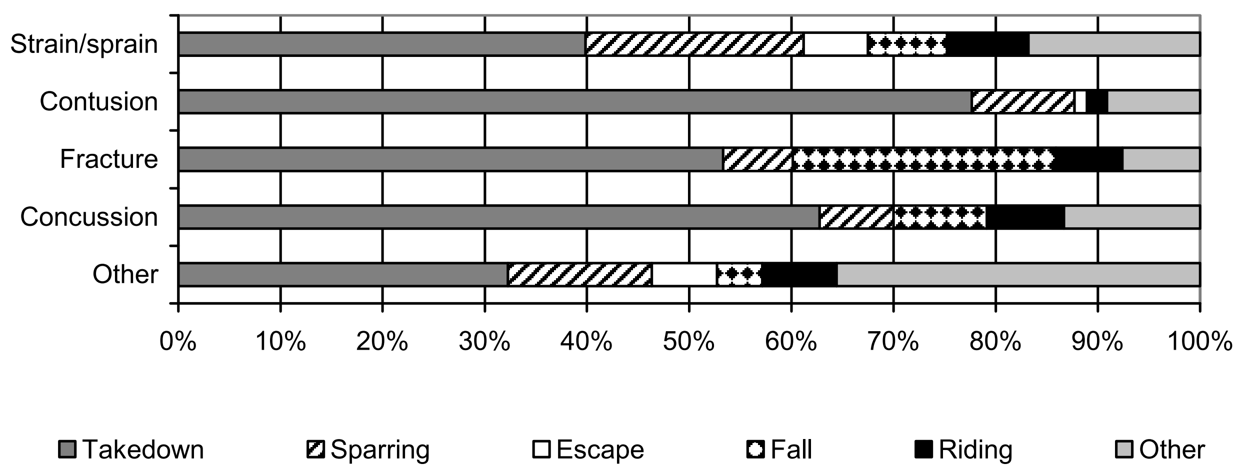
Table 9.8 Practice-Related Variables for Wrestling Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Practice		
First 1/2 hour	8,004	16.0%
Second 1/2 hour	11,313	22.6%
Third 1/2 hour	19,596	39.2%
Fourth 1/2 hour	8,917	17.9%
>2 hours into practice	2,121	4.2%
Total	**49,951**	**100%**
Practice Type		
Noncontact skills practice	2,051	4.1%
Partial contact skills practice	6,688	13.3%
Partial contact full scrimmage	1,105	2.2%
Full contact skills practice	26,727	53.2%
Full contact partial numbers scrimmage	568	1.1%
Full contact full scrimmage	8,279	16.5%
Other	4,811	9.6%
Total	**50,230**	**100%**

Table 9.9 Activities Leading to Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Activity						
Takedown	18,045	45.7%	20,157	40.6%	38,203	42.9%
Sparring	4,668	11.8%	9,643	19.4%	14,311	16.1%
Fall	4,063	10.3%	2,866	5.8%	6,929	7.8%
N/A,	756	1.9%	5,990	12.1%	6,746	7.6%
Riding	4,413	11.2%	1,920	3.9%	6,334	7.1%
Conditioning	438	1.1%	4,576	9.2%	5,014	5.6%
Escape	2,032	5.2%	2,420	4.9%	4,452	5.0%
Reversal	2,187	5.5%	1,897	3.8%	4,084	4.6%
Other	2,853	7.2%	209	0.4%	3,062	3.4%
Total	**39,457**	**100%**	**49,677**	**100%**	**89,134**	**100%**

Figure 9.5 Activity Resulting in Wrestling Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year



X. Baseball Injury Epidemiology

Table 10.1 Baseball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**173**	**186,264**	**0.93**	**44,760**
Competition	92	67,167	1.37	22,803
Practice	81	119,097	0.68	21,957

Table 10.2 Demographic Characteristics of Injured Baseball Athletes, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year*

Year in School	
Freshman	7,266 (16.6%)
Sophomore	10,125 (23.1%)
Junior	11,953 (27.3%)
Senior	14,480 (33.0%)
Total†	**43,824 (100%)**
Age (years)	
Minimum	13
Maximum	19
Mean (St. Dev.)	16.3 (1.3)
BMI	
Minimum	17.9
Maximum	38.7
Mean (St. Dev.)	24.2 (3.7)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 10.1 Diagnosis of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

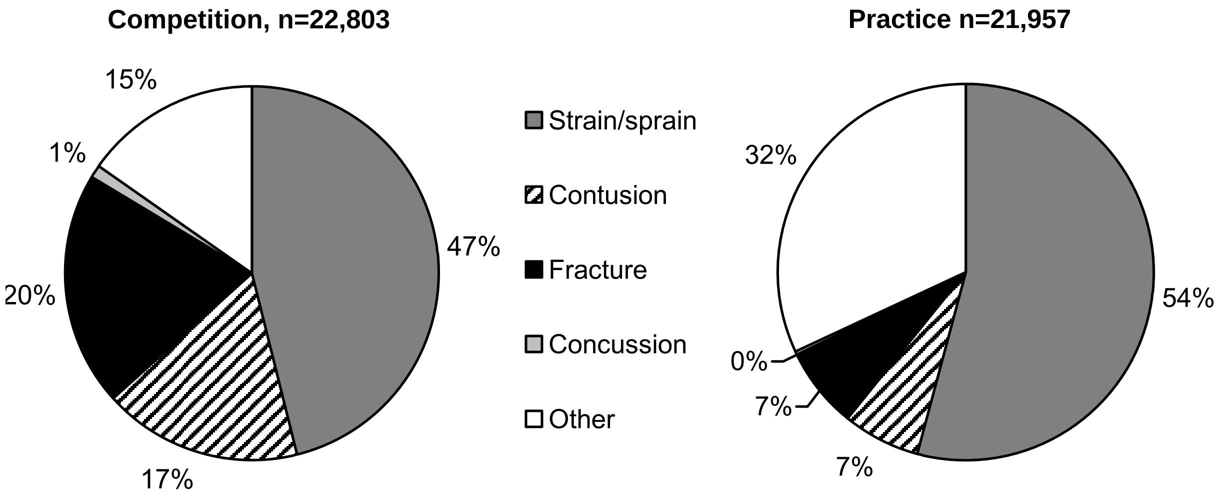


Table 10.3 Body Site of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Ankle	2,810	12.3%	3,335	15.2%	6,145	13.7%
Knee	1,403	6.2%	2,601	11.8%	4,004	8.9%
Head/face	2,374	10.4%	1,392	6.3%	3,766	8.4%
Hip/thigh/upper leg	2,367	10.4%	2,630	12.0%	4,997	11.2%
Hand/wrist	4,500	19.7%	3,392	15.4%	7,891	17.6%
Shoulder	4,007	17.6%	3,134	14.3%	7,141	16.0%
Trunk	402	1.8%	1,315	6.0%	1,717	3.8%
Lower leg	1,307	5.7%	1,739	7.9%	3,046	6.8%
Arm/elbow	2,938	12.9%	2,113	9.6%	5,051	11.3%
Foot	0	0.0%	0	0.0%	0	0.0%
Neck	64	0.3%	0	0.0%	64	0.1%
Other	633	2.8%	306	1.4%	938	2.1%
Total	**22,803**	**100%**	**21,957**	**100%**	**44,760**	**100%**

Table 10.4 Ten Most Common Baseball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition n=22,803		Practice n=21,957		Total n=44,760	
	n	%	n	%	n	%
Diagnosis						
Ankle strain/sprain	2,375	10.4%	2,766	12.6%	5,142	11.5%
Hip/thigh/upper leg strain/sprain	2,366	10.4%	2,630	12.0%	4,997	11.2%
Shoulder other	2,460	10.8%	1,207	5.5%	3,667	8.2%
Hand/wrist strain/sprain	2,283	10.0%	644	2.9%	2,927	6.5%
Shoulder strain/sprain	915	4.0%	1,927	8.8%	2,842	6.3%
Hand/wrist fracture	1,648	7.2%	939	4.3%	2,587	5.8%
Arm/elbow strain/sprain	1,241	5.4%	644	2.9%	1,884	4.2%
Arm/elbow other	686	3.0%	1,102	5.0%	1,788	4.0%
Knee other	0	0.0%	1,664	7.6%	1,664	3.7%
Trunk strain/sprain	249	1.1%	1,315	6.0%	1,564	3.5%

Figure 10.2 Time Loss of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

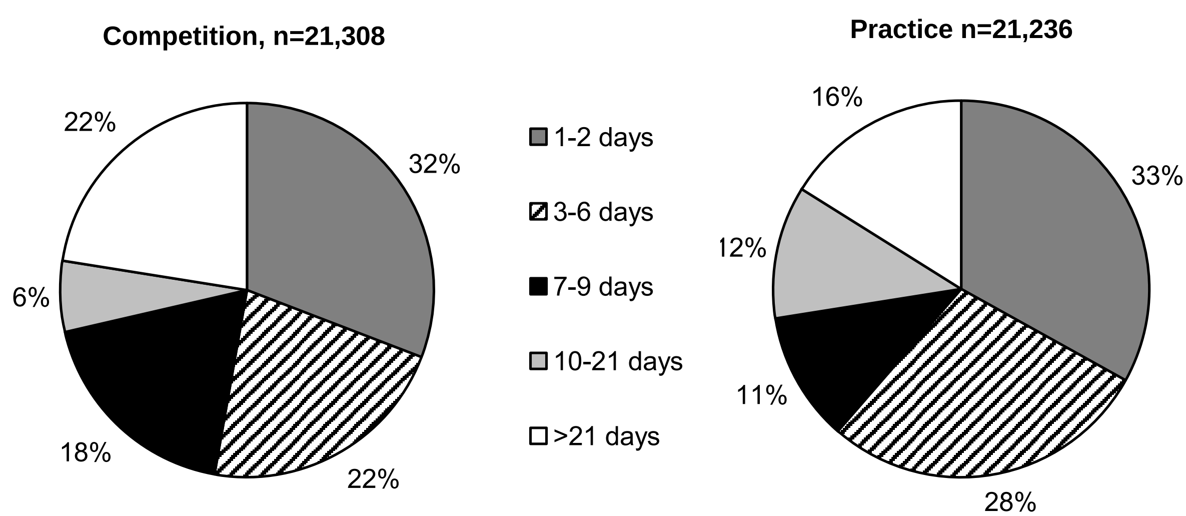


Table 10.5 Baseball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	2,363	10.6%	2,187	10.0%	4,550	10.3%
Did not require surgery	19,907	89.4%	19,643	90.0%	39,549	89.7%
Total	**22,270**	**100%**	**21,829**	**100%**	**44,099**	**100%**

Figure 10.3 History of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

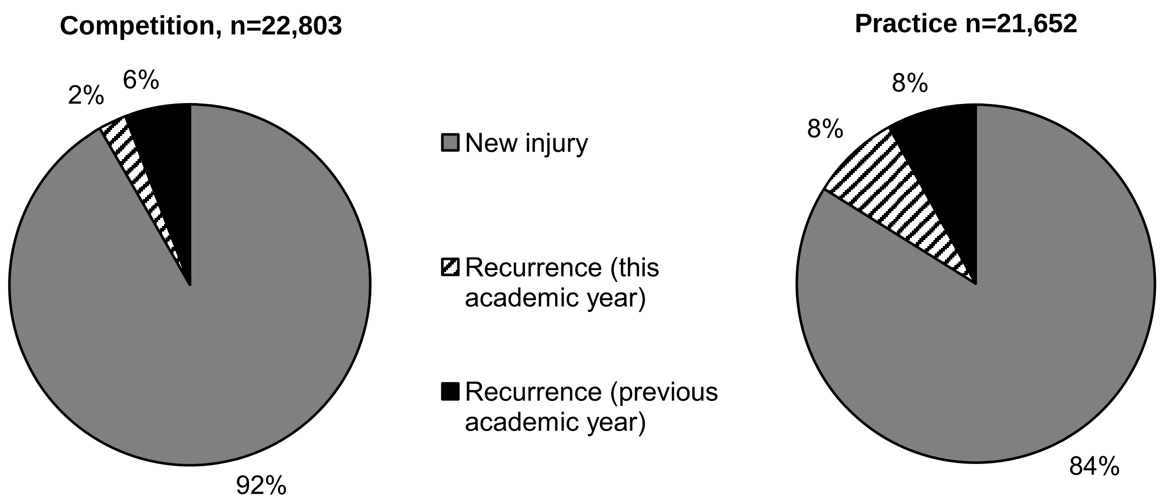


Table 10.6 Time during Season of Baseball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Season		
Preseason	13,055	29.2%
Regular season	30,324	67.7%
Post season	1,381	3.1%
Total	**44,760**	**100%**

Table 10.7 Competition-Related Variables for Baseball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Competition		
Warm-ups	250	1.1%
Beginning	1,911	8.4%
Middle	16,212	71.1%
End	4,429	19.4%
Total	**22,803**	**100%**
Competition Location		
Home	10,646	46.7%
Away	10,690	46.9%
Neutral site	1,467	6.4%
Total	**22,803**	**100%**
Injury Related to Foul Play		
Yes, and ruled foul play	0	100%
Yes, but not ruled foul play	0	100%
No	22,050	99.2%
Unknown	185	0.8%
Total	**22,234**	**100%**
Field Location		
Home plate	6,555	29.5%
Pitchers mound	3,185	14.3%
Second base	3,046	13.7%
First base	2,912	13.1%
Outfield	2,823	12.7%
Infield	1,459	6.6%
Third base	1,435	6.5%
Foul territory	633	2.8%
Other	186	0.8%
Total	**22,234**	**100%**

Table 10.8 Practice-Related Variables for Baseball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Practice		
First 1/2 hour	4,728	21.9%
Second 1/2 hour	6,160	28.5%
Third 1/2 hour	7,719	35.7%
Fourth 1/2 hour	2,717	12.6%
>2 hours into practice	313	1.4%
Total	**21,637**	**100%**
Practice Type		
Noncontact skills practice	14,687	67.5%
Noncontact partial numbers scrimmage	1,492	6.9%
Noncontact full scrimmage	1,322	6.1%
Partial contact skills practice	619	2.8%
Partial contact partial numbers scrimmage	569	2.6%
Full contact skills practice	1,393	6.4%
Full contact partial numbers scrimmage	569	2.6%
Full contact full scrimmage	185	0.8%
Other	938	4.3%
Total	**21,773**	**100%**

Figure 10.4 Player Position of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

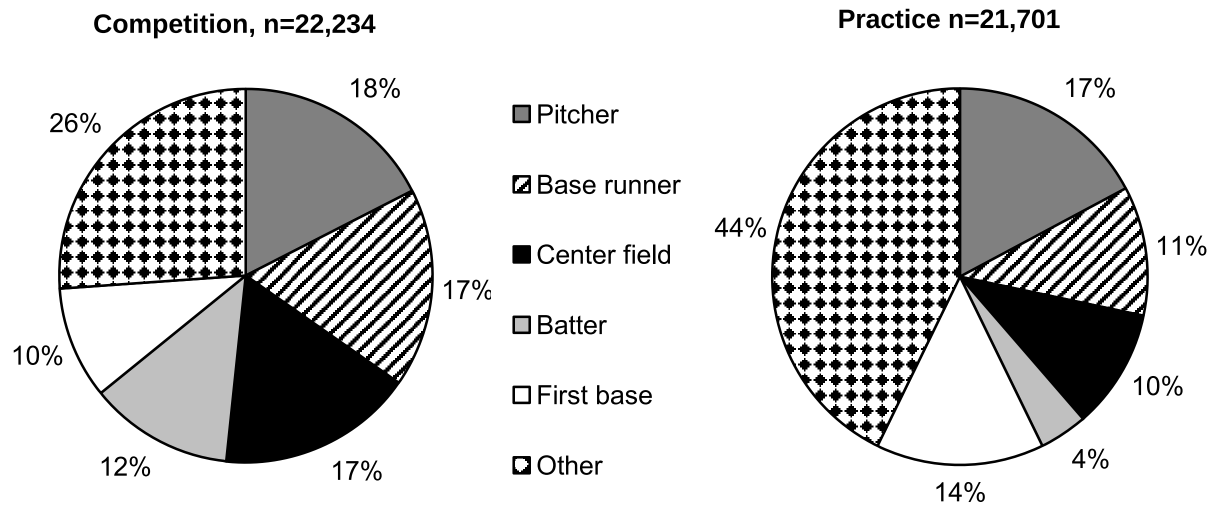
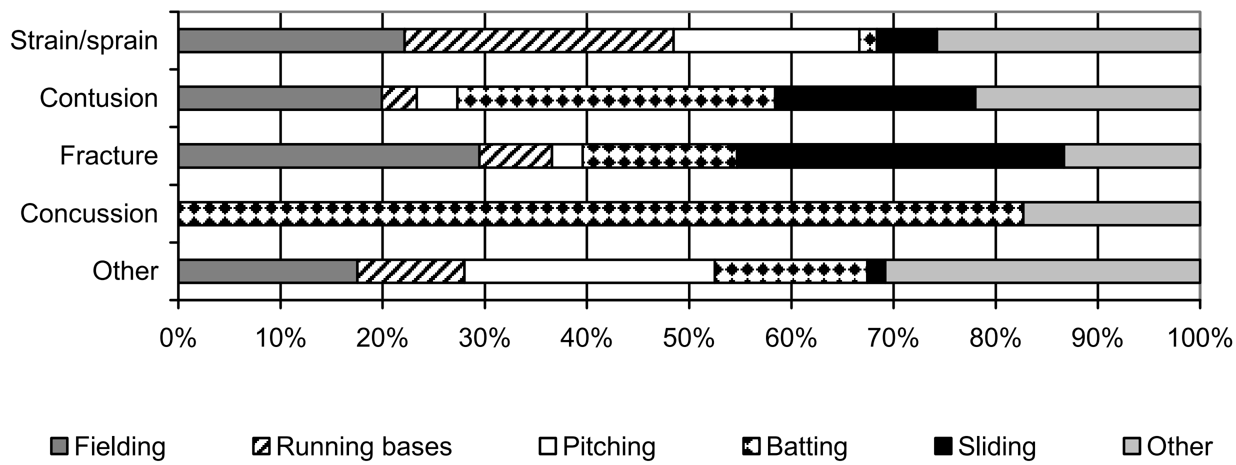


Table 10.9 Activities Leading to Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
Fielding	4,855	21.8%	4,652	21.4%	9,507	21.6%
Running bases	2,738	12.3%	4,667	21.4%	7,404	16.8%
Pitching	3,754	16.9%	3,137	14.4%	6,891	15.7%
Batting	3,595	16.2%	1,255	5.8%	4,850	11.0%
Sliding	3,581	16.1%	906	4.2%	4,487	10.2%
Throwing (not pitching)	1,426	6.4%	1,851	8.5%	3,277	7.4%
General play	881	4.0%	1,578	7.2%	2,459	5.6%
Conditioning	186	0.8%	2,196	10.1%	2,382	5.4%
Catching	847	3.8%	1,218	5.6%	2,065	4.7%
Other	372	1.7%	306	1.4%	678	1.5%
Total	**22,234**	**100%**	**21,765**	**100%**	**44,000**	**100%**

Figure 10.5 Activity Resulting in Baseball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year



XI. Softball Injury Epidemiology

Table 11.1 Softball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**187**	**144,954**	**1.29**	**63,316**
Competition	96	51,670	1.86	33,325
Practice	91	93,284	0.98	29,991

Table 11.2 Demographic Characteristics of Injured Softball Athletes, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year*

Year in School	
Freshman	16,111 (25.6%)
Sophomore	14,809 (23.5%)
Junior	22,031 (35.0%)
Senior	10,048 (16.0%)
Total†	**62,998 (100%)**
Age (years)	
Minimum	13
Maximum	18
Mean (St. Dev.)	15.8 (1.2)
BMI	
Minimum	16.7
Maximum	42.2
Mean (St. Dev.)	23.6 (4.1)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 11.1 Diagnosis of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

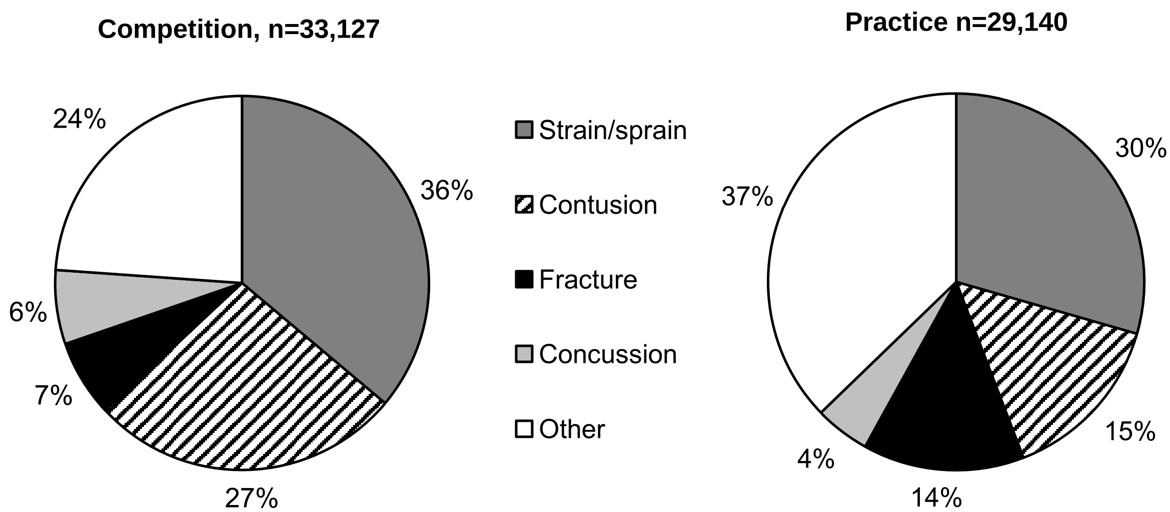


Table 11.3 Body Site of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Body Site						
Ankle	6,177	18.6%	2,877	9.9%	9,055	14.5%
Knee	3,035	9.2%	3,001	10.3%	6,037	9.7%
Head/face	6,676	20.2%	3,546	12.2%	10,221	16.4%
Hip/thigh/upper leg	5,574	16.8%	4,162	14.3%	9,735	15.6%
Hand/wrist	3,310	10.0%	4,221	14.5%	7,531	12.1%
Shoulder	1,310	4.0%	2,224	7.6%	3,534	5.7%
Trunk	416	1.3%	1,012	3.5%	1,428	2.3%
Lower leg	3,041	9.2%	3,804	13.1%	6,845	11.0%
Arm/elbow	3,304	10.0%	2,871	9.9%	6,175	9.9%
Foot	285	0.9%	1,223	4.2%	1,508	2.4%
Neck	0	0.0%	0	0.0%	0	0.0%
Other	0	0.0%	199	0.7%	199	0.3%
Total	**33,128**	**100%**	**29,140**	**100%**	**62,267**	**100%**

Table 11.4 Ten Most Common Softball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition n=33,127		Practice n=29,140		Total n=62,267	
	n	%	n	%	n	%
Diagnosis						
Hip/thigh/upper leg strain/sprain	4,723	14.3%	3,138	10.8%	7,861	12.6%
Ankle strain/sprain	4,523	13.7%	2,681	9.2%	7,204	11.6%
Arm/elbow other	2,553	7.7%	2,479	8.5%	5,032	8.1%
Lower leg contusion	2,494	7.5%	1,678	5.8%	4,172	6.7%
Knee other	2,114	6.4%	1,822	6.3%	3,937	6.3%
Head/face concussion	2,119	6.4%	1,309	4.5%	3,428	5.5%
Head/face other	2,071	6.3%	784	2.7%	2,854	4.6%
Shoulder other	1,046	3.2%	1,765	6.1%	2,810	4.5%
Hand/wrist fracture	947	2.9%	1,850	6.4%	2,798	4.5%
Hand/wrist contusion	1,586	4.8%	787	2.7%	2,373	3.8%

Figure 11.2 Time Loss of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

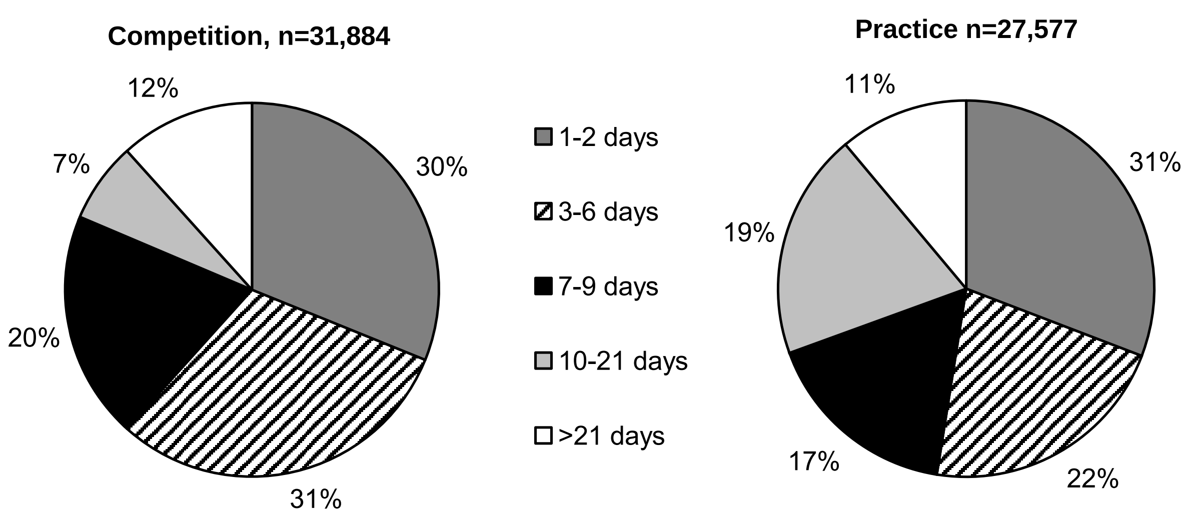


Table 11.5 Softball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	1,905	5.8%	1,636	5.6%	3,541	5.7%
Did not require surgery	30,785	94.2%	27,307	94.4%	58,093	94.3%
Total	**32,690**	**100%**	**28,944**	**100%**	**61,634**	**100%**

Figure 11.3 History of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

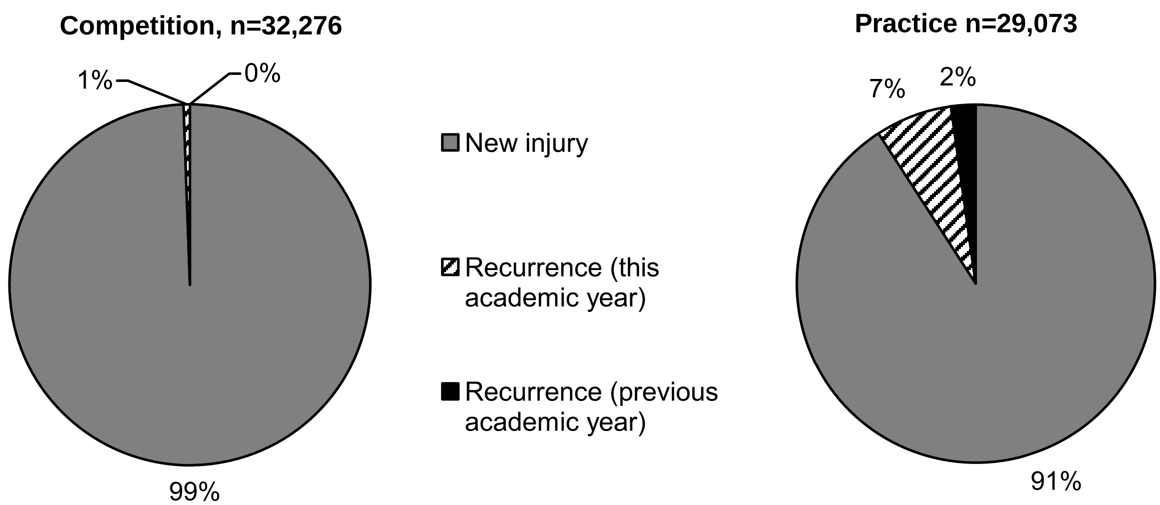


Table 11.6 Time during Season of Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Season		
Preseason	20,359	32.2%
Regular season	42,105	66.5%
Post season	851	1.3%
Total	**63,316**	**100%**

Table 11.7 Competition-Related Variables for Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Competition		
Warm-ups	973	3.0%
Beginning	6,015	18.4%
Middle	22,007	67.2%
End	2,908	8.9%
Overtime	827	2.5%
Total	**32,731**	**100%**
Competition Location		
Home	18,274	55.2%
Away	12,281	37.1%
Neutral site	2,573	7.8%
Total	**33,127**	**100%**
Injury Related to Foul Play		
No	32,081	96.8%
Yes, and ruled foul play	196	0.6%
Yes, but not ruled foul play	851	2.6%
Unknown	0	0%
Total	**33,127**	**100%**
Field Location		
Home plate	6,555	29.5
First base	2,912	13.1
Second base	3,046	13.7
Third base	1,435	6.5
Infield	1,459	6.6
Pitchers mound	3,185	14.3
Outfield	2,823	12.7
Foul territory	633	2.8
Other	186	0.8
Total	**22,234**	**100**

Table 11.8 Practice-Related Variables for Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	n	%
Time in Practice		
First 1/2 hour	6,458	22.2%
Second 1/2 hour	5,252	18.1%
Third 1/2 hour	9,546	32.8%
Fourth 1/2 hour	5,790	19.9%
>2 hours into practice	2,028	7.0%
Total	**29,073**	**100%**
Practice Type		
Noncontact skills practice	17,411	62.4%
Noncontact partial numbers scrimmage	1,636	5.9%
Noncontact full scrimmage	392	1.4%
Partial contact skills practice	1,673	6.0%
Partial contact partial numbers scrimmage	1,219	4.4%
Partial contact full scrimmage	1,244	4.5%
Full contact skills practice	2,360	8.5%
Full contact partial numbers scrimmage	196	0.7%
Full contact full scrimmage	785	2.8%
Other	979	3.5%
Total	**27,895**	**100%**

Figure 11.4 Player Position of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

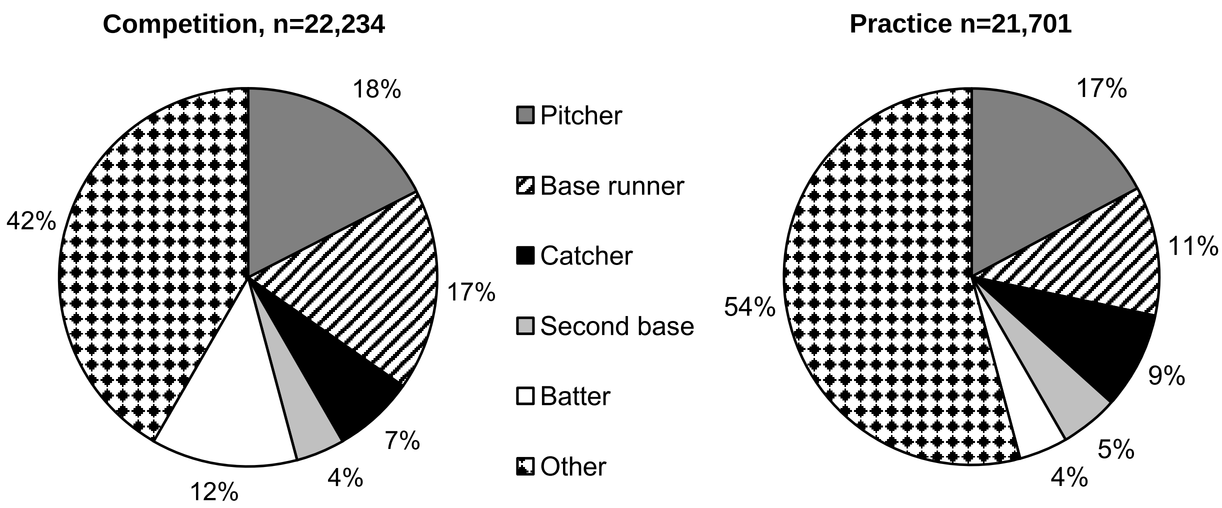
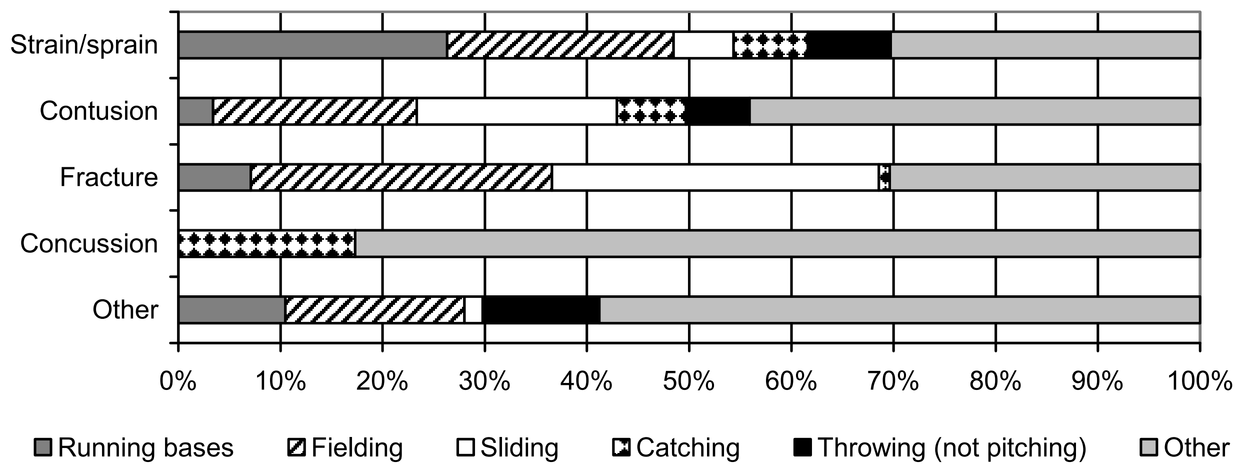


Table 11.9 Activities Leading to Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
Running bases	7,831	23.6%	4,153	14.3%	11,984	19.3%
Throwing (not pitching)	4,909	14.8%	4,558	15.7%	9,467	15.3%
Catching	4,066	12.3%	4,787	16.5%	8,853	14.3%
Fielding	3,145	9.5%	3,796	13.1%	6,941	11.2%
Sliding	3,910	11.8%	2,487	8.6%	6,398	10.3%
Pitching	4,089	12.3%	908	3.1%	4,997	8.1%
Batting	3,221	9.7%	1,442	5.0%	4,663	7.5%
Conditioning	0	0.0%	4,010	13.9%	4,010	6.5%
General play	1,561	4.7%	1,582	5.5%	3,143	5.1%
Other	396	1.2%	1,219	4.2%	1,616	2.6%
Total	**33,128**	**100%**	**28,944**	**100%**	**62,071**	**100%**

Figure 11.5 Activity Resulting in Softball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year



XII. Gender Differences within Sports

12.1 Boys' and Girls' Soccer

Table 12.1 Comparison of Boys' and Girls' Soccer Injury Rates, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' soccer	Girls' soccer*	RR (95% CI)†
Total	1.75	**2.35**	**1.34 (1.16-1.55)**
Competition	3.63	**5.15**	**1.42 (1.19-1.69)**
Practice	0.96	**1.16**	**1.21 (0.96-1.53)**

*Throughout this chapter, rate ratios (RR) and injury proportion ratios (IPR) compare the gender with a higher injury rate/proportion (bolded) to the gender with a lower injury rate/proportion.
†Throughout this chapter, statistically significant RR and IPR are bolded.

Table 12.2 Comparison of Body Sites of Boys' and Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Body Site			
Ankle	21.1%	**23.3%**	1.10 (0.80-1.52)
Knee	13.5%	**21.0%**	1.56 (0.84-0.99)
Head/face	**16.4%**	12.7%	1.29 (0.86-1.94)
Hip/thigh/upper leg	14.7%	**15.5%**	1.05 (0.70-1.59)
Hand/wrist	3.2%	**6.7%**	2.08 (0.90-4.80)
Shoulder	**4.3%**	1.3%	**3.25 (1.15-9.17)**
Trunk	**6.6%**	1.2%	**5.63 (1.76-18.0)**
Lower leg	**8.2%**	7.7%	1.06 (0.58-1.94)
Arm/elbow	1.8%	**2.8%**	1.56 (0.48-5.06)
Foot	**7.2%**	5.5%	1.30 (0.65-2.63)
Neck	0.7%	**0.8%**	1.14 (0.12-10.5)
Other	**2.2%**	1.5%	1.53 (0.41-5.68)
Total	**100%**	**100%**	---

Table 12.3 Comparison of Diagnoses of Boys' and Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Diagnosis			
Strain/sprain	49.5%	**55.3%**	1.12 (0.94-1.32)
Contusion	**12.7%**	11.5%	1.11 (0.69-1.77)
Fracture	**10.7%**	7.1%	1.51 (0.87-2.64)
Concussion	10.3%	10.3%	1.00 (0.60-1.65)
Other	**16.8%**	15.9%	1.06 (0.70-1.59)
Total	**100%**	**100%**	---

Table 12.4 Most Common Boys' and Girls' Soccer Injury Diagnoses*, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Diagnosis			
Ankle strain/sprain	20.2%	**22.4%**	1.11 (0.80-1.54)
Hip/thigh/upper leg strain/sprain	10.6%	**11.9%**	1.13 (0.70-1.81)
Head/face concussion	**10.4%**	10.3%	1.01 (0.61-1.67)
Knee strain/sprain	7.8%	**11.7%**	1.50 (0.85-2.64)
Knee other	4.2%	**6.7%**	1.57 (0.75-3.29)

*Only includes diagnoses accounting for >5% of boys' or girls' soccer injuries.

Table 12.5 Comparison of Time Loss of Boys' and Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Time Loss			
1-2 days	**20.1%**	16.2%	1.24 (0.85-1.81)
3-6 days	31.8%	**33.9%**	1.07 (0.83-1.38)
7-9 days	17.6%	**17.9%**	1.01 (0.70-1.48)
10-21 days	16.5%	**18.5%**	1.12 (0.76-1.65)
22 days or more	**14.1%**	13.6%	1.04 (0.67-1.61)
Total	**100.0%**	**100.0%**	---

Table 12.6 Comparison of Mechanisms of Boys' and Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Soccer Mechanism			
Contact with another player	28.8%	**31.3%**	1.09 (0.83-1.42)
Stepped on/fell on/kicked	**14.8%**	13.4%	1.10 (0.73-1.68)
Rotation around a planted foot/inversion	12.3%	**13.0%**	1.06 (0.66-1.70)
Overuse, heat illness, conditioning, etc.	12.6%	**12.8%**	1.01 (0.63-1.62)
Contact with ball	**12.0%**	11.3%	1.06 (0.65-1.71)
Uneven playing surface	**4.1%**	3.4%	1.20 (0.55-2.61)
Slide tackle	**6.7%**	3.2%	**2.11 (1.04-4.31)**
Contact with goal	0.0%	**0.6%**	---
Other	8.8%	**11.0%**	1.26 (0.73-2.18)
Total	**100%**	**100%**	---

Table 12.7 Comparison of Activities of Boys' and Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Soccer Activity			
General play	19.4%	**20.5%**	1.05 (0.74-1.49)
Defending	11.8%	**15.1%**	1.28 (0.81-2.01)
Ball handling/dribbling	10.0%	**13.5%**	1.35 (0.86-2.12)
Chasing loose ball	10.9%	**11.4%**	1.04 (0.64-1.70)
Goaltending	9.5%	**11.1%**	1.17 (0.66-2.06)
Passing (foot)	**6.7%**	5.3%	1.24 (0.60-2.60)
Shooting (foot)	**7.9%**	3.5%	**2.26 (1.09-4.67)**
Receiving pass	**6.6%**	4.2%	1.57 (0.79-3.11)
Heading ball	**7.9%**	2.9%	**2.73 (1.36-5.47)**
Other	9.3%	**12.6%**	1.35 (0.82-2.24)
Total	**100%**	**100%**	---

12.2 Boys' and Girls' Basketball

Table 12.8 Comparison of Boys' and Girls' Basketball Injury Rates, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' basketball	Girls' basketball	RR (95% CI)*
Total	1.39	**1.61**	1.16 (0.99-1.35)
Competition	2.23	**3.30**	**1.48 (1.20-1.82)**
Practice	**1.04**	0.90	1.16 (0.92-1.45)

Table 12.9 Comparison of Body Sites of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Body Site			
Ankle	**33.2%**	30.0%	1.11 (0.85-1.44)
Knee	14.8%	**18.3%**	1.24 (0.83-1.83)
Head/face	10.3%	**14.3%**	1.39 (0.87-2.21)
Hip/thigh/upper leg	4.3%	**8.3%**	1.94 (0.98-3.84)
Hand/wrist	**12.5%**	9.5%	1.31 (0.80-2.16)
Shoulder	4.7%	**4.9%**	1.03 (0.47-2.24)
Trunk	**4.8%**	2.8%	1.72 (0.73-4.07)
Lower leg	1.2%	**4.7%**	**3.87 (1.23-12.2)**
Arm/elbow	**3.8%**	0.5%	**7.31 (1.47-36.4)**
Foot	**7.7%**	5.0%	1.53 (0.76-3.07)
Neck	0.2%	**0.5%**	2.65 (0.31-22.8)
Other	**2.4%**	1.1%	2.28 (0.52-10.0)
Total	**100%**	**100%**	---

Table 12.10 Comparison of Diagnoses of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Diagnosis			
Strain/sprain	**55.6%**	55.2%	1.01 (0.86-1.18)
Contusion	**7.8%**	5.9%	1.32 (0.70-2.50)
Fracture	**10.8%**	7.8%	1.38 (0.78-2.46)
Concussion	5.1%	**10.2%**	**2.01 (1.09-3.70)**
Other	20.7%	**20.9%**	1.01 (0.71-1.42)
Total	**100%**	**100%**	---

Table 12.11 Most Common Boys' and Girls' Basketball Injury Diagnoses*, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Diagnosis			
Ankle strain/sprain	**32.1%**	27.5%	1.17 (0.89-1.53)
Knee strain/sprain	6.1%	**9.6%**	1.58 (0.85-2.94)
Head/face concussion	5.1%	**10.2%**	**2.01 (1.09-3.70)**
Knee other	**5.9%**	5.8%	1.01 (0.51-2.03)
Hand/wrist fracture	**5.4%**	3.7%	1.47 (0.65-3.33)

*Only includes diagnoses accounting for >5% of boys' or girls' basketball injuries.

Table 12.12 Comparison of Time Loss of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Time Loss			
1-2 days	**30.6%**	21.7%	**1.42 (1.03-1.94)**
3-6 days	**26.1%**	24.0%	1.09 (0.80-1.48)
7-9 days	**15.0%**	14.1%	1.07 (0.70-1.64)
10-21 days	13.6%	**22.8%**	**1.67 (1.14-2.45)**
22 days or more	14.6%	**17.5%**	1.20 (0.80-1.80)
Total	**100%**	**100%**	---

Table 12.13 Comparison of Mechanisms of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Basketball Mechanism			
Collision with another player	**28.8%**	23.8%	1.21 (0.90-1.63)
Jumping/landing	**22.6%**	21.6%	1.05 (0.75-1.46)
Overuse, heat illness, conditioning, etc.	9.1%	**15.2%**	**1.67 (1.03-2.71)**
Rotation around a planted foot/inversion	11.0%	**11.2%**	1.02 (0.62-1.68)
Stepped on/fell on/kicked	**11.8%**	9.3%	1.26 (0.76-2.11)
Contact with ball	5.7%	**6.6%**	1.15 (0.57-2.33)
Other	11.0%	**12.3%**	1.12 (0.69-1.82)
Total	**100%**	**100%**	---

Table 12.14 Comparison of Activities of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Basketball Activity			
Rebounding	**25.0%**	19.7%	1.27 (0.91-1.78)
General play	18.1%	**22.3%**	1.24 (0.87-1.76)
Defending	17.0%	**17.1%**	1.01 (0.68-1.49)
Chasing loose ball	11.1%	**11.4%**	1.03 (0.64-1.68)
Shooting	**10.2%**	9.3%	1.10 (0.63-1.90)
Ball handling/dribbling	4.5%	**8.4%**	1.86 (0.94-3.72)
Receiving pass	**4.2%**	3.6%	1.17 (0.50-2.75)
Other	**9.9%**	8.1%	1.22 (0.70-2.14)
Total	**100%**	**100%**	---

12.3 Boys' Baseball and Girls' Softball

Table 12.15 Comparison of Baseball and Softball Injury Rates, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Baseball	Softball	RR (95% CI)
Total	0.93	**1.29**	**1.39 (1.13-1.71)**
Competition	1.37	**1.86**	**1.36 (1.02-1.81)**
Practice	0.68	**0.98**	**1.43 (1.06-1.93)**

Table 12.16 Comparison of Body Sites of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Baseball	Softball	IPR (95% CI)
Body Site			
Ankle	13.7%	**14.5%**	1.06 (0.56-2.01)
Knee	8.9%	**9.7%**	1.08 (0.50-2.34)
Head/face	8.4%	**16.4%**	1.95 (0.99-3.83)
Hip/thigh/upper leg	11.2%	**15.6%**	1.40 (0.69-2.84)
Hand/wrist	17.6%	**12.1%**	1.46 (0.78-2.74)
Shoulder	**16.0%**	5.7%	**2.81 (1.18-6.72)**
Trunk	**3.8%**	2.3%	1.67 (0.52-5.42)
Lower leg	6.8%	**11.0%**	1.62 (0.69-3.77)
Arm/elbow	**11.3%**	9.9%	1.14 (0.52-2.51)
Foot	0.0%	**2.4%**	---
Neck	**0.1%**	0.0%	----
Other	**2.1%**	0.3%	**6.57 (1.12-38.5)**
Total	**100%**	**100%**	---

Table 12.17 Comparison of Diagnoses of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Baseball	Softball	IPR (95% CI)
Diagnosis			
Strain/sprain	**50.0%**	33.0%	**1.51 (1.10-2.07)**
Contusion	12.1%	**21.3%**	1.76 (0.98-3.15)
Fracture	**13.7%**	10.0%	1.38 (0.65-2.92)
Concussion	0.8%	**5.5%**	**6.66 (1.60-27.7)**
Other	23.4%	**30.2%**	1.29 (0.83-2.03)
Total	**100%**	**100%**	---

Table 12.18 Most Common Baseball and Softball Injury Diagnoses*, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Baseball	Softball	IPR (95% CI)
Diagnosis			
Ankle strain/sprain	11.5%	**11.6%**	1.01 (0.50-2.03)
Hip/thigh/upper leg strain/sprain	11.2%	**12.6%**	1.13 (0.54-2.37)
Shoulder other	**8.2%**	4.5%	1.82 (0.59-5.59)
Hand/wrist strain/sprain	**6.5%**	2.1%	**3.15 (1.04-9.59)**
Arm/elbow other	4.0%	**8.1%**	2.02 (0.58-7.11)
Lower leg contusion	1.4%	**6.7%**	**4.85 (1.30-18.1)**

*Only includes diagnoses accounting for >5% of baseball or softball injuries.

Table 12.19 Comparison of Time Loss of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Baseball	Softball	IPR (95% CI)
Time Loss			
1-2 days	**32.0%**	30.9%	1.03 (0.69-1.54)
3-6 days	25.2%	**26.4%**	1.05 (0.67-1.64)
7-9 days	14.7%	**18.5%**	1.26 (0.67-2.35)
10-21 days	8.9%	**12.8%**	1.44 (0.68-3.05)
22 days or more	**19.3%**	11.4%	1.69 (0.89-3.24)
Total	**100%**	**100%**	---

Table 12.20 Comparison of Mechanisms of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Baseball	Softball	IPR (95% CI)
Baseball/Softball Mechanism			
Overuse, heat illness, conditioning, etc.	10.6%	**20.0%**	1.88 (0.98-3.63)
Contact with another player	**12.7%**	12.3%	1.03 (0.50-2.12)
Contact with bases	**11.9%**	9.8%	1.21 (0.60-2.47)
Throwing - not pitching	5.5%	**9.0%**	1.63 (0.61-4.37)
Throwing - pitching	**10.8%**	4.0%	**2.71 (1.03-7.10)**
Contact with thrown ball (non-pitch)	1.9%	**8.3%**	**4.40 (1.52-12.8)**
Rotation around a planted foot/inversion	**10.9%**	1.4%	**7.92 (2.67-23.5)**
Hit by batted ball (line drive)	3.2%	**6.1%**	1.92 (0.59-6.24)
Hit by pitch	**5.4%**	3.4%	1.57 (0.48-5.17)
Other	**27.1%**	25.6%	1.06 (0.69-1.63)
Total	**100%**	**100%**	---

Table 12.21 Comparison of Activities of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2007-08 School Year

	Baseball	Softball	IPR (95% CI)
Baseball/Softball Activity			
Running bases	16.8%	**19.3%**	1.15 (0.65-2.02)
Fielding	**21.6%**	11.2%	**1.94 (1.08-3.48)**
Throwing (not pitching)	7.4%	**15.3%**	2.04 (0.96-4.35)
Pitching	**15.7%**	8.1%	**2.71 (1.03-7.10)**
Catching	4.7%	**14.3%**	**3.03 (1.17-7.85)**
Sliding	10.2%	**10.3%**	1.01 (0.47-2.14)
Batting	**11.0%**	7.5%	1.47 (0.63-3.46)
Conditioning	5.4%	**6.5%**	1.19 (0.37-3.85)
General play	**5.6%**	5.1%	1.11 (0.40-3.03)
Other	1.5%	**2.6%**	1.66 (0.34-8.31)
Total	**100%**	**100%**	---

XIII. Trends over Time

Table 13.1 Injury Rates by Sport, Type of Exposure, and Year, High School Sports-Related Injury Surveillance Study, US, 2005-08 School Years

	2005-06	**2006-07**	**2007-08**	**p-value for trend***
Overall total	2.51	2.59	2.31	0.512
Competition	4.63	4.88	4.45	0.726
Practice	1.69	1.75	1.52	0.495
Boys' football total	4.36	4.45	4.18	0.546
Competition	12.09	13.5	12.8	0.680
Practice	2.54	2.68	2.47	0.788
Boys' soccer total	2.43	2.27	1.75	0.189
Competition	4.22	4.31	3.63	0.411
Practice	1.58	1.45	0.96	0.206
Girls' soccer total	2.36	2.51	2.35	0.964
Competition	5.21	5.43	5.15	0.870
Practice	1.10	1.31	1.16	0.821
Girls' volleyball total	1.64	1.37	1.22	0.104
Competition	1.92	1.40	1.43	0.366
Practice	1.48	1.36	1.12	0.121
Boys' basketball total	1.89	1.75	1.39	0.158
Competition	2.98	2.87	2.23	0.247
Practice	1.46	1.28	1.04	0.052
Girls' basketball total	2.01	2.09	1.61	0.433
Competition	3.60	3.60	3.30	0.333
Practice	1.37	1.44	0.90	0.409
Boys' wrestling total	2.50	2.51	2.27	0.357
Competition	**3.93**	**3.80**	**3.70**	**0.048**
Practice	2.04	2.06	1.76	0.371
Boys' baseball total	1.19	1.25	0.93	0.446
Competition	1.77	2.01	1.37	0.575
Practice	0.87	0.82	0.68	0.170
Girls' softball total	1.13	1.11	1.29	0.398
Competition	1.78	1.96	1.86	0.707
Practice	0.79	0.65	0.98	0.611

*Statistically significant tests for trend are bolded.

Table 13.2 Nationally Estimated Number of Injuries by Sport, Type of Exposure, and Year, High School Sports-Related Injury Surveillance Study, US, 2005-08 School Years

	2005-06	2006-07	2007-08
Overall total	**1,442,533**	**1,472,849**	**1,419,723**
Competition	**759,334**	**766,512**	**763,034**
Practice	**683,199**	**706,337**	**656,689**
Boys' football total	516,150	574,367	616,665
Competition	280,919	292,316	311,780
Practice	235,231	282,051	304,885
Boys' soccer total	218,760	171,874	159,351
Competition	119,703	93,295	99,785
Practice	99,058	78,579	59,566
Girls' soccer total	185,770	230,769	215,850
Competition	122,803	149,231	146,102
Practice	62,967	81,538	69,748
Girls' volleyball total	81,813	80,493	72,261
Competition	32,677	27,423	26,539
Practice	49,136	53,069	45,722
Boys' basketball total	100,058	96,670	82,612
Competition	44,826	46,109	36,766
Practice	55,232	50,561	45,846
Girls' basketball total	103,566	102,831	73,283
Competition	53,812	53,703	45,236
Practice	49,753	49,128	28,047
Boys' wrestling total	105,542	101,139	91,625
Competition	36,259	38,750	40,698
Practice	69,283	62,389	50,927
Boys' baseball total	67,560	60,296	44,760
Competition	33,639	33,494	22,803
Practice	33,922	26,802	21,957
Girls' softball total	63,313	54,411	63,316
Competition	34,696	32,191	33,325
Practice	28,618	22,220	29,991

Table 13.3 Body Site of Injury by Year, High School Sports-Related Injury Surveillance Study, US, 2005-08 School Years

	2005-06 n=1,480,557	2006-07 n=1,464,926	2007-08 n=1,411,621
Body Site			
Ankle	22.7%	19.8%	18.5%
Knee	14.2%	16.6%	14.6%
Head/face	12.3%	12.4%	12.4%
Hip/thigh/upper leg	10.8%	10.5%	10.2%
Shoulder	7.9%	8.0%	10.1%
Hand/wrist	8.0%	7.5%	9.1%
Trunk	6.2%	6.7%	6.5%
Lower leg	4.6%	5.2%	5.7%
Arm/elbow	4.1%	3.9%	4.6%
Foot	4.0%	4.0%	4.2%
Neck	2.2%	1.9%	1.8%
Other	3.2%	3.6%	2.4%
Total	**100%**	**100%**	**100%**

*Throughout this chapter, n's represent the total number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Table 13.4 Injury Diagnosis by Year, High School Sports-Related Injury Surveillance Study, US, 2005-08 School Years

	2005-06, n=1,444,172	2006-07, n=1,466398	2007-08 n=1,414,139
Diagnosis			
Strain/sprain	52.0%	48.2%	48.3%
Contusion	12.2%	13.7%	12.4%
Fracture	9.8%	8.9%	10.2%
Concussion	9.1%	8.4%	9.2%
Other	16.8%	20.9%	19.9%
Total	**100%**	**100%**	**100%**

Table 13.5 Most Common Injury Diagnoses by Year, High School Sports-Related Injury Surveillance Study, US, 2005-08 School Years

	2005-06 n=1,435,954	2006-07 n=1,463,273	2007-08 n=1,410,654
Diagnosis			
Ankle strain/sprain	20.6%	17.8%	17.3%
Head/face concussion	9.0%	8.4%	9.2%
Knee strain/sprain	7.6%	8.8%	7.8%
Hip/thigh/upper leg strain/sprain	7.9%	7.7%	7.3%
Knee other	4.3%	4.9%	4.7%
Shoulder other	3.1%	3.7%	4.1%
Hand/wrist fracture	3.2%	3.3%	4.0%
Shoulder strain/sprain	3.4%	2.9%	3.4%
Trunk strain/sprain	2.8%	2.7%	3.2%
Hand/wrist strain/sprain	3.1%	2.5%	3.8%

Table 13.6 Time Loss of Injuries by Year, High School Sports-Related Injury Surveillance Study, US, 2005-07 School Years

	2005-06 n=1,378,145	2006-07 n=1,423,183	2007-08 n=1,355,981
Time Loss			
1-2 days	22.5%	26.6%	22.8%
3-6 days	30.0%	28.5%	28.8%
7-9 days	15.3%	14.7%	15.8%
10-21 days	14.9%	14.1%	16.7%
22 days or more	17.2%	16.1%	15.9%
Total	**100%**	**100%**	**100%**

Table 13.7 Injuries Requiring Surgery by Year, High School Sports-Related Injury Surveillance Study, US, 2005-08 School Years

	2005-06 n=1,429,072	2006-07 n=1,428,960	2007-08 n=1,380,872
Need for surgery			
Required surgery	5.3%	6.4%	6.1%
Did not require surgery	94.7%	93.6%	93.9%
Total	**100%**	**100%**	**100%**

IX. Reporter Demographics & Compliance

During the 2007-08 school year, 100 ATCs were invited to participate in the study at the beginning of the school year. In addition, 20 ATCs were invited to participate during the school year to replace a previously enrolled ATC who was no longer able to participate. ATCs were expected to report for every week in which they were enrolled. For example, an ATC who joined the study as a replacement school in week 10 was not expected to report for weeks 1-9. Overall, 113 enrolled ATCs reported an average of 42 study weeks. The majority of ATCs (87%) reported all the weeks during which they were enrolled, with only 6 ATCs (5%) missing over 10 weeks. Internal validity checks yielded 96.7% sensitivity, 100% specificity, a positive predictive value of 100%, and a negative predictive value of 99.4%.

Prior to the start of the 2007-08 High School RIO™ study, participating ATCs were asked to complete a short demographics survey. Three-quarters (79%) of participating high schools were public schools, with the remainder being private. All participating ATCs provided services to athletes of their high school on 5 or more days each week. Over half (62%) of ATCs participating during the 2007-08 study year had participated during the 2005-06 school year.

An online "End of Season" survey gave all participating ATCs the opportunity to provide feedback on their experiences with High School RIO™. This survey was completed by 73 ATCs (63%). Average reporting time burdens were 15 minutes for the weekly exposure report and 7 minutes for the injury report form. Using a 5 point Likert scale, RIO™ was overwhelmingly reported to be either very easy (70.0%) or somewhat easy (24.7%) to use (5 and 4 on the Likert scale, respectively), with ATCs being either very satisfied (70.0%) or somewhat satisfied (26.0%) with the study (5 and 4 on the Likert scale, respectively). Suggestions provided by ATCs, such as the addition or clarification of questions or answer choices, will used to improve the National High School Sports-Related Injury Surveillance Study for the 2008-09 school year.

X. Summary

High school sports play an important role in the adoption and maintenance of a physically active lifestyle among millions of US adolescents. Too often injury prevention in this population is overlooked as sports-related injuries are thought to be unavoidable. In reality, sports-related injuries are largely preventable through the application of evidence-based preventive interventions. Such preventive interventions can include educational campaigns, introduction of new/improved protective equipment, rule changes, other policy changes, etc. The morbidity, mortality, and disability caused by high school sports-related injuries can be reduced through the development and implementation of improved injury diagnosis and treatment modalities as well as through effective prevention strategies. However, surveillance of exposure based injury rates in a nationally representative sample of high school athletes and subsequent epidemiologic analysis of patterns of injury are needed to drive evidence-based prevention practices.

Prior to the implementation of the High School Sports-Related Injury Surveillance Study by Dr. Comstock, the study of high school sports-related injuries had largely been limited by an inability to calculate injury rates due to a lack of exposure data (i.e., frequency of participation in athletic activities including training, practice, and competition), an inability to compare findings across groups (i.e., sports/activities, genders, schools, and levels of competition), or an inability to generalize findings from small non-representative samples. The value of national injury surveillance studies that collect injury, exposure, and risk factor data from representative samples has been well demonstrated by the National Collegiate Athletic Association's Injury Surveillance System (NCAA ISS). Data collected by the NCAA ISS since 1982 has been used to develop preventive interventions including changes in coaching habits, increased use of protective equipment, and rule changes which have had proven success in reducing injuries among collegiate athletes. For example, NCAA ISS data has been used to develop several interventions intended to reduce the number of preseason heat-related football injuries including the elimination of consecutive days of multiple practices, daily hour limitations, and a gradual increase in equipment for conditioning and heat acclimation. Additionally, several committees have considered NCAA ISS data when making recommendations including the NCAA Committee on Competitive Safeguards and Medical Aspects of Sports' recommendation for mandatory eye protection in women's lacrosse, the NCAA Men's Ice Hockey Rules Committee's recommendation for stricter penalties for hitting from behind, checking into the boards, and not wearing a mouthpiece, and the NCAA Men's Basketball Rules Committee's recent discussions of widening the free-throw lane to prevent injuries related to player contact. Unfortunately, because an equivalent injury surveillance system to collect injury and exposure data from a nationally representative sample of high school athletes had not previously existed, injury prevention efforts targeted to reduce injury rates in this population were based largely upon data collected from collegiate athletes. This is unacceptable because distinct biophysiological differences (e.g., lower muscle mass, immature growth plates, etc.) means high school athletes are not merely miniature versions of their collegiate counterparts.

The successful implementation and maintenance of the National High School Sports-Related Injury Surveillance Study demonstrates the value of a national injury surveillance system at the high school level. Dr. Comstock and her research staff are committed to maintaining a permanent national high school sports injury surveillance system.

While the health benefits of a physically active lifestyle including sports participation are undeniable, participants are at risk of injury because a certain endemic level of injury can be expected during any physical activity, especially those with a competitive component. However, injury rates among high school athletes should be reduced to the lowest possible level without discouraging adolescents from engaging in this important form of physical activity. This goal can best be accomplished by monitoring injury rates and patterns of injury among high school athletes over time; investigating the etiology of preventable injuries; and developing, implementing, and evaluating evidence-based preventive interventions. Surveillance systems such as the model used for this study are critical in achieving these goals.

SUMMARY REPORT

NATIONAL HIGH SCHOOL SPORTS-RELATED INJURY SURVEILLANCE STUDY

2008-2009 School Year

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Note

The analyses presented here provide only a brief summary of collected data, with the feasibility of a more detailed presentation limited by the extensive breadth and detail contained in the dataset. The principal investigator, Dr. R. Dawn Comstock, is happy to provide further information or to discuss research partnership opportunities upon request.

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I. Introduction & Methodology

1.1 Project Overview

To combat the epidemic of obesity among youth in the United States (US), adolescents must be encouraged to get up off the couch and participate in physically active sports, recreation, and leisure activities. Participation in high school sports, one of the most popular physical activities among adolescents, has grown rapidly from an estimated 4.0 million participants in 1971-72 to an estimated 7.4 million in 2008-09. While the health benefits of a physically active lifestyle including participating in sports are undeniable, high school athletes are at risk of sports-related injury because a certain endemic level of injury can be expected among participants of any physical activity. The challenge to injury epidemiologists is to reduce injury rates among high school athletes to the lowest possible level without discouraging adolescents from engaging in this important form of physical activity. This goal can best be accomplished by investigating the etiology of preventable injuries; by developing, implementing, and evaluating protective interventions using such science-based evidence; and by responsibly reporting epidemiologic findings while promoting a physically active lifestyle among adolescents.

1.2 Background and Significance

High school sports play an important role in the adoption and maintenance of a physically active lifestyle among millions of US adolescents. Too often injury prevention in this population is overlooked as sports-related injuries are thought to be unavoidable. In reality, sports-related injuries are largely preventable through the application of preventive interventions based on evidence-based science. The morbidity, mortality, and disability caused by high school sports-related injuries can be reduced through the development of effective prevention strategies and through programmatic decisions based on injury prevention. However, such efforts rely upon accurate national estimates of injury incidence, injury rate calculations, and risk and protective factor data. Previously, no injury surveillance system capable of providing researchers with the needed quality of injury and exposure data for high school sports-related injuries existed.

Since the 2005-06 school year, Dr. R. Dawn Comstock has conducted the National High School Sports-Related Injury Surveillance System to monitor injuries among US high school athletes participating in boys' football, boys' and girls' soccer, girls' volleyball, boys' and girls' basketball, boys' wrestling, boys' baseball, and girls' softball. This surveillance has been conducted using the time- and cost-efficient RIO^{TM} (Reporting Information Online) surveillance system. The first three study years were funded by the Centers for Disease Control, the Research Institute at Nationwide Children's Hospital, DonJoy Orthotics, EyeBlack, and The Ohio State University. Through the generous contributions of the Centers for Disease Control, the National Federation of State High School Associations (NFHS), and DonJoy Orthotics, the National High School Sports-Related Injury Surveillance System was able to be continued during the 2008-09 school year.

1.3 Specific Aims

The continuing objectives of this study are to maintain the National High School Sports-Related Injury Surveillance System among a nationally representative sample of US high schools. The specific aims of this study are:

A) To determine the incidence (number) of injuries among US high school boys' football, boys' and girls' soccer, girls' volleyball, boys' and girls' basketball, boys' wrestling, boys' baseball, and girls' softball athletes.

B) To calculate the rate of injuries per 1,000 athlete-competitions, per 1,000 athlete-practices, and per 1,000 athlete-exposures for US high school athletes in the 9 sports of interest.

C) To provide detailed information about the injuries sustained by US high school athletes including the type, site, severity, initial and subsequent treatment/care, outcome, etc.

D) To provide detailed information about the injury events including athlete demographics, position played, phase of play/activity, etc.

E) To identify potential risk or protective factors.

F) To compare injury rates and patterns from the 2005-06 through the 2008-09 school years.

1.4 Project Design

The National High School Sports-Related Injury Surveillance System defined an injury as:

A) An injury that occurred as a result of participation in an organized high school competition or practice and

B) Required medical attention by a team physician, certified athletic trainer, personal physician, or emergency department/urgent care facility and

C) Resulted in restriction of the high school athlete's participation for one or more days beyond the day of injury and

D) Any fracture, concussion, or dental injury regardless of whether or not it resulted in restriction of the student-athlete's participation.

An athlete exposure was defined as one athlete participating in one practice or competition where he or she is exposed to the possibility of athletic injury. Exposure was expressed in two parts:

A) Number of athlete-practices = the sum of the number of athletes at each practice during the past week. For example, if 20 athletes practiced on Monday through Thursday and 18 practiced on Friday, the number of athlete-practices would equal 98.

B) Number of athlete-competitions = the sum of the number of athletes at each competition during the past week. For example, if 9 athletes played in a Freshman game, 12 in a JV game, and 14 in a Varsity game, the number of athlete-competitions would equal 35.

1.5 Sample Recruitment

All eligible schools (i.e., all US high schools with a National Athletic Trainers' Association (NATA) affiliated certified athletic trainer (ATC) willing to serve as a reporter) were categorized into 8 sampling strata by geographic location (northeast, midwest, south, and west) and high school size (enrollment ≤ 1,000 or > 1,000 students). Participant schools were then randomly selected from each substrata to obtain 100 study schools. To maintain a nationally representative sample, if a school dropped out of the study, another school from the same stratum was randomly selected for replacement. Participating ATCs were offered a $300 honorarium along with individualized injury reports following the study's conclusion.

1.6 Data Collection

Each ATC that enrolled their school in National High School Sports-Related Injury Surveillance System received an email every Monday throughout the study period reminding them to enter their school's data into the surveillance system. Each participating ATC was asked to complete 44 weekly exposure reports: one for each week from August 4, 2008 through June 7, 2009. Exposure reports collected exposure information (number of athlete-competitions and athlete-practices) and the number of reportable injuries sustained by student athletes of each sport that was currently in session at their school. For each reportable injury, the ATC was asked to complete an injury report. The injury report collected detailed information about the injured player (e.g., age, year in school, etc.), the injury (e.g. site, type, severity, etc.) and the injury event (e.g., position played, phase of play, etc.). This internet-based surveillance tool provided ATCs with the ability to view all their submitted data throughout the study and update reports as needed (e.g., need for surgery, days till resuming play, etc.).

1.7 Data Management

In an effort to decrease loss-to follow up, a log of reporters' utilization of the internet-based injury surveillance system was maintained throughout the study period. Reporters who repeatedly failed to log on to complete the weekly exposure and injury reports or who had errors with their reporting were contacted by the study staff and either reminded to report, asked to correct errors, or assessed for their willingness to continue participating in the study.

1.8 Data Analysis

Data were analyzed using SAS software, version 9.1 and SPSS, version 17.0. Although fractures, concussions, and dental injuries resulting in <1 day time loss were collected, unless otherwise noted, analyses in this report excluded these injuries. With the exception of injury rates, data were weighted for all analyses to produce national estimates. For each sport in each stratum, weights account for the total number of US schools offering the sport and the average number of participating study schools reporting each week for that sport. For example, following is the algorithm used to calculate football weights for the small (enrollment ≤ 1,000) west stratum:

$$Weight = \frac{\text{national total \# of small, west US high schools}}{\text{average \# of small, west participating schools reporting football each week}}$$

Injury rates were calculated as the ratio of unweighted case counts per 1,000 athlete-exposures, and they were compared using rate ratios (RR) with 95% confidence intervals (CI). Following is an example of the RR calculation comparing the rate of injury in boys' soccer to the rate of injury in girls' soccer:

$$RR = \frac{\text{\# boys' soccer injuries / total \# boys' soccer athlete-exposures}}{\text{\# girls' soccer injuries / total \# girls' soccer athlete-exposures}}$$

Injury proportions were compared using injury proportion ratios (IPR) and corresponding confidence intervals calculated using the Complex Samples module of SPSS in order to account for the sampling weights and the complex sampling design. Following is an example of the IPR calculation comparing the proportion of male soccer concussions to the proportion of female soccer concussions:

$$IPR = \frac{\text{\# boys' soccer concussions / total \# boys' soccer injuries}}{\text{\# girls' soccer concussions / total \# girls' soccer injuries}}$$

An RR or IPR >1.00 suggests a risk association while an RR or IPR <1.00 suggests a protective association. CI not including 1.00 were considered statistically significant. Injury rates over time were compared by running a linear regression and testing for trend.

II. Overall Injury Epidemiology

Table 2.1 Injury Rates by Sport and Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Overall total	**4,255**	**2,112,479**	**2.01**	**1,248,126**
Competition	**2,311**	**570,177**	**4.05**	**690,525**
Practice	**1,944**	**1,542,302**	**1.26**	**557,601**
Boys' football total	2,061	588,876	3.50	527,321
Competition	1,121	99,532	11.26	288,637
Practice	940	489,344	1.92	238,684
Boys' soccer total	350	215,699	1.62	149,229
Competition	218	63,636	3.43	87,082
Practice	132	152,063	0.87	62,147
Girls' soccer total	381	184,268	2.07	192,108
Competition	251	54,670	4.59	123,312
Practice	130	129,598	1.00	68,796
Girls' volleyball total	167	188,075	0.89	56,609
Competition	58	64,294	0.90	19,764
Practice	109	123,781	0.88	36,845
Boys' basketball total	319	236,419	1.35	79,230
Competition	160	69,043	2.32	40,152
Practice	159	167,376	0.95	39,078
Girls' basketball total	295	191,871	1.54	64,933
Competition	177	56,555	3.13	38,277
Practice	118	135,316	0.87	26,656
Boys' wrestling total	392	180,641	2.17	88,996
Competition	160	47,770	3.35	39,029
Practice	232	132,871	1.75	49,967
Boys' baseball total	144	185,622	0.78	39,869
Competition	86	65,359	1.32	25,584
Practice	58	120,263	0.48	14,285
Girls' softball total	146	141,008	1.04	49,831
Competition	80	49,318	1.62	28,688
Practice	66	91,690	0.72	21,143

*Only includes injuries resulting in ≥1 days time loss.

Table 2.2 Proportion of Injuries Resulting in Time Loss, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

	≥1 days time loss	<1 day time loss	Total
Overall	**98.6%**	**1.4%**	**100%**
Boys' football	98.5%	1.5%	**100%**
Boys' soccer	98.3%	1.7%	**100%**
Girls' soccer	99.2%	0.8%	**100%**
Girls' volleyball	99.4%	0.6%	**100%**
Boys' basketball	96.6%	3.4%	**100%**
Girls' basketball	98.6%	1.4%	**100%**
Boys' wrestling	99.5%	0.5%	**100%**
Boys' baseball	98.6%	1.4%	**100%**
Girls' softball	100.0%	0.0%	**100%**

*By study definition, non-time loss injuries were fractures, concussions, and dental injuries. Because they accounted for less than 2% of all injuries, they are not included in any other analyses.

Table 2.3 Demographic Characteristics of Injured Athletes by Sex, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

	Male	Female
Year in School		
Freshman	176,340 (19.9%)	89,339 (24.6%)
Sophomore	211,262 (23.9%)	102,792 (28.3%)
Junior	231,294 (26.1%)	79,301 (21.8%)
Senior	262,028 (29.7%)	86,481 (23.8%)
Total†	**880,924 (100%)**	**357,913 (100%)**
Age (years)		
Minimum	13	13
Maximum	19	19
Mean (St. Dev.)	16.0 (1.3)	15.8 (1.2)
BMI		
Minimum	9.6	15.4
Maximum	49.0	48.8
Mean (St. Dev.)	24.8 (4.4)	22.3 (3.8)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 2.1 Injury Diagnosis by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

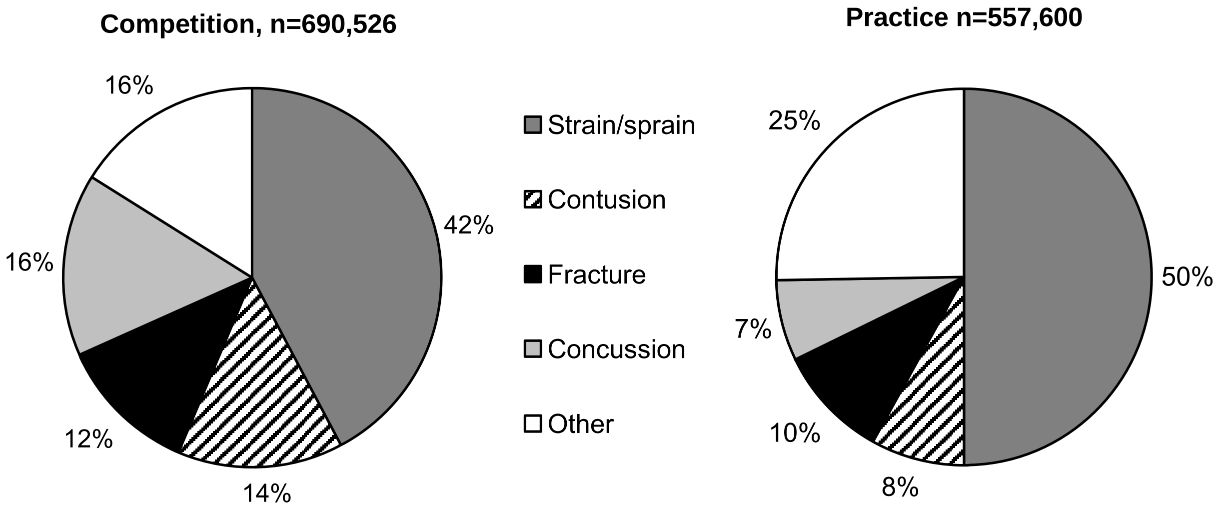


Table 2.4 Body Site of Injury by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Body Site						
Ankle	107,559	15.7%	96,689	17.4%	204,248	16.4%
Head/face	137,272	19.9%	53,881	9.7%	191,154	15.4%
Knee	110,844	16.1%	73,795	13.3%	184,639	14.8%
Hip/thigh/upper leg	51,415	7.5%	76,706	13.8%	128,121	10.3%
Hand/wrist	61,214	8.9%	55,473	9.9%	116,687	9.4%
Shoulder	60,412	8.8%	45,148	8.1%	105,560	8.5%
Trunk	38,947	5.6%	42,990	7.7%	81,936	6.5%
Lower leg	38,709	5.6%	33,749	6.1%	72,458	5.8%
Foot	30,899	4.5%	31,975	5.7%	62,874	5.1%
Arm/elbow	29,797	4.4%	21,796	3.9%	51,593	4.2%
Neck	10,001	1.5%	13,240	2.4%	23,241	1.9%
Other	10,194	1.5%	11,323	2.0%	21,517	1.7%
Total	**687,263**	**100%**	**556,765**	**100%**	**1,244,028***	**100%**

*Totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Table 2.5 Most Commonly Injured Ankle Structures, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

	Male		Female		Total	
	n	%	n	%	n	%
Ankle Ligament						
Anterior talofibular ligament	96,937	79.7%	69,285	83.8%	166,222	81.4%
Calcaneofibular ligament	34,690	28.5%	25,424	30.7%	60,114	29.4%
Anterior tibiofibular ligament	32,627	26.8%	21,455	25.9%	54,082	26.5%
Posterior talofibular ligament	8,328	6.9%	15,950	19.3%	24,278	11.9%
Posterior tibiofibular ligament	6,920	5.7%	4,889	5.9%	11,809	5.8%
Total	**121,556**	**100%**	**82,692**	**100%**	**204,248**	**100%**

*Multiple responses allowed per injury report.

Table 2.6 Most Commonly Injured Knee Structures, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Male		Female		Total	
	n	%	n	%	n	%
Knee Ligament						
Medial collateral ligament	50,255	38.7%	11,855	21.6%	62,110	33.6%
Torn cartilage (meniscus)	25,069	19.3%	12,907	23.5%	37,976	20.6%
Patella/patellar tendon	23,326	18.0%	12,339	22.5%	35,665	19.0%
Anterior cruciate ligament	22,498	17.3%	12,594	23.0%	35,092	19.0%
Lateral collateral ligament	9,976	7.7%	4,488	8.2%	14,464	7.8%
Posterior cruciate ligament	697	0.5%	1,552	2.8%	2,249	1.2%
Total	**129,796**	**100%**	**54,842**	**100%**	**184,638**	**100%**

*Multiple responses allowed per injury report.

Table 2.7 Ten Most Common Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition n=687,266		Practice n=556,764		Overall n=1,244,026	
	n	%	n	%	n	%
Diagnosis						
Ankle Strain/Sprain	100,400	14.6%	87,265	15.7%	187,665	15.1%
Head/Face Concussion	107,063	15.6%	39,060	7.0%	146,123	11.7%
Knee strain/sprain	64,726	9.4%	34,388	6.2%	99,113	8.0%
Hip/thigh/upper leg strain/sprain	33,522	4.9%	62,973	11.3%	96,495	7.8%
Knee other	26,076	3.8%	29,539	5.3%	55,615	4.5%
Shoulder other	27,755	4.0%	21,959	3.9%	49,714	4.0%
Hand/wrist fracture	28,501	4.1%	21,155	3.8%	49,657	4.0%
Shoulder strain/sprain	26,893	3.9%	19,371	3.5%	46,264	3.7%
Hand/wrist strain/sprain	17,148	2.5%	19,267	3.5%	36,416	2.9%
Trunk strain/sprain	13,276	1.9%	21,759	3.9%	35,035	2.8%

Figure 2.2 Time Loss by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

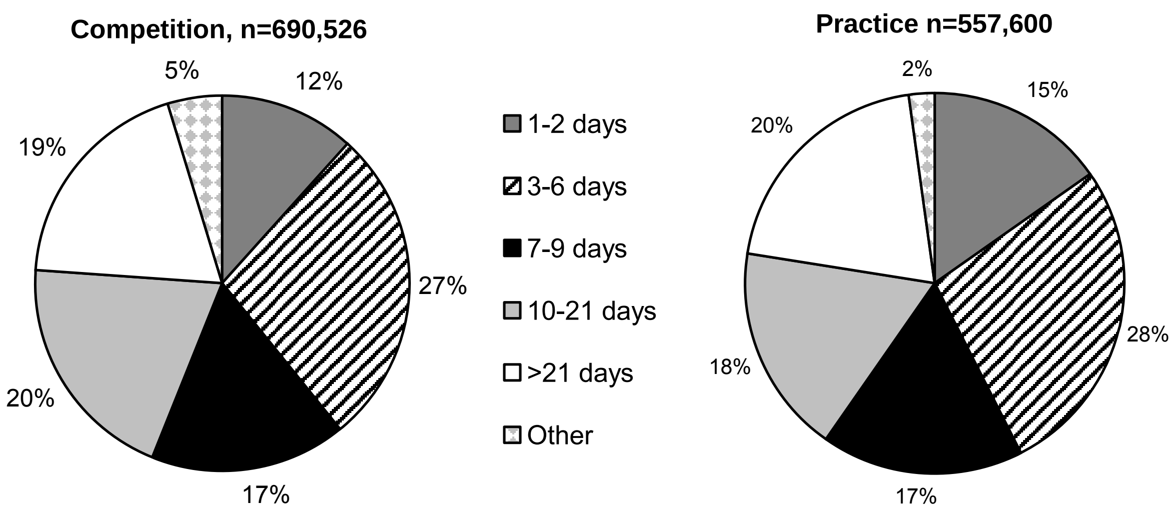


Table 2.8 Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	54,252	8.1%	26,617	4.9%	80,869	6.7%
Did not require surgery	618,266	91.9%	515,303	95.1%	1,133,569	93.3%
Total	**672,518**	**100%**	**541,920**	**100%**	**1,214,438**	**100%**

Figure 2.3 New and Recurring Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

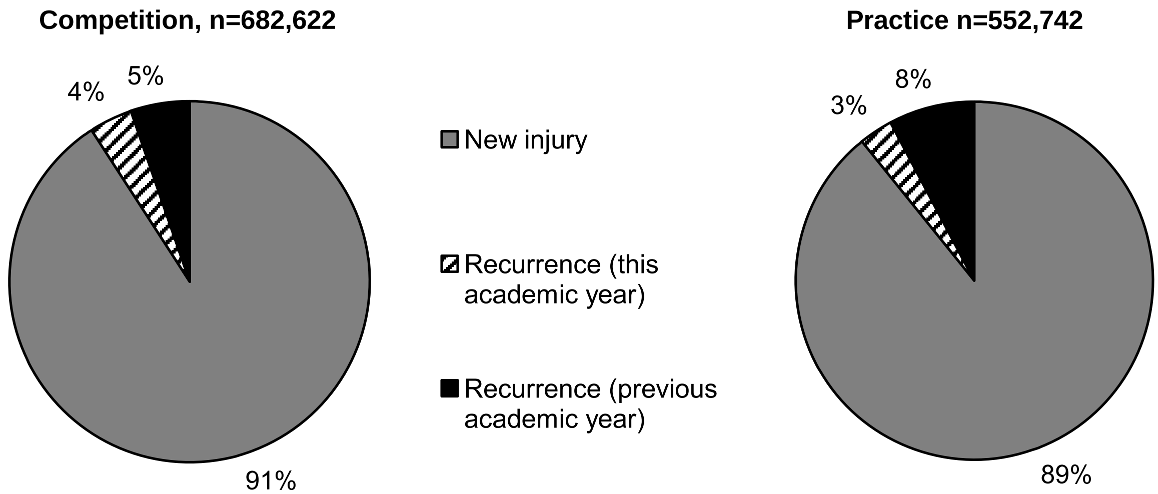


Table 2.9 Time during Season of Injury, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Season		
Preseason	315,289	25.3%
Regular season	887,866	71.4%
Post season	41,298	3.3%
Total	**1,244,453**	**100%**

Table 2.10 Competition-Related Variables, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Injury Related to Foul Play		
No	553,920	86.1%
Yes, and ruled foul play	27,971	4.3%
Yes, but not ruled foul play	29,489	4.6%
Unknown	32,250	5.0%
Total	**643,630**	**100%**

Table 2.11 Practice-Related Variables, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Practice		
First 1/2 hour	62,213	12.5%
Second 1/2 hour	112,246	22.5%
1-2 hours into practice	251,132	50.3%
>2 hours into practice	73,803	14.8%
Total	**499,394**	**100%**

Table 2.12 Methods for Injury Evaluation and Assessment, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
% of Injuries Evaluated by:*		
Certified athletic trainer	1,183,807	54.1%
Physician	465,115	21.3%
Dentist/oral surgeon	5,045	0.2%
Nurse practitioner	10,297	0.5%
Physician's assistant	12,352	0.6%
Other	510,705	23.3%
Total	**2,187,321**	**100%**
% of Injuries Assessed by:*		
Evaluation	1,251,594	60.4%
X-ray	550,237	26.6%
MRI	152,234	7.3%
CT-scan	55,099	2.7%
Surgery	17,787	0.9%
Blood work/lab test	20,377	1.0%
Other	23,899	1.2%
Total	**2,071,227**	**100%**

*Multiple responses allowed per injury report.

III. Boys’ Football Injury Epidemiology

Table 3.1 Football Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**2,061**	**588,876**	**3.50**	**527,321**
Competition	1,121	99,532	11.26	288,637
Practice	940	489,344	1.92	238,684

Table 3.2 Demographic Characteristics of Injured Football Athletes, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

Year in School	
Freshman	107,529 (20.5%)
Sophomore	124,352 (23.7%)
Junior	133,108 (25.4%)
Senior	159,938 (30.5%)
Total†	**524,927 (100%)**
Age (years)	
Minimum	13
Maximum	19
Mean (St. Dev.)	16.0 (1.3)
BMI	
Minimum	9.6
Maximum	45.4
Mean (St. Dev.)	25.9 (4.6)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 3.1 Diagnosis of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

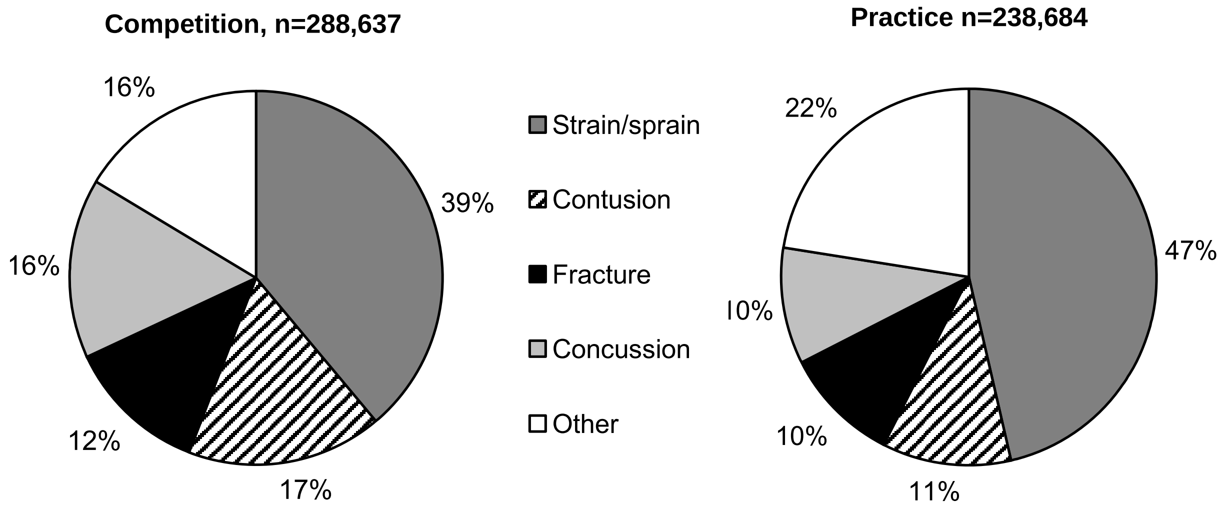


Table 3.3 Body Site of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Knee	56,116	19.5%	32,779	13.7%	88,894	16.9%
Head/face	49,140	17.1%	26,575	11.1%	75,714	14.4%
Ankle	32,364	11.2%	32,184	13.5%	64,548	12.3%
Hand/wrist	32,156	11.2%	25,782	10.8%	57,937	11.0%
Shoulder	32,848	11.4%	23,849	10.0%	56,697	10.8%
Hip/thigh/upper leg	18,041	6.3%	30,536	12.8%	48,577	9.2%
Trunk	22,832	7.9%	21,486	9.0%	44,319	8.4%
Lower leg	14,133	4.9%	11,014	4.6%	25,147	4.8%
Arm/elbow	14,455	5.0%	10,081	4.2%	24,536	4.7%
Foot	8,283	2.9%	7,863	3.3%	16,146	3.1%
Neck	4,825	1.7%	11,036	4.6%	15,861	3.0%
Other	2,883	1.0%	5,500	2.3%	8,383	1.6%
Total	**288,074**	**100%**	**238,685**	**100%**	**526,758**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Table 3.4 Ten Most Common Football Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition n=288,633		Practice n= 238,687		Total n= 527,320	
	n	%	n	%	n	%
Diagnosis						
Head/face concussion	44,316	15.4%	23,850	10.0%	68,166	12.9%
Ankle strain/sprain	29,344	10.2%	27,686	11.6%	57,031	10.8%
Knee strain/sprain	36,975	12.8%	17,142	7.2%	54,116	10.3%
Hip/thigh/upper leg strain/sprain	8,850	3.1%	23,001	9.6%	31,851	6.0%
Shoulder other	17,716	6.1%	11,162	4.7%	28,878	5.5%
Hand/wrist fracture	15,011	5.2%	7,533	3.2%	22,544	4.3%
Shoulder strain/sprain	11,528	4.0%	9,062	3.8%	20,591	3.9%
Knee other	9,937	3.4%	9,539	4.0%	19,476	3.7%
Hand/wrist strain/sprain	7,978	2.8%	9,365	3.9%	17,343	3.3%
Knee contusion	8,490	2.9%	4,540	1.9%	13,030	2.5%

Figure 3.2 Time Loss of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

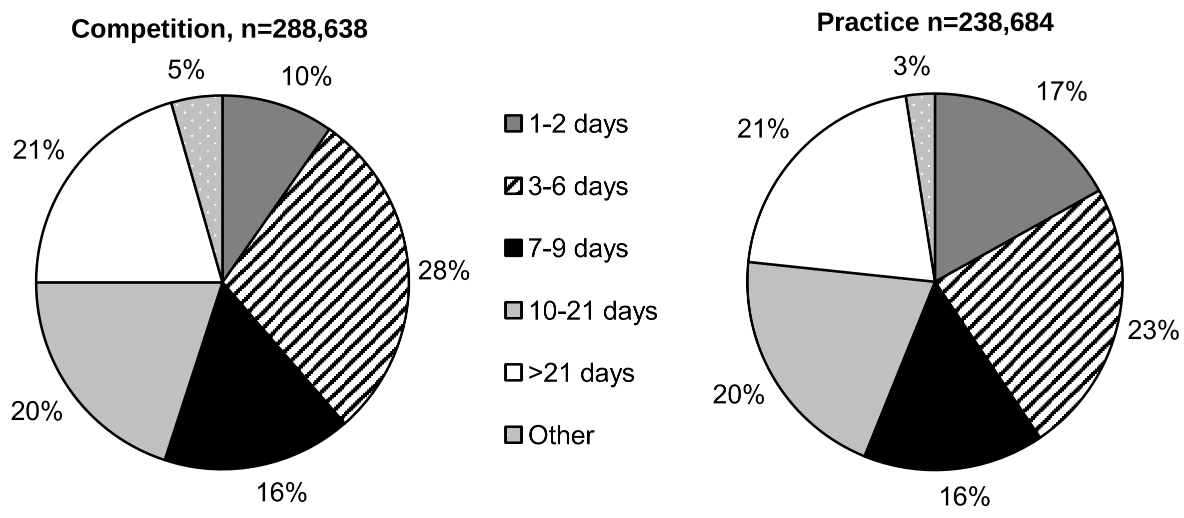


Table 3.5 Football Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Need for surgery						
Required surgery	25,694	9.1%	15,385	6.7%	41,078	8.0%
Did not require surgery	256,055	90.9%	215,947	93.3%	472,002	92.0%
Total	**281,749**	**100%**	**231,332**	**100%**	**513,081**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Figure 3.3 History of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

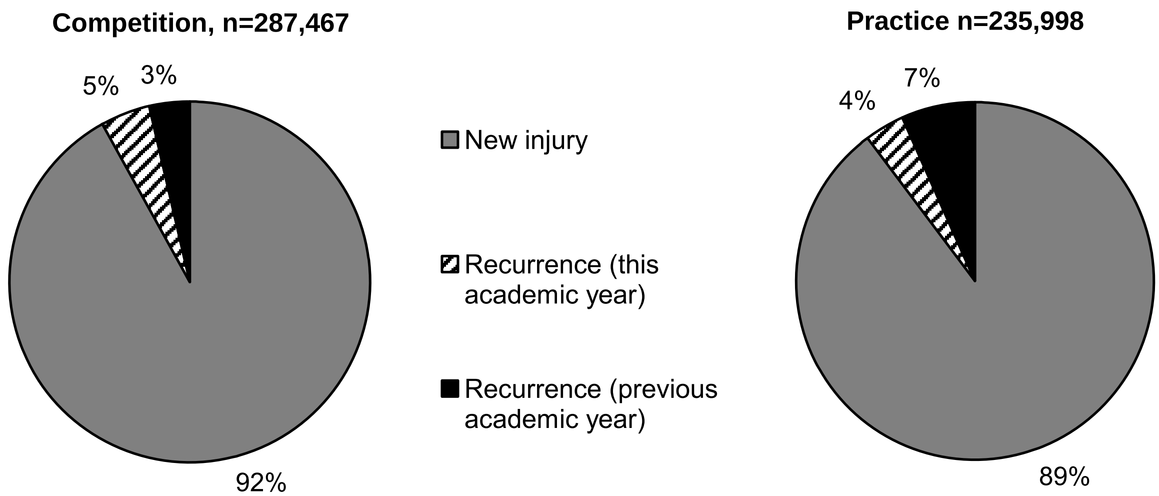


Table 3.6 Time during Season of Football Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Season		
Preseason	155,906	29.6%
Regular season	353,907	67.3%
Post season	16,310	3.1%
Total	**526,124**	**100%**

Table 3.7 Competition-Related Variables for Football Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Competition		
Pre-competition/warm-ups	4,246	1.5%
First quarter	36,853	13.4%
Second quarter	81,606	29.7%
Third quarter	87,397	31.8%
Fourth quarter	64,073	23.3%
Overtime	372	0.1%
Total	**274,546**	**100%**
Injury Related to Foul Play		
No	242,690	91.8%
Yes, and ruled foul play	5,426	2.1%
Yes, but not ruled foul play	6,754	2.6%
Unknown	9,425	3.6%
Total	**264,295**	**100%**
Field Location		
Between the 20 yrd lines	213,048	77.1%
Red zone	55,543	20.1%
End zone	5,350	1.9%
Off the field	2,424	0.9%
Total	**276,365**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Table 3.8 Practice-Related Variables for Football Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Practice		
First 1/2 hour	22,390	10.7%
Second 1/2 hour	45,694	21.8%
1-2 hours into practice	107,497	51.3%
>2 hours into practice	34,042	16.2%
Total	209,624	100%

Figure 3.4 Player Position of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

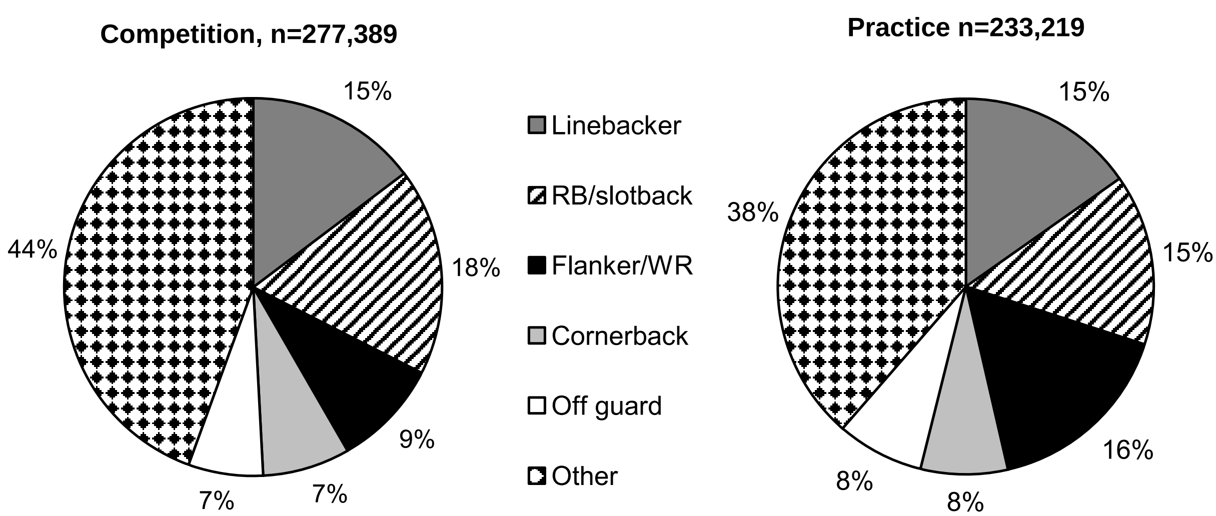
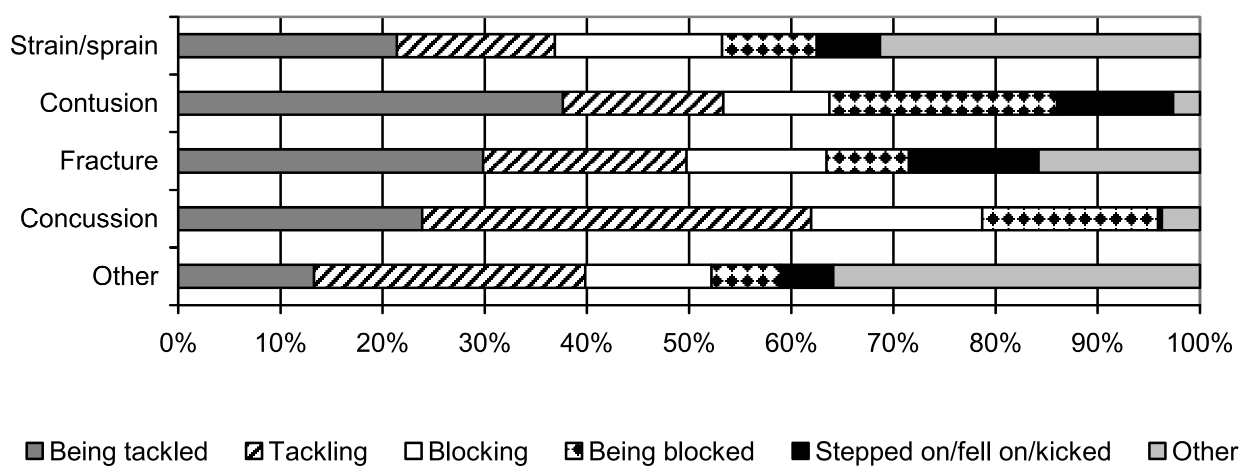


Table 3.9 Activities Leading to Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
Being tackled	80,767	28.9%	39,959	17.0%	120,725	23.5%
Tackling	68,770	24.6%	39,149	16.7%	107,919	21.0%
Blocking	40,806	14.6%	33,756	14.4%	74,562	14.5%
Being blocked	41,599	14.9%	17,714	7.5%	59,313	11.5%
N/A, chronic/overuse	4,915	1.8%	42,245	18.0%	47,160	9.2%
Stepped on/fell on/kicked	16,616	5.9%	17,981	7.7%	34,597	6.7%
Rotation around a planted foot	9,350	3.3%	18,383	7.8%	27,733	5.4%
Other	16,734	6.0%	25,728	10.9%	42,463	8.2%
Total	**279,557**	**100%**	**234,915**	**100%**	**514,472**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Figure 3.5 Activity Resulting in Football Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year



IV. Boys' Soccer Injury Epidemiology

Table 4.1 Boys' Soccer Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**350**	**215,699**	**1.62**	**149,229**
Competition	218	63,636	3.43	87,082
Practice	132	152,063	0.87	62,147

Table 4.2 Demographic Characteristics of Injured Boys' Soccer Athletes, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

Year in School	
Freshman	25,276 (17.0%)
Sophomore	33,286 (22.3%)
Junior	39,070 (26.2%)
Senior	51,301 (34.4%)
Total†	**148,933 (100%)**
Age (years)	
Minimum	13
Maximum	18
Mean (St. Dev.)	16.1 (1.2)
BMI	
Minimum	15.2
Maximum	33.7
Mean (St. Dev.)	22.7 (2.5)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 4.1 Diagnosis of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

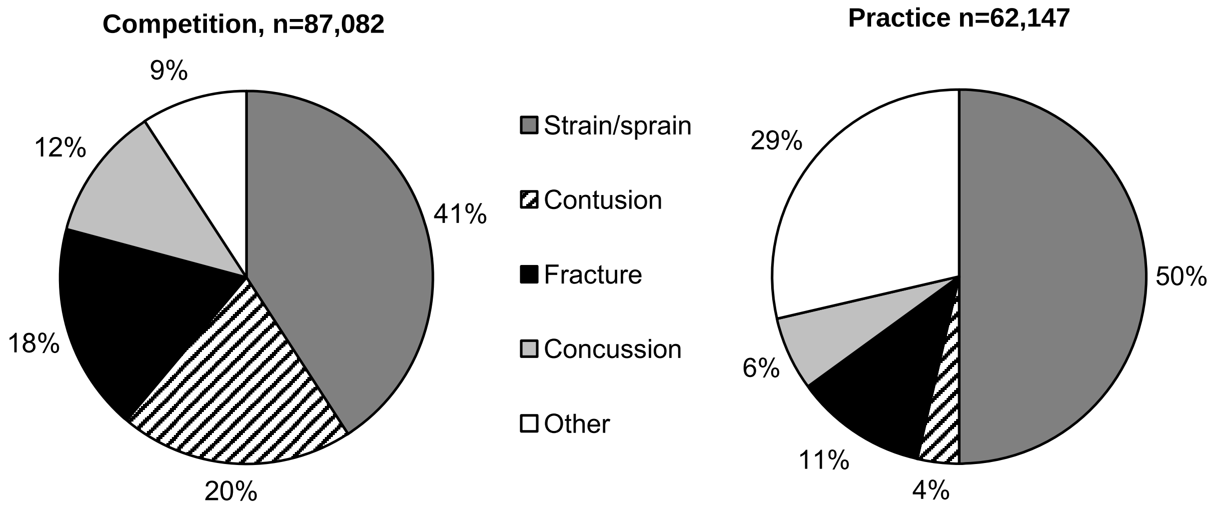


Table 4.3 Body Site of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Hip/thigh/upper leg	10,014	11.5%	16,161	26.0%	26,175	17.5%
Ankle	15,656	18.0%	8,912	14.3%	24,568	16.5%
Lower leg	12,305	14.1%	7,963	12.8%	20,267	13.6%
Head/face	14,210	16.3%	4,294	6.9%	18,504	12.4%
Knee	11,009	12.6%	6,572	10.6%	17,581	11.8%
Foot	6,654	7.6%	7,988	12.9%	14,642	9.8%
Hand/wrist	6,534	7.5%	3,000	4.8%	9,534	6.4%
Trunk	4,100	4.7%	4,588	7.4%	8,688	5.8%
Shoulder	4,414	5.1%	1,202	1.9%	5,616	3.8%
Arm/elbow	1,265	1.5%	1,123	1.8%	2,388	1.6%
Neck	663	0.8%	0	0.0%	663	0.4%
Other	258	0.3%	345	0.6%	602	0.4%
Total	**87,082**	**100%**	**62,147**	**100%**	**149,229**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Table 4.4 Ten Most Common Boys' Soccer Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition n= 87,081		Practice n= 62,147		Total n=149,228	
	n	%	n	%	n	%
Diagnosis						
Hip/thigh/upper leg strain/sprain	6,472	7.4%	14,171	22.8%	20,643	13.8%
Ankle strain/sprain	13,800	15.8%	6,699	10.8%	20,499	13.7%
Head/face concussion	10,253	11.8%	3,962	6.4%	14,215	9.5%
Hand/wrist fracture	5,411	6.2%	2,485	4.0%	7,895	5.3%
Knee strain/sprain	4,430	5.1%	3,003	4.8%	7,433	5.0%
Lower leg fracture	4,346	5.0%	2,264	3.6%	6,611	4.4%
Lower leg contusion	5,856	6.7%	258	0.4%	6,114	4.1%
Foot strain/sprain	2,591	3.0%	2,668	4.3%	5,258	3.5%
Knee contusion	4,014	4.6%	539	0.9%	4,553	3.1%
Shoulder sprain/strain	3,076	3.5%	227	0.4%	3,303	2.2%

Figure 4.2 Time Loss of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

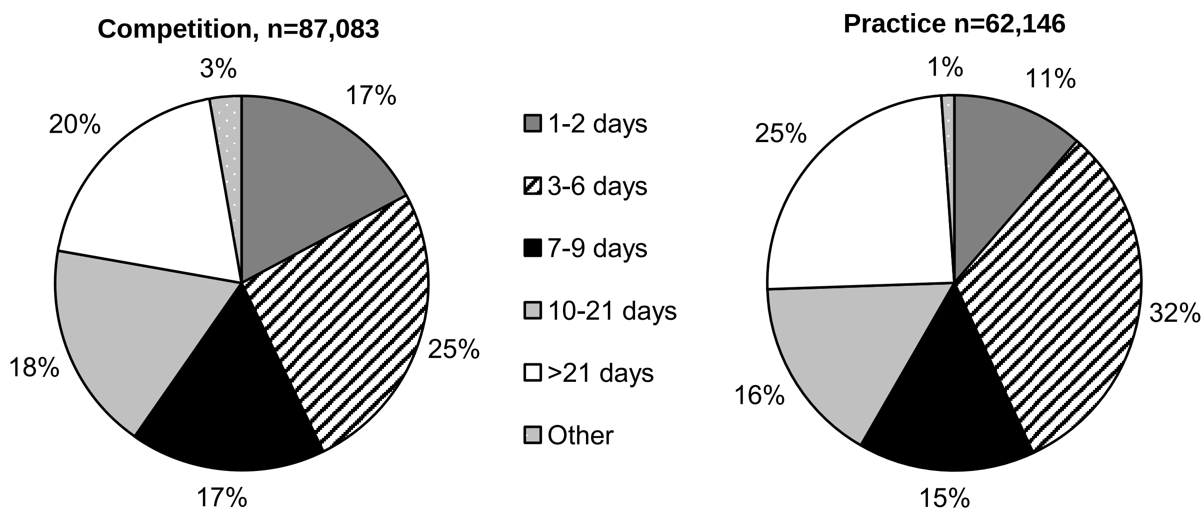


Table 4.5 Boys' Soccer Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	5,583	6.5%	730	1.2%	6,313	4.3%
Did not require surgery	80,080	93.5%	60,083	98.8%	140,163	95.7%
Total	**85,663**	**100%**	**60,813**	**100%**	**146,476**	**100%**

Figure 4.3 History of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

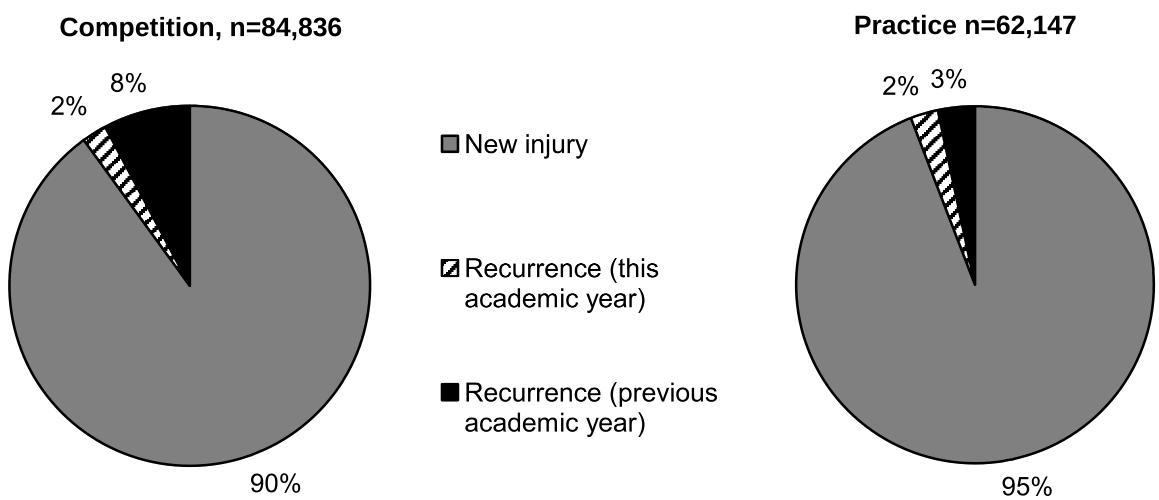


Table 4.6 Time during Season of Boys' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Season		
Preseason	41,877	28.1%
Regular season	102,338	68.7%
Post season	4,669	3.1%
Total	**148,884**	**100%**

Table 4.7 Competition-Related Variables for Boys' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Competition		
Pre-competition/warm-ups	2,889	3.5%
First half	26,878	32.6%
Second half	51,652	62.6%
Overtime	1,106	1.3%
Total	**82,526**	**100%**
Injury Related to Foul Play		
No	64,025	76.6%
Yes, and ruled foul play	6,129	7.3%
Yes, but not ruled foul play	8,878	10.6%
Unknown	4,595	5.5%
Total	**83,628**	**100%**
Field Location		
Top of goal box extended to center line (offense)	28,141	34.60%
Goal box (defense)	15,206	18.70%
Top of goal box extended to center line (defense)	13,169	16.20%
Side of goal box (offense)	9,639	11.80%
Goal box (offense)	9,120	11.20%
Side of goal box (defense)	4,678	5.70%
Off the field	1,435	1.80%
Total	**81,387**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Table 4.8 Practice-Related Variables for Boys' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Practice		
First 1/2 hour	2,617	4.6%
Second 1/2 hour	12,248	21.6%
1-2 hours into practice	28,780	50.8%
>2 hours into practice	12,975	22.9%
Total	**56,619**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Figure 4.4 Player Position of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

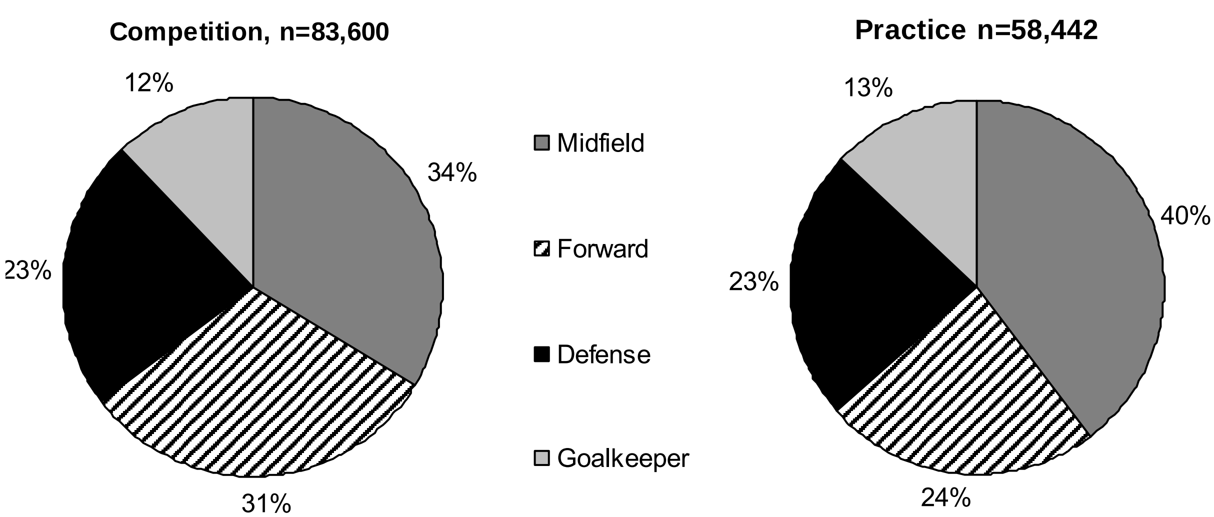
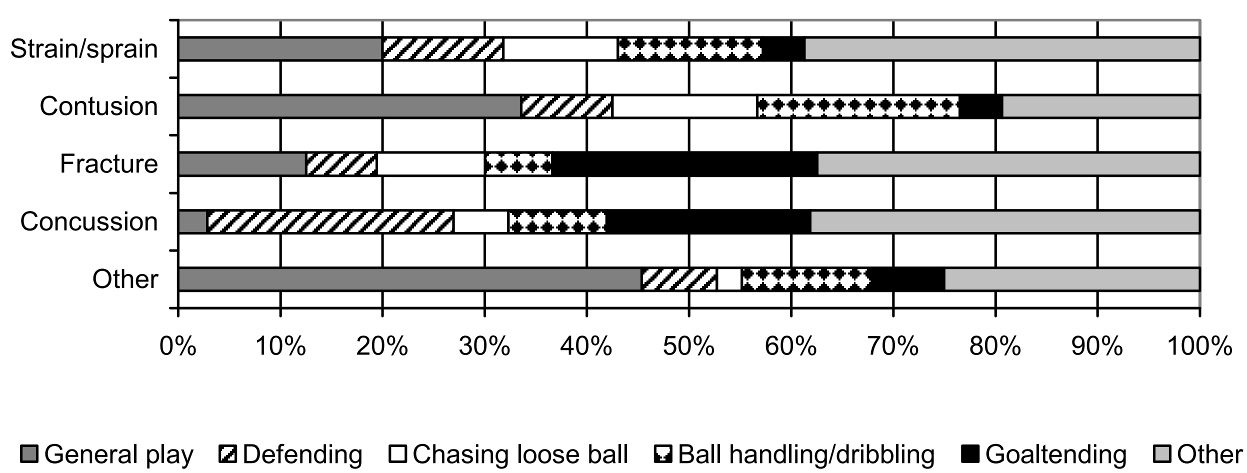


Table 4.9 Activities Leading to Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
General play	12,697	15.4%	20,236	34.1%	32,933	23.2%
Ball handling/dribbling	14,228	17.3%	4,438	7.5%	18,666	13.2%
Defending	9,776	11.9%	6,085	10.3%	15,861	11.2%
Chasing loose ball	9,818	11.9%	3,656	6.2%	13,474	9.5%
Goaltending	7,225	8.8%	6,047	10.2%	13,272	9.4%
Passing (foot)	4,443	5.4%	5,323	9.0%	9,766	6.9%
Shooting (foot)	6,048	7.3%	3,547	6.0%	9,596	6.8%
Heading ball	6,075	7.4%	1,622	2.7%	7,697	5.4%
Receiving pass	3,608	4.4%	1,451	2.4%	5,059	3.6%
Other	8,559	10.3%	6,886	11.6%	15,443	10.8%
Total	**82,477**	**100%**	**59,291**	**100%**	**141,767**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Figure 4.5 Activity Resulting in Boys' Soccer Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year



V. Girls' Soccer Injury Epidemiology

Table 5.1 Girls' Soccer Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**381**	**184,268**	**2.07**	**192,108**
Competition	251	54,670	4.59	123,312
Practice	130	129,598	1.00	68,796

Table 5.2 Demographic Characteristics of Injured Girls' Soccer Athletes, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

Year in School	
Freshman	42,263 (22.4%)
Sophomore	58,557 (31.1%)
Junior	41,727 (22.1%)
Senior	45,862 (24.3%)
Total†	**188,409 (100%)**
Age (years)	
Minimum	14
Maximum	18
Mean (St. Dev.)	15.8 (1.2)
BMI	
Minimum	15.4
Maximum	45.4
Mean (St. Dev.)	21.9 (3.7)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 5.1 Diagnosis of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

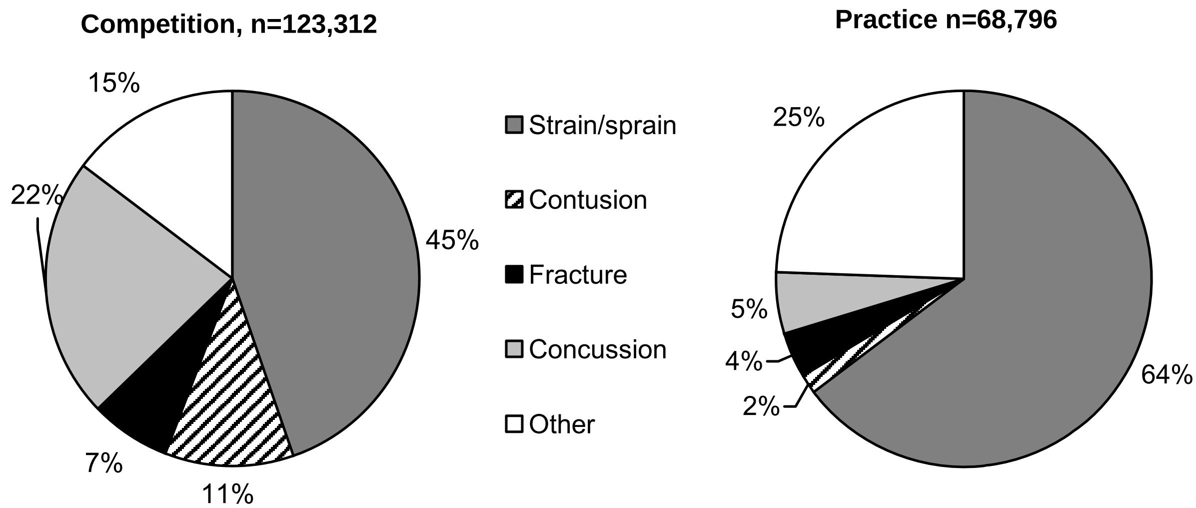


Table 5.3 Body Site of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Head/face	31,654	25.7%	3,873	5.6%	35,527	18.5%
Ankle	19,121	15.5%	15,986	23.2%	35,108	18.3%
Hip/thigh/upper leg	15,703	12.7%	18,168	26.4%	33,871	17.6%
Knee	21,305	17.3%	8,867	12.9%	30,173	15.7%
Foot	8,497	6.9%	5,016	7.3%	13,513	7.0%
Lower leg	5,206	4.2%	6,439	9.4%	11,645	6.1%
Trunk	4,218	3.4%	4,022	5.8%	8,241	4.3%
Hand/wrist	2,857	2.3%	2,261	3.3%	5,118	2.7%
Arm/elbow	3,079	2.5%	866	1.3%	3,946	2.1%
Neck	3,120	2.5%	309	0.4%	3,429	1.8%
Shoulder	1,965	1.6%	558	0.8%	2,522	1.3%
Other	6,585	5.3%	2,430	3.5%	9,015	4.7%
Total	**123,312**	**100%**	**68,796**	**100%**	**192,108**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Table 5.4 Ten Most Common Girls' Soccer Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition n=123,313		Practice n= 68,798		Total n=192,109	
	n	%	n	%	n	%
Diagnosis						
Ankle strain/sprain	17,214	14.0%	15,856	23.0%	33,070	17.2%
Head/face concussion	27,684	22.5%	3,564	5.2%	31,248	16.3%
Hip/thigh/upper leg strain/sprain	13,802	11.2%	16,324	23.7%	30,126	15.7%
Knee strain/sprain	11,153	9.0%	3,871	5.6%	15,024	7.8%
Knee other	7,758	6.3%	4,735	6.9%	12,493	6.5%
Lower leg other	1,593	1.3%	5,391	7.8%	6,983	3.6%
Trunk strain/sprain	3,707	3.0%	2,430	3.5%	6,136	3.2%
Foot strain/sprain	4,331	3.5%	1,901	2.8%	6,233	3.2%
Foot other	2,020	1.6%	2,446	3.6%	4,466	2.3%
Foot contusion	2,016	1.6%	668	1.0%	2,684	1.4%

Figure 5.2 Time Loss of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

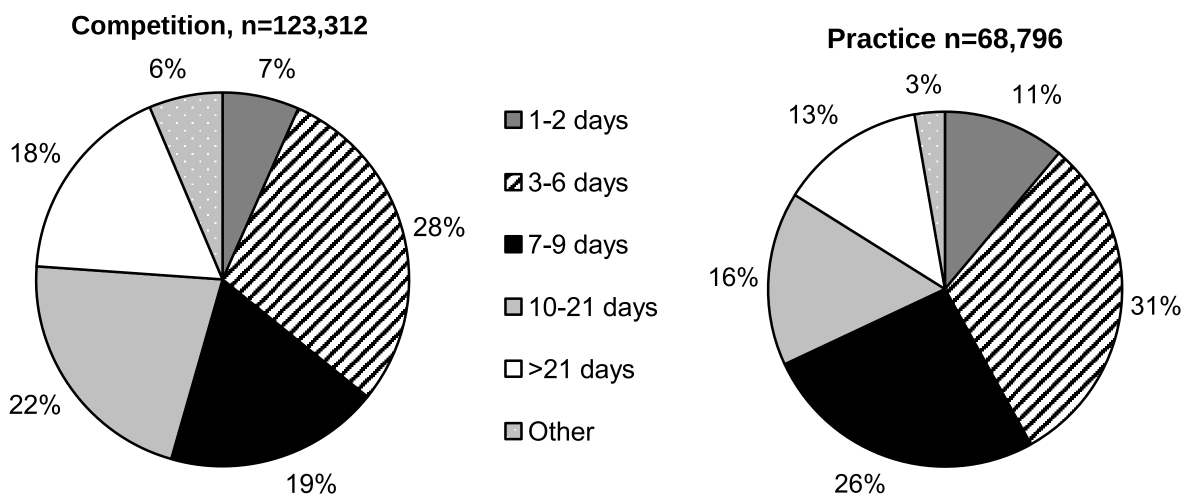


Table 5.5 Girls' Soccer Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	8,975	7.4%	1,410	2.1%	10,384	5.5%
Did not require surgery	112,559	92.6%	65,434	97.9%	177,993	94.5%
Total	**121,534**	**100%**	**66,843**	**100%**	**188,377**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Figure 5.3 History of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

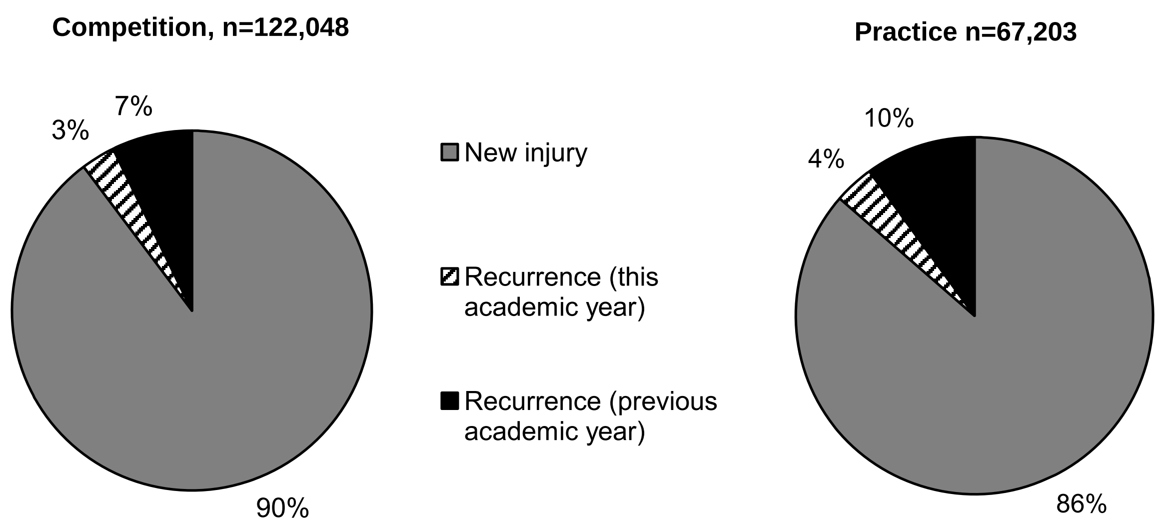


Table 5.6 Time during Season of Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Season		
Preseason	38,255	19.9%
Regular season	147,297	76.7%
Post season	6,556	3.4%
Total	**192,108**	**100%**

Table 5.7 Competition-Related Variables for Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Competition		
Pre-competition/warm-ups	1,706	1.5%
First half	41,143	36.1%
Second half	71,112	62.3%
Overtime	131	0.1%
Total	**114,091**	**100%**
Injury Related to Foul Play		
No	91,373	77.4%
Yes, and ruled foul play	8,966	7.6%
Yes, but not ruled foul play	7,201	6.1%
Unknown	10,448	8.9%
Total	**117,988**	**100%**
Field Location		
Top of goal box extended to center line (offense)	36,424	34.1%
Top of goal box extended to center line (defense)	24,861	23.3%
Goal box (defense)	12,955	12.1%
Goal box (offense)	9,550	9.0%
Side of goal box (offense)	9,430	8.8%
Side of goal box (defense)	7,212	6.8%
Off the field	6,239	5.8%
Total	**106,671**	**100%**

Table 5.8 Practice-Related Variables for Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Practice		
First 1/2 hour	10,950	17.8%
Second 1/2 hour	11,969	19.5%
1-2 hours into practice	31,145	50.7%
>2 hours into practice	7,323	11.9%
Total	**61,386**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Figure 5.4 Player Position of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

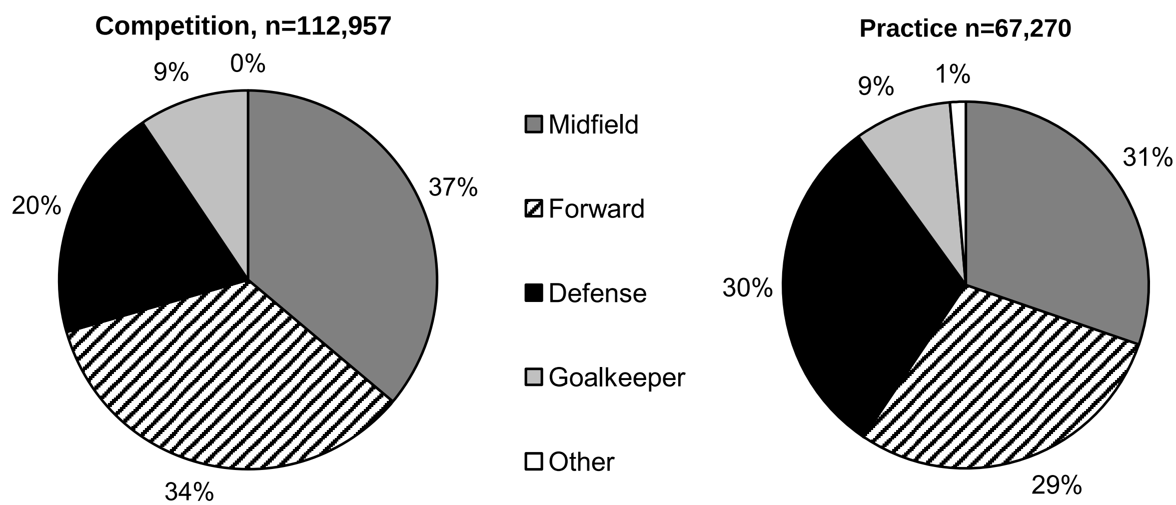
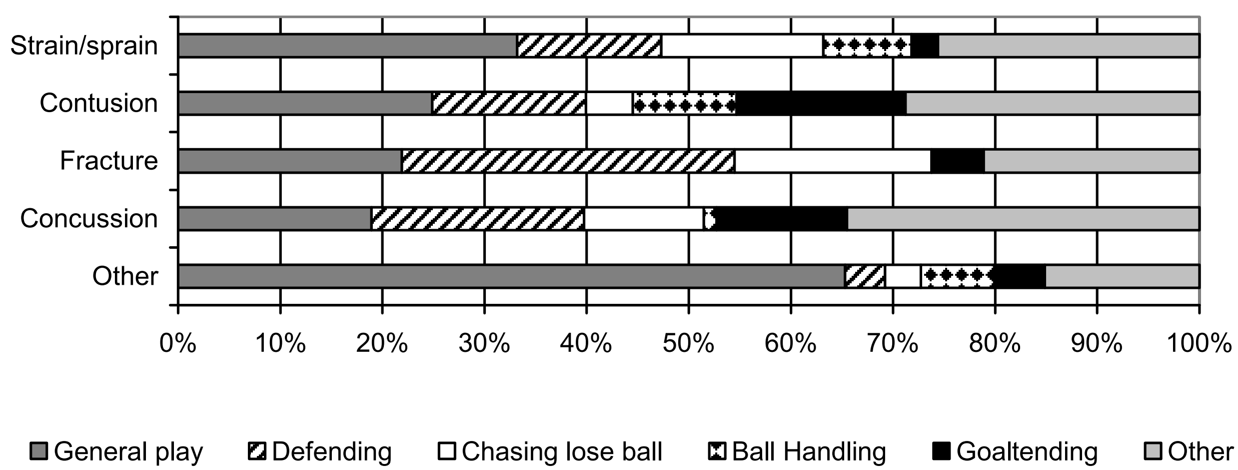


Table 5.9 Activities Leading to Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
General play	34,964	29.6%	31,718	46.6%	66,683	35.8%
Defending	20,622	17.5%	5,859	8.6%	26,481	14.2%
Chasing loose ball	19,566	16.6%	3,165	4.6%	22,731	12.2%
Ball handling/dribbling	10,242	8.7%	2,643	3.9%	12,885	6.9%
Goaltending	7,864	6.7%	2,930	4.3%	10,794	5.8%
Shooting (foot)	2,816	2.4%	7,893	11.6%	10,708	5.8%
Passing (foot)	4,623	3.9%	3,567	5.2%	8,190	4.4%
Receiving pass	5,453	4.6%	2,454	3.6%	7,907	4.2%
Conditioning	0	0.0%	5,193	7.6%	5,193	2.8%
Blocking shot	2,723	2.3%	0	0.0%	2,723	1.5%
Other	9,128	7.7%	2,686	3.9%	11,814	6.3%
Total	**118,001**	**100%**	**68,108**	**100%**	**186,109**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Figure 5.5 Activity Resulting in Girls' Soccer Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year



VI. Volleyball Injury Epidemiology

Table 6.1 Volleyball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**167**	**188,075**	**0.89**	**56,609**
Competition	58	64,294	0.90	19,764
Practice	109	123,781	0.88	36,845

Table 6.2 Demographic Characteristics of Injured Volleyball Athletes, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

Year in School	
Freshman	16,969 (30.2%)
Sophomore	14,949 (26.6%)
Junior	12,211 (21.7%)
Senior	12,022 (21.4%)
Total†	**56,151 (100%)**
Age (years)	
Minimum	13
Maximum	18
Mean (St. Dev.)	15.5 (1.3)
BMI	
Minimum	16.6
Maximum	34.1
Mean (St. Dev.)	22.0 (4.0)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 6.1 Diagnosis of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

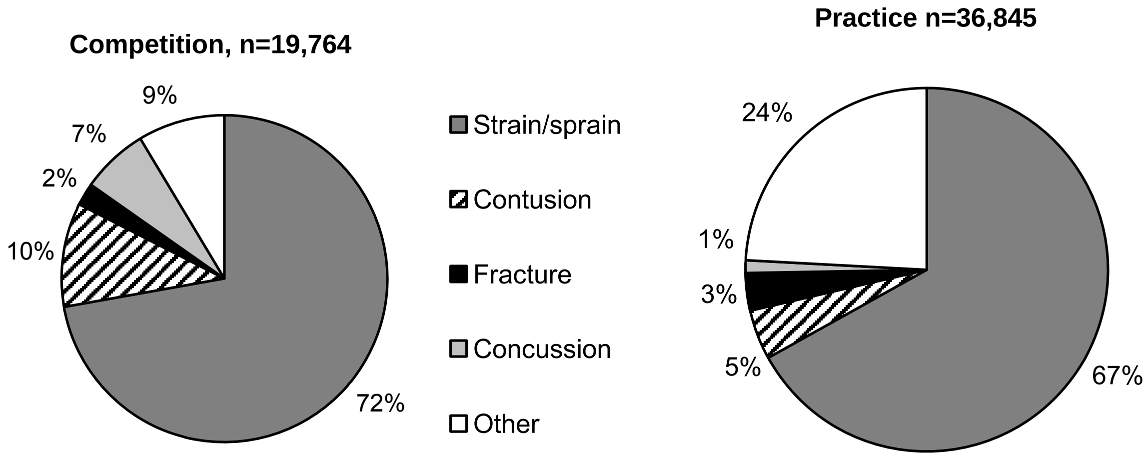


Table 6.3 Body Site of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Ankle	8,622	43.6%	11,926	32.4%	20,548	36.3%
Shoulder	694	3.5%	6,018	16.3%	6,712	11.9%
Knee	2,086	10.6%	4,133	11.2%	6,219	11.0%
Hand/wrist	1,475	7.5%	3,734	10.1%	5,209	9.2%
Hip/thigh/upper leg	1,480	7.5%	1,920	5.2%	3,401	6.0%
Lower leg	1,050	5.3%	2,372	6.4%	3,423	6.0%
Trunk	788	4.0%	2,152	5.8%	2,941	5.2%
Arm/elbow	1,457	7.4%	788	2.1%	2,246	4.0%
Head/face	1,327	6.7%	474	1.3%	1,802	3.2%
Foot	314	1.6%	1,481	4.0%	1,795	3.2%
Neck	468	2.4%	379	1.0%	848	1.5%
Other	0	0.0%	1,467	4.0%	1,467	2.6%
Total	**19,764**	**100%**	**36,845**	**100%**	**56,609**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Table 6.4 Ten Most Common Volleyball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition n=19,760		Practice n=36,844		Total n=56,606	
	n	%	n	%	n	%
Diagnosis						
Ankle strain/sprain	8,622	43.6%	11,926	32.4%	20,548	36.3%
Hand/wrist strain/sprain	1,244	6.3%	2,881	7.8%	4,125	7.3%
Shoulder other	379	1.9%	3,326	9.0%	3,705	6.5%
Shoulder strain/sprain	314	1.6%	2,692	7.3%	3,007	5.3%
Knee other	474	2.4%	2,413	6.5%	2,887	5.1%
Knee strain/sprain	1,416	7.2%	1,233	3.3%	2,649	4.7%
Trunk strain/sprain	474	2.4%	1,998	5.4%	2,472	4.4%
Hip/thigh/upper leg strain/sprain	694	3.5%	1,446	3.9%	2,140	3.8%
Lower leg strain/sprain	671	3.4%	1,073	2.9%	1,744	3.1%
Head/face concussion	1,327	6.7%	394	1.1%	1,722	3.0%

Figure 6.2 Time Loss of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

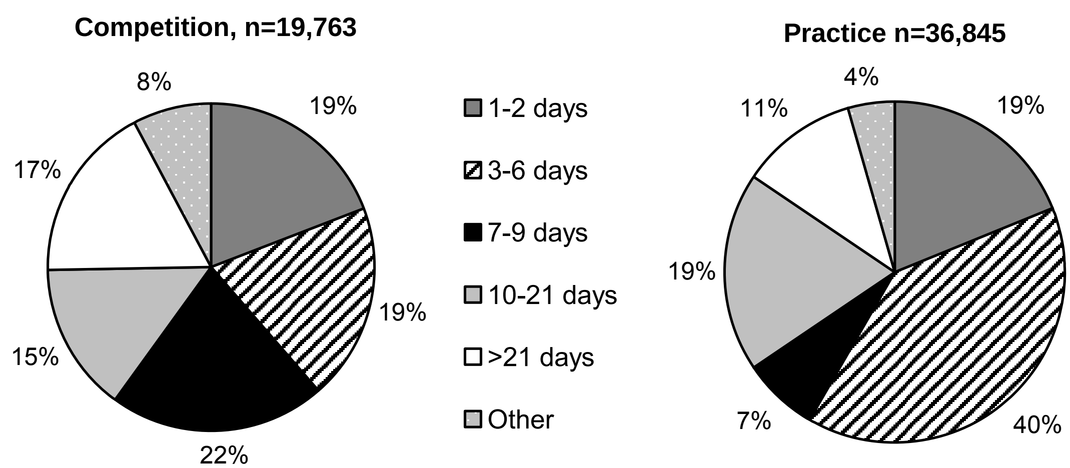


Table 6.5 Volleyball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	788	2.2%	0	0.0%	788	1.4%
Did not require surgery	18,502	97.8%	35,109	100.0%	53,611	98.6%
Total	**19,290**	**100%**	**35,109**	**100%**	**54,399**	**100%**

Figure 6.3 History of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

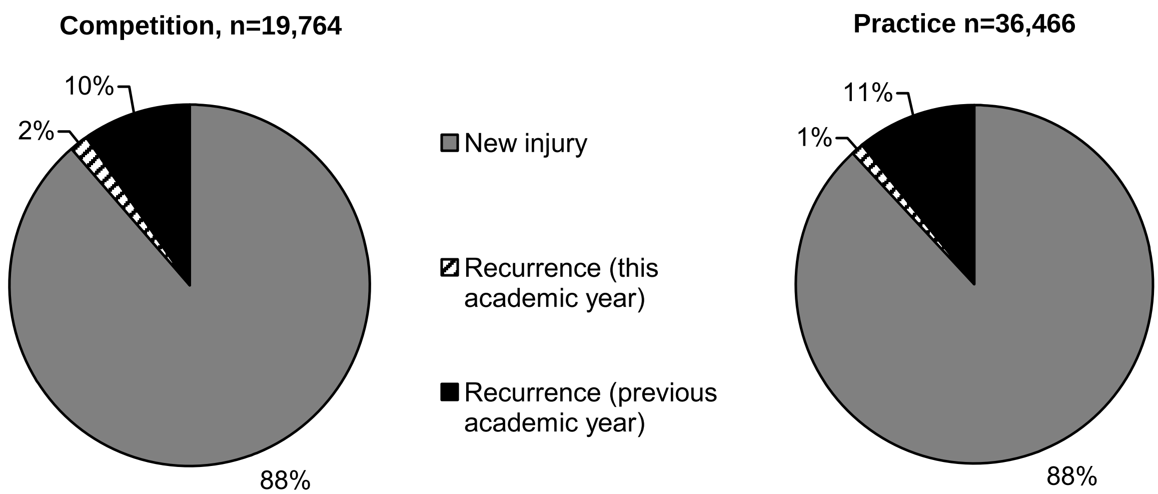


Table 6.6 Time during Season of Volleyball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Season		
Preseason	14,553	25.9%
Regular season	40,021	71.2%
Post season	1,657	2.9%
Total	**56,230**	**100%**

Table 6.7 Competition-Related Variables for Volleyball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Competition		
Pre-competition/warm-ups	3,170	16.2%
First game	4,122	21.0%
Second game	7,913	40.4%
Third game	4,399	22.4%
Total	**19,604**	**100%**
Injury Related to Foul Play		
No	19,305	100.0%
Yes, and ruled foul play	0	0.0%
Yes, but not ruled foul play	0	0.0%
Unknown	0	0.0%
Total	19,305	**100%**
Court Location		
Middle forward	7,224	39.1%
Right forward	4,987	27.0%
Left back	3,304	17.9%
Left forward	2,517	13.6%
Outside court (your side)	308	1.7%
Right back (server)	116	0.6%
Off the court	0	0.0%
Outside court (opponent's side)	0	0.0%
Total	**18,455**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Table 6.8 Practice-Related Variables for Volleyball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Practice		
First 1/2 hour	3,741	10.9%
Second 1/2 hour	10,858	31.6%
1-2 hours into practice	14,471	42.1%
>2 hours into practice	5,340	15.5%
Total	**34,410**	**100%**

Figure 6.4 Player Position of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

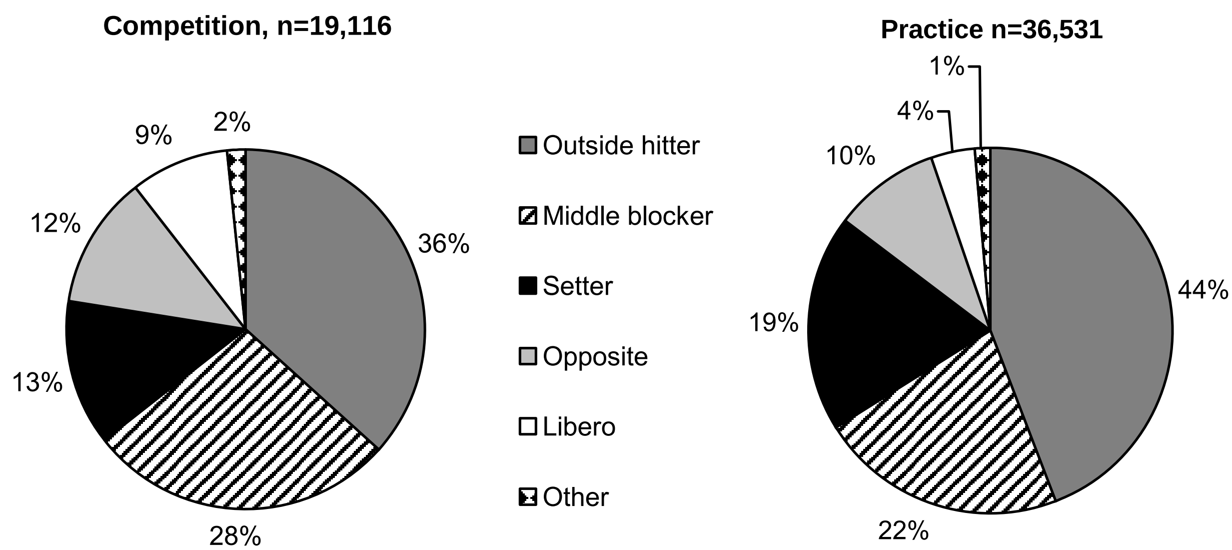
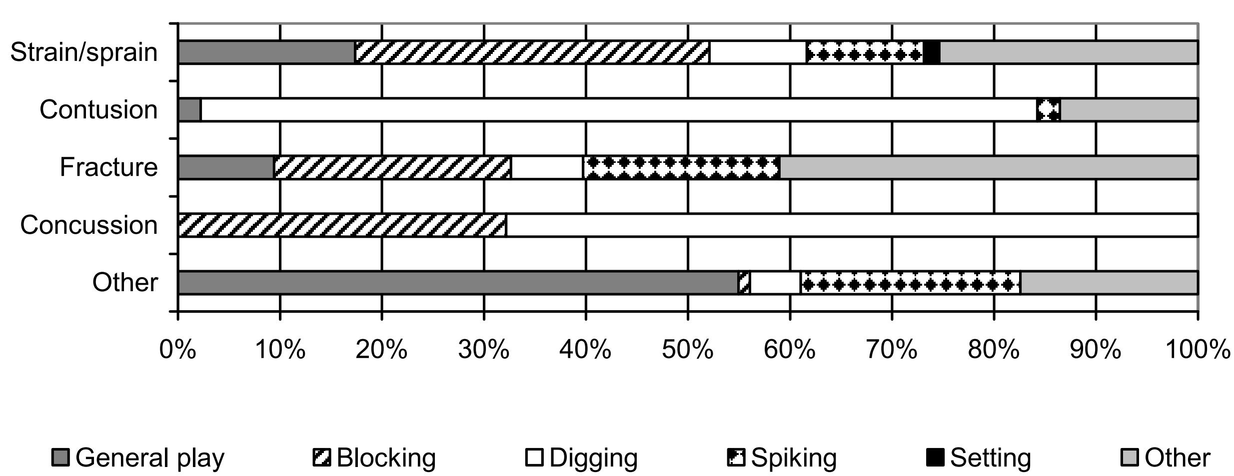


Table 6.9 Activities Leading to Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
Blocking	5,638	28.9%	8,698	24.2%	14,336	25.8%
General play	3,173	16.3%	9,339	26.0%	12,511	22.6%
Digging	6,097	31.3%	2,295	6.4%	8,392	15.1%
Spiking	1,971	10.1%	5,033	14.0%	7,004	12.6%
Passing	1,547	7.9%	4,027	11.2%	5,574	10.0%
Serving	0	0.0%	3,034	8.4%	3,034	5.5%
Conditioning	0	0.0%	2,727	7.6%	2,727	4.9%
Setting	575	2.9%	0	0.0%	575	1.0%
Other	488	2.5%	825	2.3%	1,313	2.4%
Total	**19,489**	**100%**	**35,978**	**100%**	**55,467**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Figure 6.5 Activity Resulting in Volleyball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year



VII. Boys' Basketball Injury Epidemiology

Table 7.1 Boys' Basketball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**319**	**236,419**	**1.35**	**79,230**
Competition	160	69,043	2.32	40,152
Practice	159	167,376	0.95	39,078

Table 7.2 Demographic Characteristics of Injured Boys' Basketball Athletes, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

Year in School	
Freshman	17,446 (22.0%)
Sophomore	18,118 (23.0%)
Junior	24,056 (30.5%)
Senior	19,143 (24.3%)
Total†	**78,763 (100%)**
Age (years)	
Minimum	13
Maximum	19
Mean (St. Dev.)	16.1 (1.2)
BMI	
Minimum	14.3
Maximum	42.3
Mean (St. Dev.)	22.8 (3.1)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 7.1 Diagnosis of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

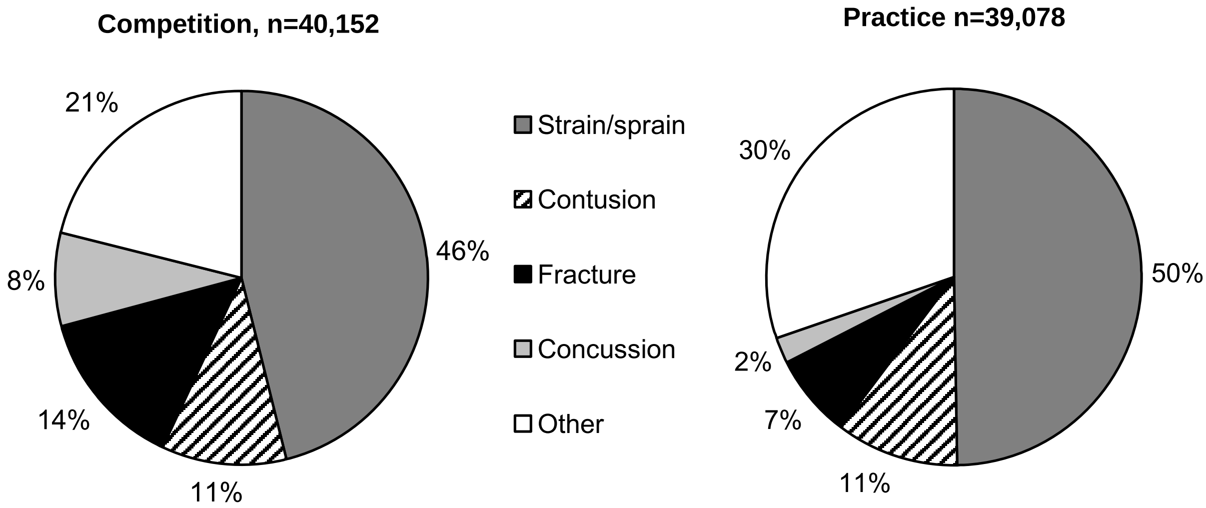


Table 7.3 Body Site of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Ankle	12,023	29.9%	11,553	29.6%	23,575	29.8%
Head/face	8,311	20.7%	4,167	10.7%	12,478	15.7%
Knee	4,905	12.2%	5,117	13.1%	10,021	12.6%
Hand/wrist	3,236	8.1%	4,571	11.7%	7,807	9.9%
Hip/thigh/upper leg	2,716	6.8%	3,792	9.7%	6,508	8.2%
Foot	2,800	7.0%	3,599	9.2%	6,399	8.1%
Trunk	1,210	3.0%	2,840	7.3%	4,050	5.1%
Shoulder	1,958	4.9%	1,269	3.2%	3,226	4.1%
Arm/elbow	1,746	4.3%	1,073	2.7%	2,819	3.6%
Lower leg	996	2.5%	633	1.6%	1,629	2.1%
Neck	0	0.0%	0	0.0%	0	0.0%
Other	251	0.6%	466	1.2%	717	0.9%
Total	**40,152**	**100%**	**39,078**	**100%**	**79,230**	**100%**

Table 7.4 Ten Most Common Boys' Basketball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition n=40,151		Practice n=39,075		Total n=79,231	
	n	%	n	%	n	%
Diagnosis						
Ankle strain/sprain	11,863	29.5%	10,999	28.1%	22,862	28.9%
Knee other	2,393	6.0%	2,543	6.5%	4,936	6.2%
Head/face other	2,703	6.7%	2,232	5.7%	4,936	6.2%
Head/face concussion	3,216	8.0%	808	2.1%	4,024	5.1%
Hip/thigh/upper leg strain/sprain	981	2.4%	2,994	7.7%	3,976	5.0%
Knee strain/sprain	1,972	4.9%	1,738	4.4%	3,710	4.7%
Hand/wrist strain/sprain	1,608	4.0%	1,229	3.1%	2,837	3.6%
Foot other	0	0.0%	2,835	7.3%	2,835	3.6%
Head/face fracture	2,175	5.4%	633	1.6%	2,808	3.5%
Hip/thigh/upper leg contusion	1,735	4.3%	2,994	7.7%	2,532	3.2%

Figure 7.2 Time Loss of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

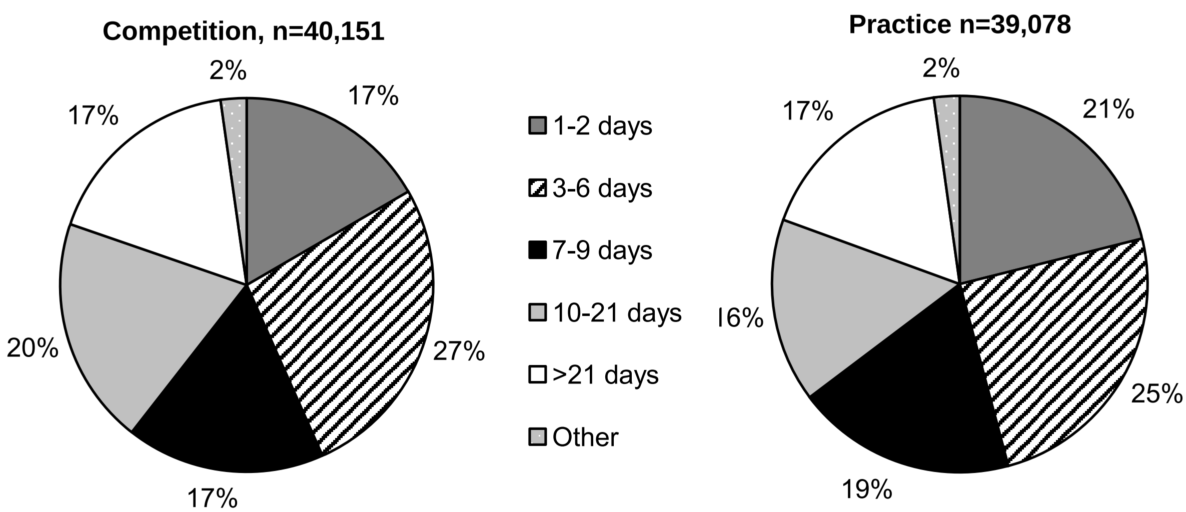


Table 7.5 Boys' Basketball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Need for surgery						
Required surgery	2,748	7.1%	2,549	6.8%	5,296	6.9%
Did not require surgery	35,885	92.9%	35,164	93.2%	71,049	93.1%
Total	**38,633**	**100%**	**37,713**	**100%**	**76,346**	**100%**

Figure 7.3 History of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

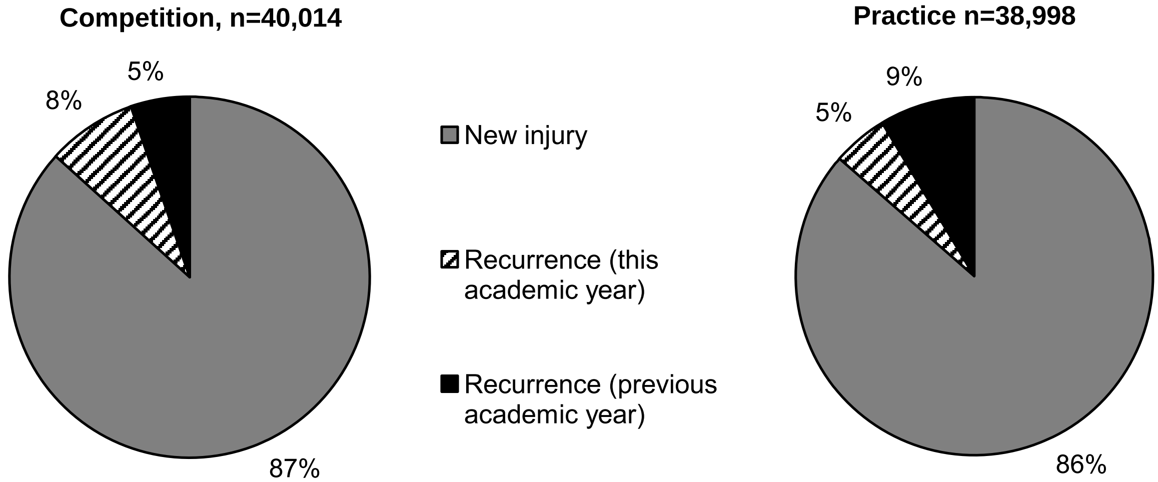


Table 7.6 Time during Season of Boys' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	**%**
Time in Season		
Preseason	14,862	18.8%
Regular season	62,870	79.4%
Post season	1,498	1.9%
Total	**79,230**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Table 7.7 Competition-Related Variables for Boys' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Competition		
Pre-competition/warm-ups	745	1.9%
First quarter	4,589	11.5%
Second quarter	9,480	23.8%
Third quarter	14,116	35.4%
Fourth quarter	10,399	26.1%
Overtime	571	1.4%
Total	**39,901**	**100%**
Injury Related to Foul Play		
No	30,685	80.9%
Yes, and ruled foul play	4,572	12.0%
Yes, but not ruled foul play	750	2.0%
Unknown	1,941	5.1%
Total	**37,948**	**100%**
Court Location		
Inside lane (offense)	10,663	26.8%
Inside lane (defense)	10,648	26.8%
Between 3 pt arc and lane (defense)	4,687	11.8%
Between 3 pt arc and lane (offense)	4,339	10.9%
Outside 3 point arc (defense)	2,964	7.4%
Outside 3 point arc (offense)	2,880	7.2%
Backcourt	2,192	5.5%
Out of bounds	1,420	3.6%
Off the court	0	0.0%
Total	**39,793**	**100%**

*Totals and n's are not always equal due to slight rounding of weighted number of injuries

Table 7.8 Practice-Related Variables for Boys' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Practice		
First 1/2 hour	4,716	13.2%
Second 1/2 hour	9,605	26.8%
1-2 hours into practice	17,313	48.4%
>2 hours into practice	4,140	11.6%
Total	**35,774**	**100%**

Figure 7.4 Player Position of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

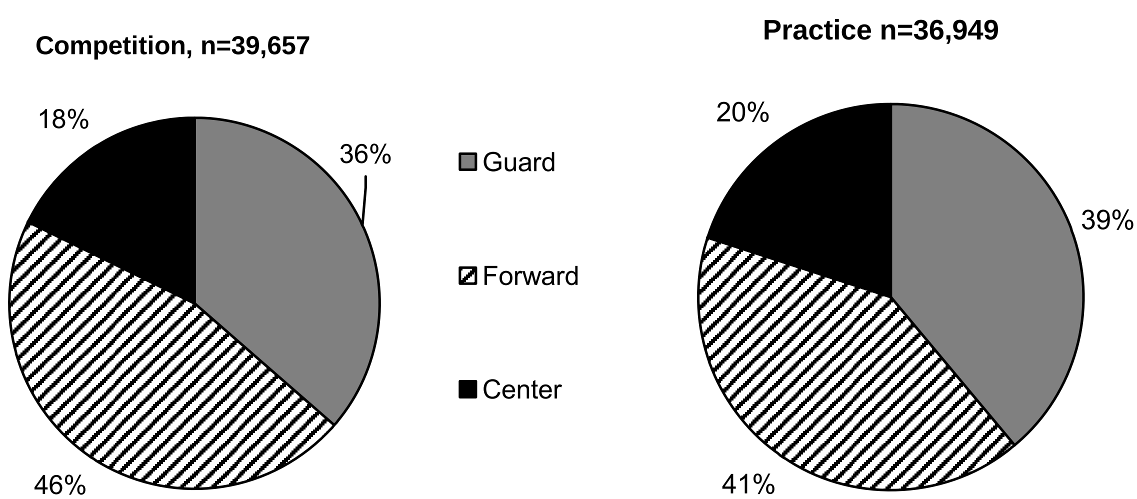
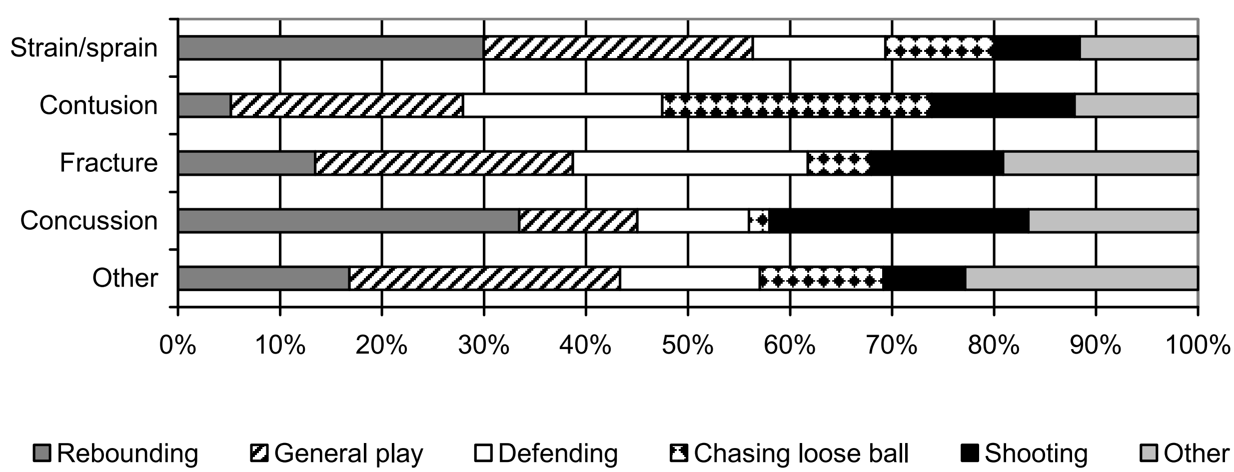


Table 7.9 Activities Leading to Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
General play	4,866	12.1%	14,701	39.0%	19,566	25.1%
Rebounding	10,982	27.4%	6,494	17.2%	17,476	22.5%
Defending	5,956	14.8%	5,592	14.8%	11,549	14.8%
Chasing loose ball	7,034	17.5%	2,177	5.8%	9,211	11.8%
Shooting	5,310	13.2%	2,659	7.1%	7,969	10.2%
Ball handling/dribbling	3,342	8.3%	1,511	4.0%	4,853	6.2%
Receiving pass	188	0.5%	2,237	5.9%	2,425	3.1%
Conditioning	251	0.6%	1,108	2.9%	1,359	1.7%
Passing	246	0.6%	108	0.3%	354	0.5%
Other	1,976	4.9%	1,094	2.9%	3,070	3.9%
Total	**40,152**	**100%**	**37,680**	**100%**	**77,832**	**100%**

Figure 7.5 Activity Resulting in Boys' Basketball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year



VIII. Girls' Basketball Injury Epidemiology

Table 8.1 Girls' Basketball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**295**	**191,871**	**1.54**	**64,933**
Competition	177	56,555	3.13	38,277
Practice	118	135,316	0.87	26,656

Table 8.2 Demographic Characteristics of Injured Girls' Basketball Athletes, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

Year in School	
Freshman	16,184 (25.3%)
Sophomore	15,619 (24.4%)
Junior	15,361 (24.0%)
Senior	16,920 (26.4%)
Total†	**64,084 (100%)**
Age (years)	
Minimum	13
Maximum	18
Mean (St. Dev.)	15.9 (1.3)
BMI	
Minimum	16.9
Maximum	40.4
Mean (St. Dev.)	22.5 (3.6)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 8.1 Diagnosis of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

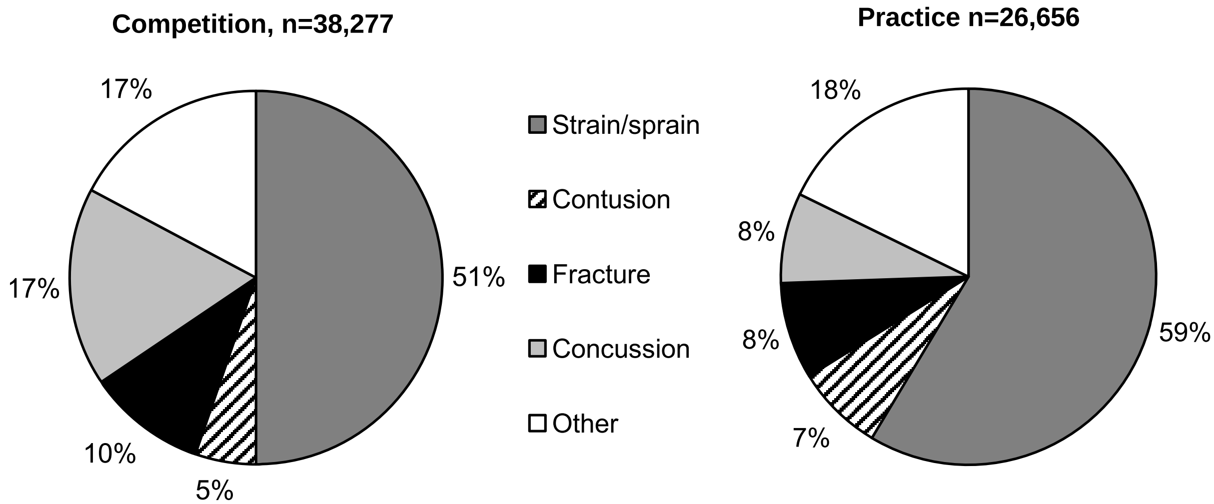


Table 8.3 Body Site of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Ankle	12,440	32.5%	7,765	29.1%	20,206	31.1%
Head/face	10,134	26.5%	2,512	9.4%	12,646	19.5%
Knee	5,455	14.3%	5,267	19.8%	10,722	16.5%
Hand/wrist	3,296	8.6%	2,788	10.5%	6,084	9.4%
Lower leg	1,925	5.0%	1,362	5.1%	3,286	5.1%
Shoulder	1,833	4.8%	1,264	4.7%	3,097	4.8%
Foot	903	2.4%	1,926	7.2%	2,829	4.4%
Trunk	907	2.4%	1,583	5.9%	2,490	3.8%
Hip/thigh/upper leg	396	1.0%	1,576	5.9%	1,972	3.0%
Neck	277	0.7%	251	0.9%	529	0.8%
Arm/elbow	349	0.9%	0	0.0%	349	0.5%
Other	360	0.9%	360	1.4%	721	1.1%
Total	**38,277**	**100%**	**26,656**	**100%**	**64,932**	**100%**

Table 8.4 Ten Most Common Girls' Basketball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition n=38,275		Practice n=26,651		Total n=64,931	
	n	%	n	%	n	%
Diagnosis						
Ankle strain/sprain	12,368	32.3%	7,350	27.6%	19,718	30.4%
Head/face concussion	6,643	17.4%	2,057	7.7%	8,700	13.4%
Knee strain/sprain	3,643	9.5%	3,270	12.3%	6,913	10.6%
Hand/wrist fracture	1,718	4.5%	903	3.4%	2,621	4.0%
Shoulder other	1,418	3.7%	808	3.0%	2,226	3.4%
Head/face other	2,229	5.8%	0	0.0%	2,229	3.4%
Hand/wrist strain/sprain	714	1.9%	1,429	5.4%	2,143	3.3%
Knee other	972	2.5%	924	3.5%	1,896	2.9%
Knee contusion	731	1.9%	1,073	4.0%	1,804	2.8%
Hip/thigh/upper leg strain/sprain	324	0.8%	1,324	5.0%	1,648	2.5%

Figure 8.2 Time Loss of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

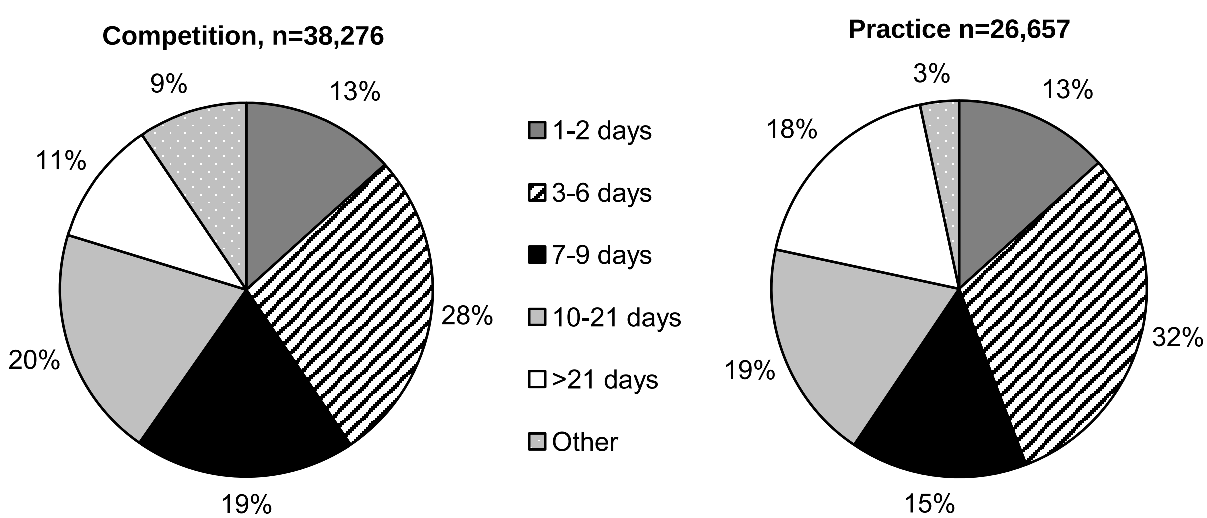


Table 8.5 Girls' Basketball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Need for surgery						
Required surgery	3,414	9.2%	2,131	8.3%	5,545	8.8%
Did not require surgery	33,619	90.8%	23,629	91.7%	57,248	91.2%
Total	**37,033**	**100%**	**25,760**	**100%**	**62,793**	**100%**

Figure 8.3 History of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

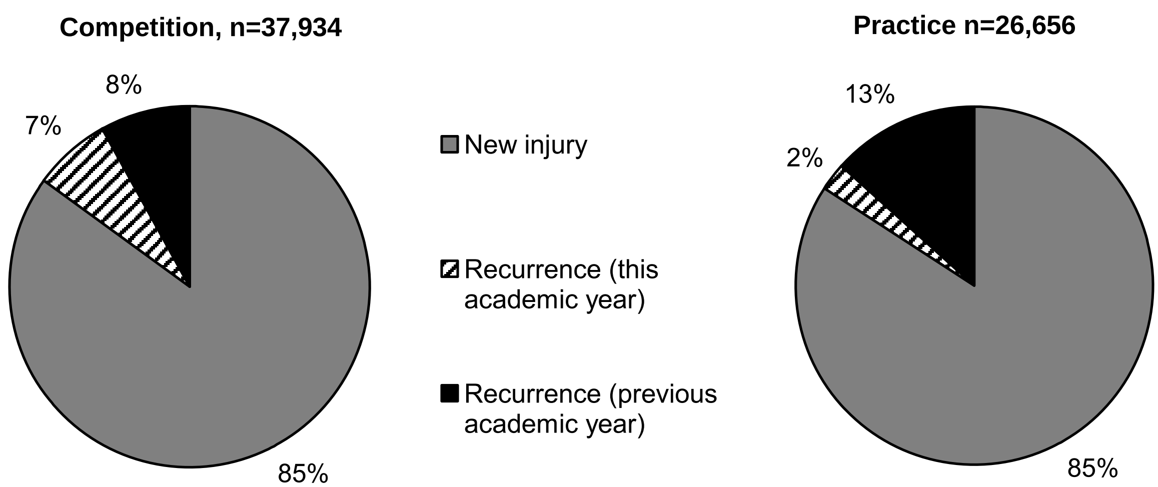


Table 8.6 Time during Season of Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Season		
Preseason	13,822	21.3%
Regular season	49,131	75.7%
Post season	1,979	3.0%
Total	**64,932**	**100%**

Table 8.7 Competition-Related Variables for Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Competition		
Pre-competition/warm-ups	1,022	2.7%
First quarter	4,310	11.6%
Second quarter	10,947	29.4%
Third quarter	10,151	27.2%
Fourth quarter	10,850	29.1%
Total	**37,280**	**100%**
Injury Related to Foul Play		
No	30,764	86.2%
Yes, and ruled foul play	1,770	5.0%
Yes, but not ruled foul play	1,921	5.4%
Unknown	1,249	3.5%
Total	**35,705**	**100%**
Court Location		
Inside lane (defense)	8,384	23.2%
Inside lane (offense)	8,255	22.8%
Outside 3 point arc (offense)	4,915	13.6%
Between 3 pt arc and lane (offense)	4,731	13.1%
Outside 3 point arc (defense)	4,388	12.1%
Between 3 pt arc and lane (defense)	3,191	8.8%
Backcourt	1,672	4.6%
Out of bounds	627	1.7%
Off the court	0	0.0%
Total	**36,165**	**100%**

Table 8.8 Practice-Related Variables for Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Practice		
First 1/2 hour	4,958	20.1%
Second 1/2 hour	6,490	26.3%
1-2 hours into practice	12,100	49.0%
>2 hours into practice	1,137	4.6%
Total	**24,686**	**100%**

Figure 8.4 Player Position of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

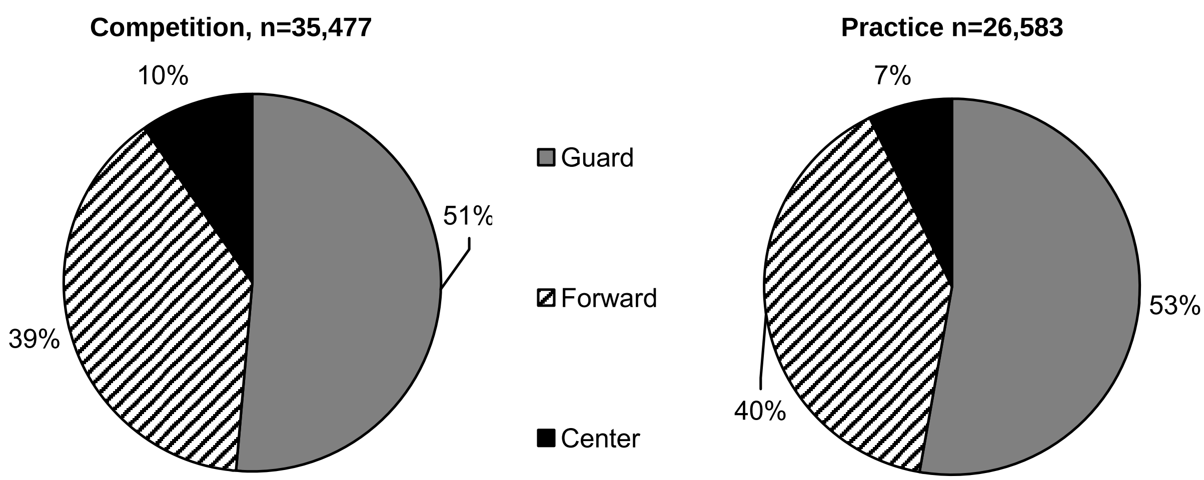
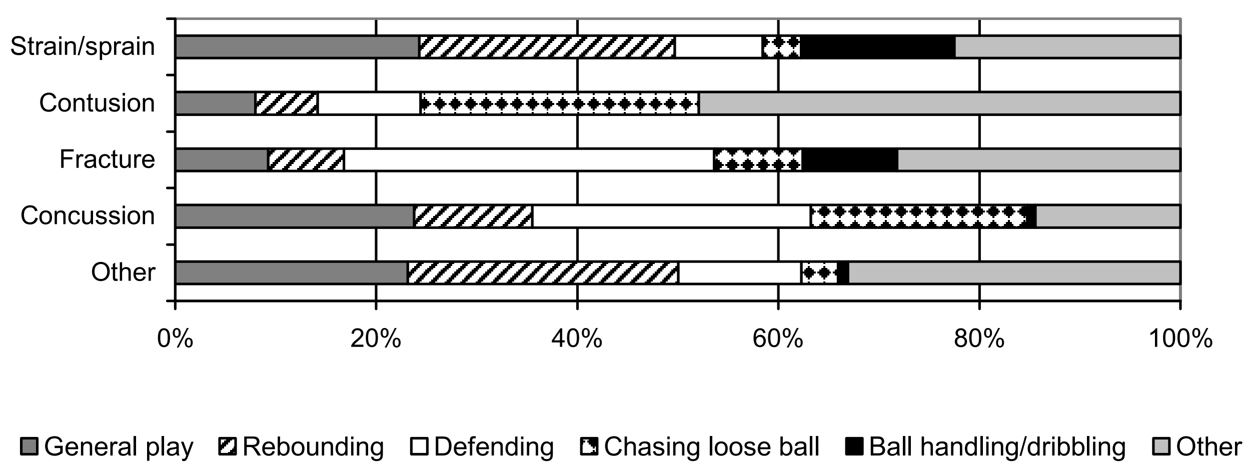


Table 8.9 Activities Leading to Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Activity						
Rebounding	8,071	21.2%	5,867	22.1%	13,939	21.6%
General play	6,348	16.7%	7,171	27.0%	13,519	20.9%
Defending	5,472	14.4%	3,970	14.9%	9,442	14.6%
Shooting	4,440	11.7%	1,598	6.0%	6,038	9.4%
Receiving pass	3,646	9.6%	2,224	8.4%	5,870	9.1%
Chasing loose ball	4,577	12.1%	679	2.6%	5,257	8.1%
Ball handling/dribbling	3,426	9.0%	866	3.3%	4,292	6.6%
Other	2,007	5.3%	4,208	15.8%	6,213	9.6%
Total	**37,987**	**100%**	**26,583**	**100%**	**64,570**	**100%**

Figure 8.5 Activity Resulting in Girls' Basketball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year



IX. Wrestling Injury Epidemiology

Table 9.1 Wrestling Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**392**	**180,641**	**2.17**	**88,996**
Competition	160	47,770	3.35	39,029
Practice	232	132,871	1.75	49,967

Table 9.2 Demographic Characteristics of Injured Wrestlers, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

Year in School	
Freshman	18,109 (20.5%)
Sophomore	24,064 (27.2%)
Junior	23,310 (26.3%)
Senior	23,024 (26.0%)
Total†	**88,507 (100%)**
Age (years)	
Minimum	14
Maximum	19
Mean (St. Dev.)	16.1 (1.3)
BMI	
Minimum	17.2
Maximum	49.0
Mean (St. Dev.)	23.7 (4.4)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 9.1 Diagnosis of Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

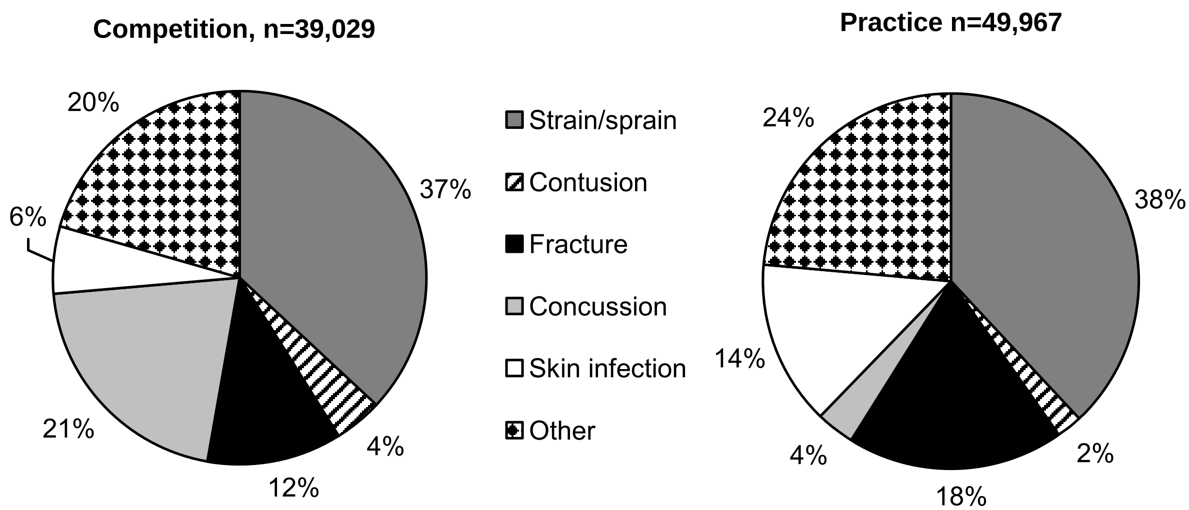


Table 9.3 Body Site of Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Shoulder	9,517	24.4%	7,106	14.2%	16,623	18.7%
Head/face	10,032	25.7%	5,201	10.4%	15,234	17.1%
Knee	3,294	8.4%	7,837	15.7%	11,130	12.5%
Hand/wrist	2,204	5.6%	8,385	16.8%	10,589	11.9%
Arm/elbow	2,900	7.4%	4,556	9.1%	7,457	8.4%
Trunk	2,905	7.4%	4,293	8.6%	7,198	8.1%
Ankle	2,434	6.2%	4,259	8.5%	6,693	7.5%
Foot	2,290	5.9%	2,536	5.1%	4,826	5.4%
Lower leg	0	0.0%	2,476	5.0%	2,476	2.8%
Neck	309	0.8%	1,187	2.4%	1,496	1.7%
Hip/thigh/upper leg	589	1.5%	679	1.4%	1,268	1.4%
Other	2,555	6.5%	1,451	2.9%	4,006	4.5%
Total	**39,029**	**100%**	**49,967**	**100%**	**88,996**	**100%**

Table 9.4 Ten Most Common Wrestling Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition n=39,029		Practice n=49,966		Total n=88,995	
	n	%	n	%	n	%
Diagnosis						
Shoulder strain/sprain	6,722	17.2%	4,663	9.3%	11,384	12.8%
Head/face concussion	8,086	20.7%	1,771	3.5%	9,858	11.1%
Ankle strain/sprain	2,364	6.1%	3,544	7.1%	5,908	6.6%
Knee other	1,474	3.8%	3,951	7.9%	5,425	6.1%
Head/face other	1,876	4.8%	3,311	6.6%	5,187	5.8%
Hand/wrist fracture	160	0.4%	4,989	10.0%	5,150	5.8%
Shoulder other	2,795	7.2%	2,325	4.7%	5,120	5.8%
Knee strain/sprain	1,567	4.0%	3,455	6.9%	5,022	5.6%
Hand/wrist other	1,382	3.5%	2,153	4.3%	3,535	4.0%
Arm/elbow other	695	1.8%	2,609	5.2%	3,304	3.7%

Figure 9.2 Time Loss of Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

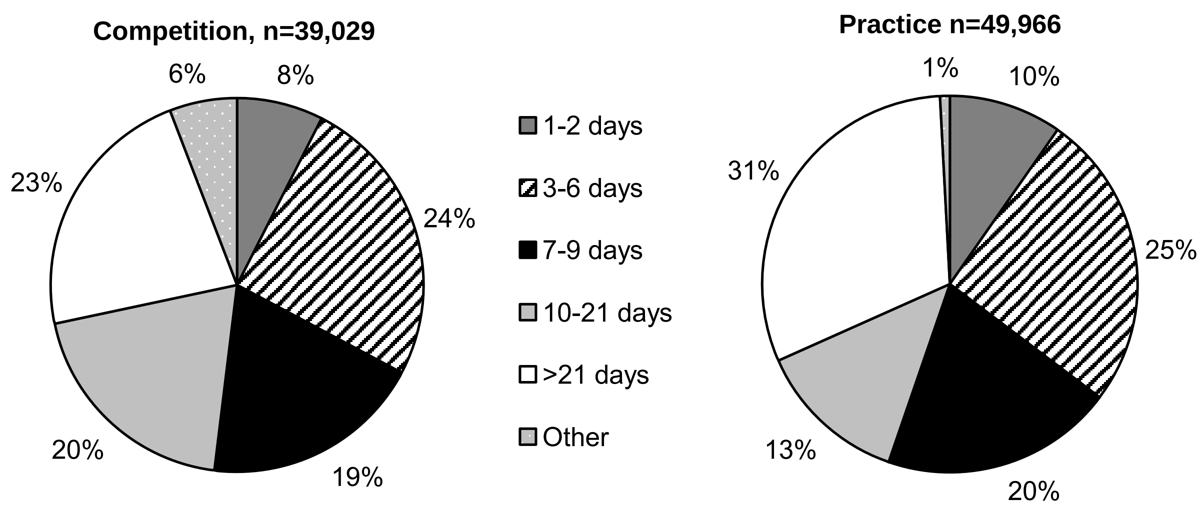


Table 9.5 Wrestling Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	2,090	5.7%	2,872	5.9%	4,961	5.8%
Did not require surgery	34,275	94.3%	46,198	94.1%	80,473	94.2%
Total	**36,365**	**100%**	**49,070**	**100%**	**85,435**	**100%**

Figure 9.3 History of Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

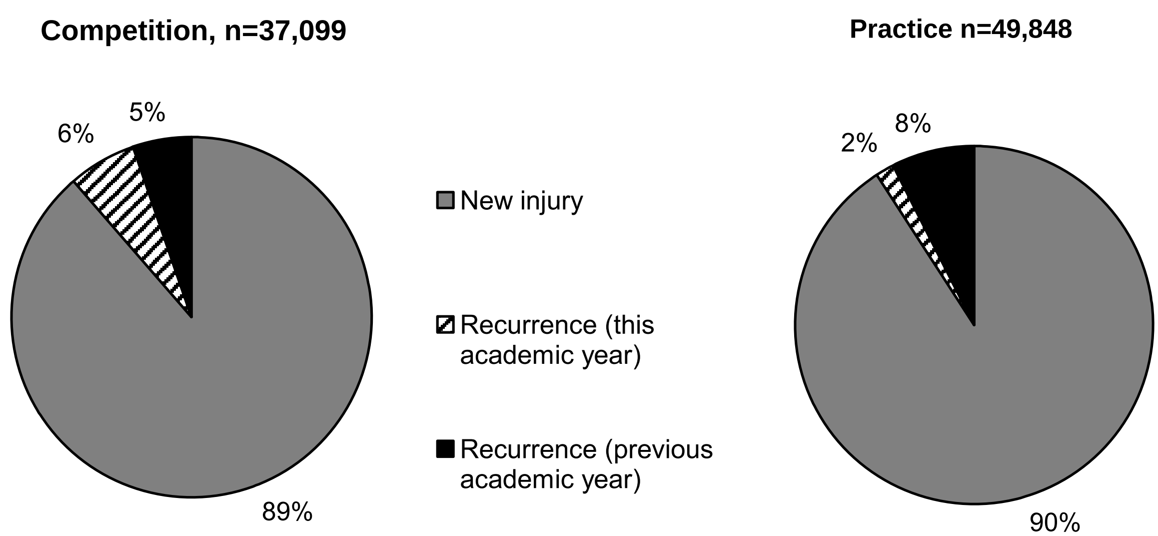


Table 9.6 Time during Season of Wrestling Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Season		
Preseason	16,551	19.0%
Regular season	67,052	76.9%
Post season	3,642	4.2%
Total	**87,244**	**100%**

Table 9.7 Competition-Related Variables for Wrestling Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Competition		
Pre-competition/warm-ups	611	1.7%
First period	5,971	16.7%
Second period	19,127	53.6%
Third period	9,483	26.6%
Overtime	462	1.3%
Total	**35,655**	**100%**
Injury Related to Foul Play		
No	27,461	81.0%
Yes, and ruled foul play	0	0.0%
Yes, but not ruled foul play	3,283	9.7%
Unknown	3,147	9.3%
Total	**33,892**	**100%**
Mat Location*		
Within circle	72,995	85.4%
Out of bounds	5,450	6.4%
Off mat	7,053	8.2%
Total	**85,498**	**100%**

*ATCs were asked to provide the mat location for both competition- and practice-related wrestling injuries.

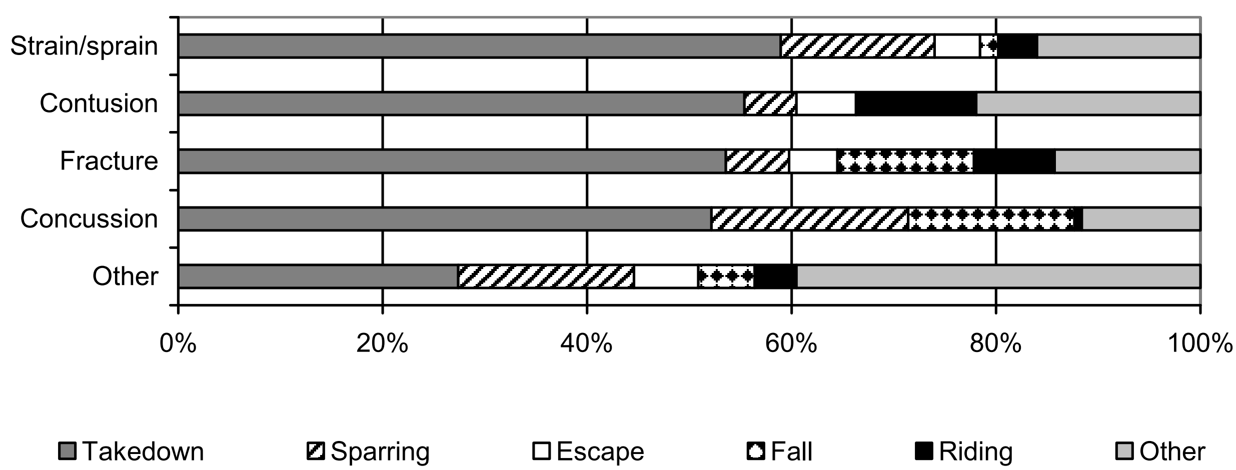
Table 9.8 Practice-Related Variables for Wrestling Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Practice		
First 1/2 hour	4,266	9.5%
Second 1/2 hour	9,430	21.1%
1-2 hours into practice	26,412	59.0%
>2 hours into practice	4,643	10.4%
Total	**44,750**	**100%**

Table 9.9 Activities Leading to Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
Takedown	18,492	50.3%	22,523	45.2%	41,014	47.3%
Sparring	3,527	9.6%	9,042	18.1%	12,569	14.5%
N/A (Skin infection, heat illness)	571	1.6%	6,815	13.7%	7,386	8.5%
Fall	3,412	9.3%	2,098	4.2%	5,510	6.4%
Escape	1,763	4.8%	2,226	4.5%	3,989	4.6%
Riding	1,706	4.6%	2,123	4.3%	3,830	4.4%
Conditioning	372	1.0%	2,898	5.8%	3,270	3.8%
Reversal	393	1.1%	1,372	2.8%	1,765	2.0%
Other	6,562	17.8%	751	1.5%	7,313	8.4%
Total	**36,798**	**100%**	**49,848**	**100%**	**86,646**	**100%**

Figure 9.4 Activity Resulting in Wrestling Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year



X. Baseball Injury Epidemiology

Table 10.1 Baseball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**144**	**185,622**	**0.78**	**39,869**
Competition	86	65,359	1.32	25,584
Practice	58	120,263	0.48	14,285

Table 10.2 Demographic Characteristics of Injured Baseball Athletes, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

Year in School	
Freshman	7,980 (20.1%)
Sophomore	11,441 (28.8%)
Junior	11,750 (29.5%)
Senior	8,622 (21.7%)
Total†	**39,793 (100%)**
Age (years)	
Minimum	14
Maximum	19
Mean (St. Dev.)	16.2 (1.1)
BMI	
Minimum	18.7
Maximum	38.1
Mean (St. Dev.)	24.9 (3.7)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 10.1 Diagnosis of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

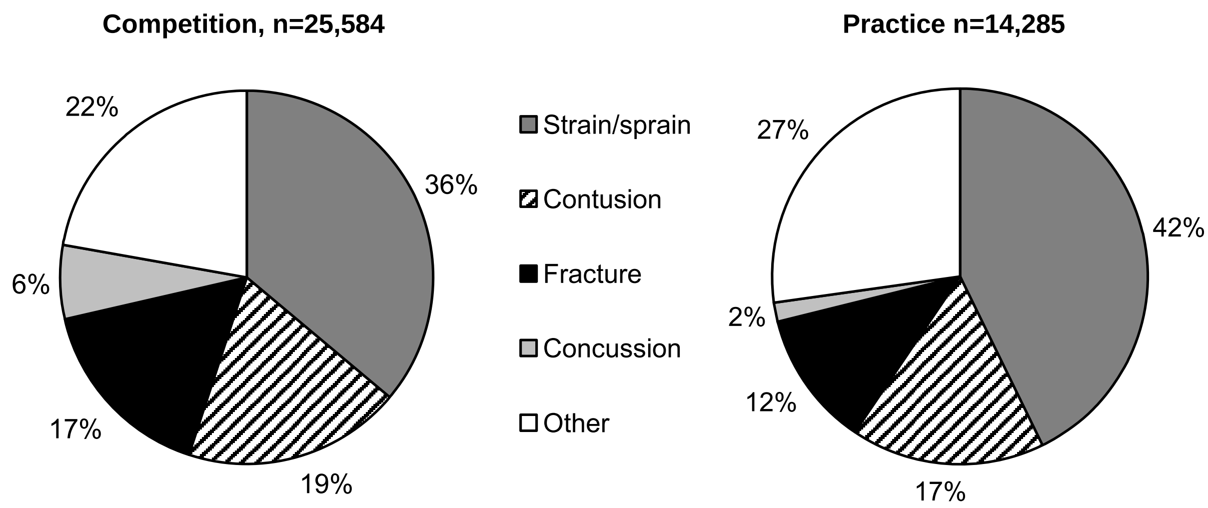


Table 10.3 Body Site of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Head/face	6,276	24.5%	2,967	20.8%	9,243	23.2%
Shoulder	4,210	16.5%	3,057	21.4%	7,267	18.2%
Hand/wrist	3,720	14.5%	2,377	16.6%	6,097	15.3%
Arm/elbow	3,636	14.2%	644	4.5%	4,280	10.7%
Hip/thigh/upper leg	1,463	5.7%	1,640	11.5%	3,103	7.8%
Ankle	1,601	6.3%	570	4.0%	2,171	5.4%
Knee	1,467	5.7%	702	4.9%	2,169	5.4%
Lower leg	1,863	7.3%	208	1.5%	2,071	5.2%
Trunk	769	3.0%	983	6.9%	1,752	4.4%
Foot	580	2.3%	920	6.4%	1,500	3.8%
Neck	0	0.0%	77	0.5%	77	0.2%
Other	0	0.0%	141	1.0%	141	0.4%
Total	**25,584**	**100%**	**14,285**	**100%**	**39,870**	**100%**

Table 10.4 Ten Most Common Baseball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition n=25,583		Practice n=14,284		Total n=39,869	
	n	%	n	%	n	%
Diagnosis						
Shoulder strain/sprain	2,796	10.9%	1,917	13.4%	4,713	11.8%
Head/face contusion	2,713	10.6%	1,336	9.4%	4,049	10.2%
Hip/thigh/upper leg strain/sprain	1,255	4.9%	1,344	9.4%	2,600	6.5%
Arm/elbow strain/sprain	1,883	7.4%	503	3.5%	2,386	6.0%
Hand/wrist fracture	1,253	4.9%	1,045	7.3%	2,297	5.8%
Ankle strain/sprain	1,601	6.3%	570	4.0%	2,171	5.4%
Shoulder other	856	3.3%	1,140	8.0%	1,996	5.0%
Head/face concussion	1,637	6.4%	221	1.5%	1,858	4.7%
Knee other	1,259	4.9%	561	3.9%	1,820	4.6%
Head/face other	946	3.7%	765	5.4%	1,711	4.3%

Figure 10.2 Time Loss of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

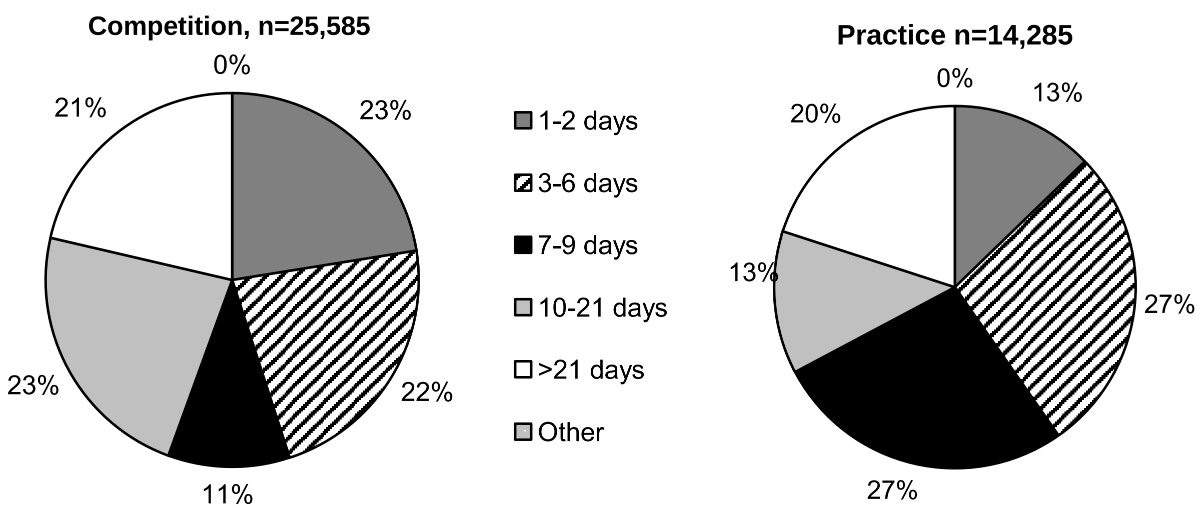


Table 10.5 Baseball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	1,929	7.8%	1,467	10.3%	3,397	8.7%
Did not require surgery	22,799	92.2%	12,818	89.7%	35,617	91.3%
Total	**24,728**	**100%**	**14,285**	**100%**	**39,013**	**100%**

Figure 10.3 History of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

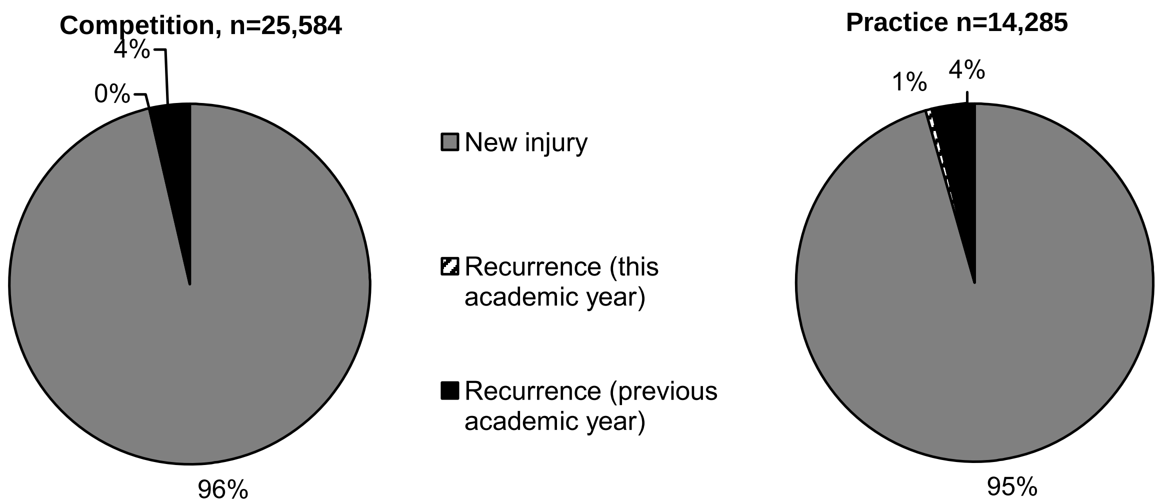


Table 10.6 Time during Season of Baseball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Season		
Preseason	8,349	20.9%
Regular season	29,558	74.1%
Post season	1,963	4.9%
Total	**39,870**	**100%**

Table 10.7 Competition-Related Variables for Baseball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Competition		
Pre-competition/warm-ups	608	2.4%
First inning	3,038	11.9%
Second inning	2,511	9.8%
Third inning	4,529	17.8%
Fourth inning	5,820	22.8%
Fifth inning	4,289	16.8%
Sixth inning	2,806	11.0%
Seventh inning	1,906	7.5%
Total	**25,508**	**100%**
Injury Related to Foul Play		
No	22,582	95.8%
Yes, and ruled foul play	295	1.3%
Yes, but not ruled foul play	702	3.0%
Unknown	0	0.0%
Total	**23,580**	**100%**
Field Location		
First base	5,132	20.1%
Home plate	3,929	15.4%
Second base	3,876	15.2%
Third base	3,604	14.1%
Outfield	3,407	13.4%
Pitcher's mound	2,896	11.4%
Infield	1,807	7.1%
Foul territory	0	0.0%
Other	856	3.4%
Total	**25,508**	**100%**

Table 10.8 Practice-Related Variables for Baseball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Practice		
First 1/2 hour	1,500	11.7%
Second 1/2 hour	1,345	10.5%
1-2 hours into practice	8,032	62.8%
>2 hours into practice	1,905	14.9%
Total	**12,782**	**100%**

Figure 10.4 Player Position of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

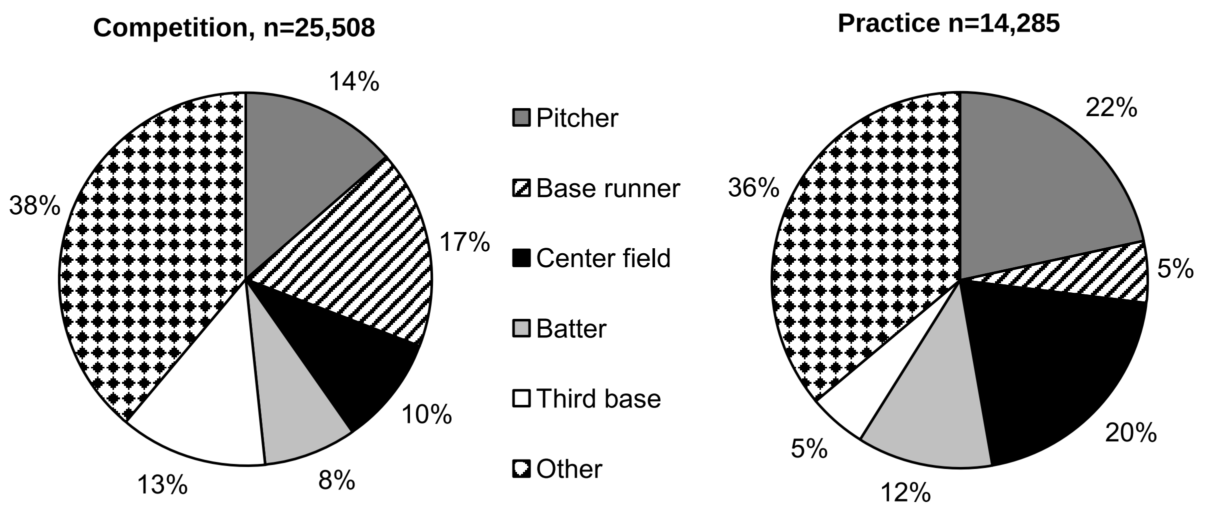
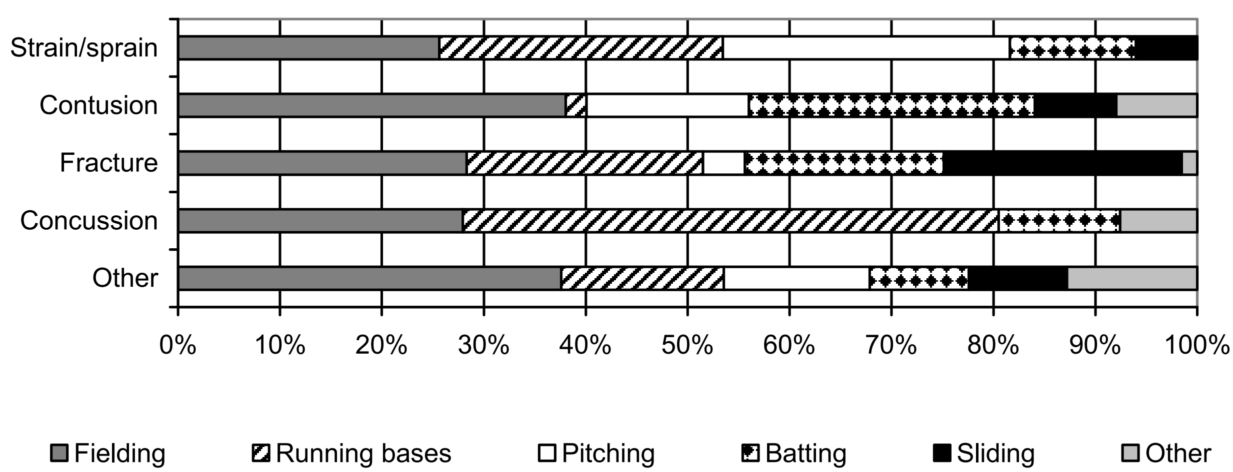


Table 10.9 Activities Leading to Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
Fielding	6,981	27.3%	3,732	26.3%	10,713	26.9%
Running bases	5,449	21.3%	1,458	10.3%	6,907	17.4%
Pitching	2,612	10.2%	3,242	22.8%	5,854	14.7%
Batting	3,715	14.5%	1,723	12.1%	5,437	13.7%
Sliding	2,873	11.2%	361	2.5%	3,235	8.1%
General play	1,320	5.2%	1,433	10.1%	2,752	6.9%
Throwing (not pitching)	1,390	5.4%	567	4.0%	1,957	4.9%
Catching	0	0.0%	578	4.1%	578	1.5%
Conditioning	0	0.0%	557	3.9%	557	1.4%
Other	1,244	4.9%	558	3.9%	1,803	4.5%
Total	**25,584**	**100%**	**14,209**	**100%**	**39,793**	**100%**

Figure 10.5 Activity Resulting in Baseball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year



XI. Softball Injury Epidemiology

Table 11.1 Softball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**146**	**141,008**	**1.04**	**49,831**
Competition	80	49,318	1.62	28,688
Practice	66	91,690	0.72	21,143

Table 11.2 Demographic Characteristics of Injured Softball Athletes, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year*

Year in School	
Freshman	13,923 (28.3%)
Sophomore	13,668 (27.7%)
Junior	10,001 (20.3%)
Senior	11,678 (23.7%)
Total†	**49,270 (100%)**
Age (years)	
Minimum	14
Maximum	18
Mean (St. Dev.)	15.9 (1.3)
BMI	
Minimum	16.8
Maximum	34.1
Mean (St. Dev.)	23.4 (3.7)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Figure 11.1 Diagnosis of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

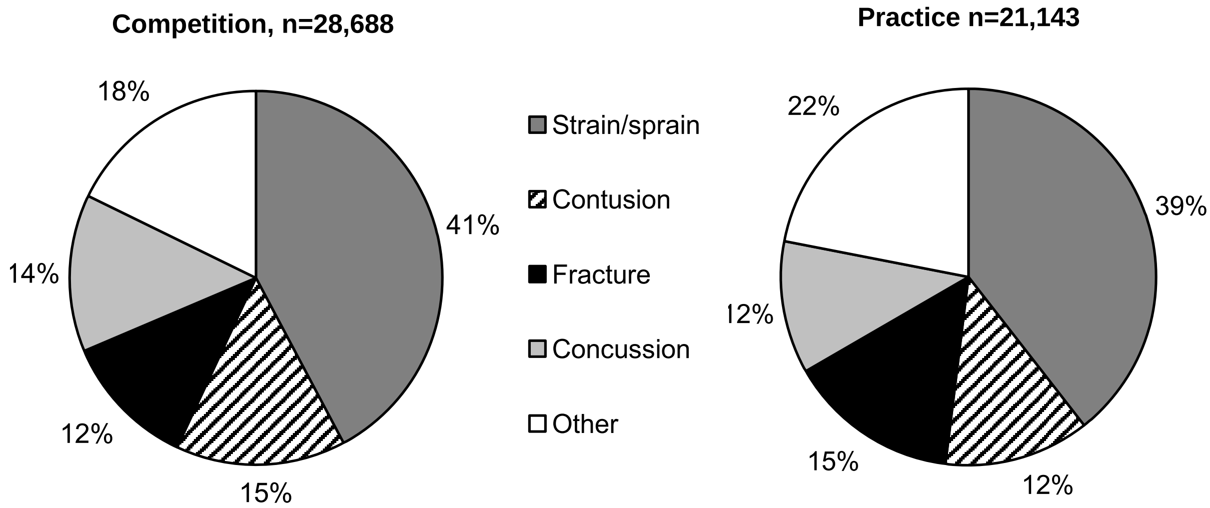


Table 11.3 Body Site of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Head/face	6,189	21.6%	3,818	18.1%	10,007	20.1%
Hand/wrist	5,736	20.0%	2,575	12.2%	8,311	16.7%
Knee	5,207	18.1%	2,521	11.9%	7,728	15.5%
Ankle	3,297	11.5%	3,534	16.7%	6,831	13.7%
Shoulder	2,975	10.4%	826	3.9%	3,800	7.6%
Arm/elbow	910	3.2%	2,663	12.6%	3,573	7.2%
Hip/thigh/upper leg	1,013	3.5%	2,234	10.6%	3,247	6.5%
Lower leg	1,231	4.3%	1,284	6.1%	2,515	5.0%
Trunk	1,216	4.2%	1,041	4.9%	2,257	4.5%
Foot	576	2.0%	647	3.1%	1,223	2.5%
Neck	340	1.2%	0	0.0%	340	0.7%
Other	0	0.0%	0	0.0%	0	0.0%
Total	**28,688**	**100%**	**21,143**	**100%**	**49,831**	**100%**

Table 11.4 Ten Most Common Softball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition n=28,688		Practice n=21,142		Total n=49,829	
	n	%	n	%	n	%
Diagnosis						
Head/face concussion	3,901	13.6%	2,432	11.5%	6,332	12.7%
Ankle strain/sprain	3,223	11.2%	2,634	12.5%	5,857	11.8%
Hand/wrist fracture	2,340	8.2%	2,088	9.9%	4,428	8.9%
Knee strain/sprain	3,362	11.7%	676	3.2%	4,038	8.1%
Knee other	1,165	4.1%	1,845	8.7%	3,010	6.0%
Hand/wrist strain/sprain	2,451	8.5%	413	2.0%	2,864	5.7%
Hip/thigh/upper leg strain/sprain	673	2.3%	1,998	9.5%	2,671	5.4%
Shoulder other	1,822	6.4%	826	3.9%	2,648	5.3%
Head/face contusion	1,239	4.3%	1,386	6.6%	2,625	5.3%
Trunk strain/sprain	599	2.1%	1,041	4.9%	1,640	3.3%

Figure 11.2 Time Loss of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

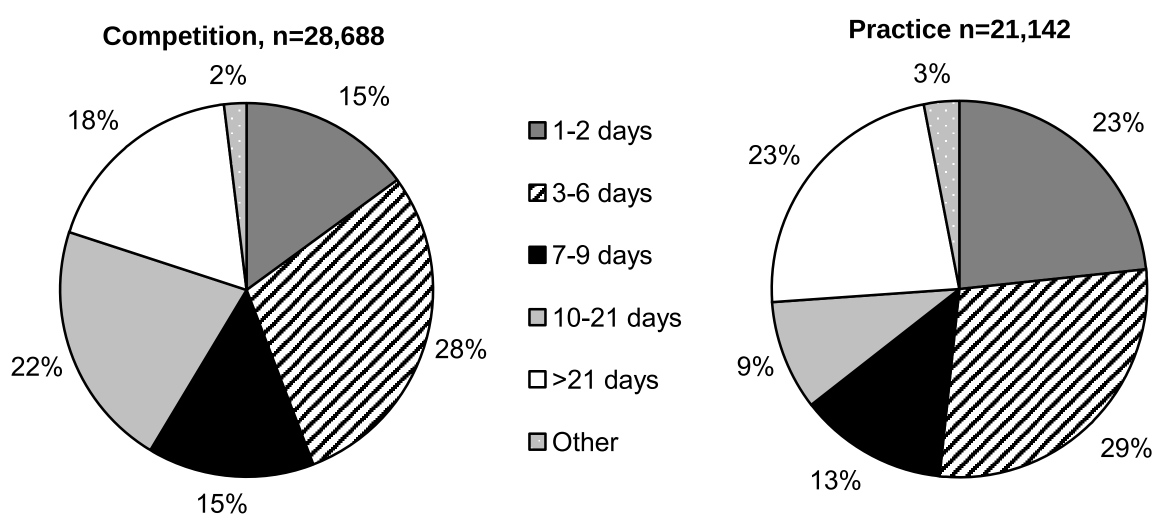


Table 11.5 Softball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Need for surgery						
Required surgery	3,032	11.0%	74	0.4%	3,105	6.4%
Did not require surgery	24,491	89.0%	20,921	99.6%	45,413	93.6%
Total	**27,523**	**100%**	**20,995**	**100%**	**48,518**	**100%**

Figure 11.3 History of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

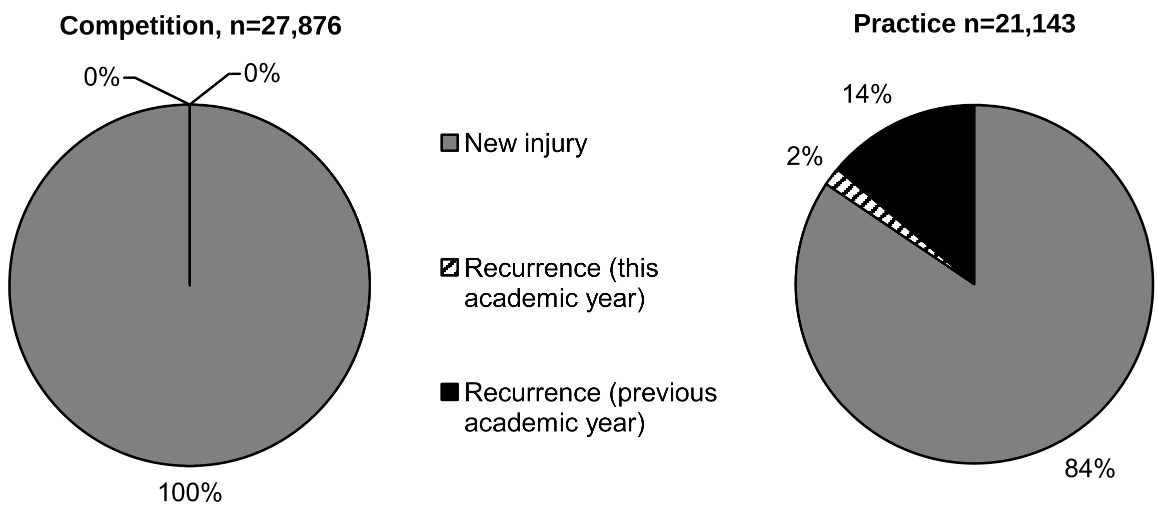


Table 11.6 Time during Season of Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Season		
Preseason	11,115	22.3%
Regular season	35,691	71.6%
Post season	3,025	6.1%
Total	**49,831**	**100%**

Table 11.7 Competition-Related Variables for Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Competition		
Pre-competition/warm-ups	487	1.7%
First inning	2,801	10.0%
Second inning	791	2.8%
Third inning	7,425	26.6%
Fourth inning	7,384	26.5%
Fifth inning	3,840	13.8%
Sixth inning	3,407	12.2%
Seventh inning	1,770	6.3%
Total	**27,905**	**100%**
Injury Related to Foul Play		
No	25,034	91.7%
Yes, and ruled foul play	813	3.0%
Yes, but not ruled foul play	0	0.0%
Unknown	1,443	5.3%
Total	**27,290**	**100%**
Field Location		
Home plate	10,711	37.8%
Second base	4,623	16.3%
Third base	3,772	13.3%
Outfield	3,728	13.2%
Pitcher's mound	2,503	8.8%
First base	2,270	8.0%
Infield	699	2.5%
Foul territory	0	0.0%
Other	0	0.0%
Total	**28,305**	**100%**

Table 11.8 Practice-Related Variables for Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	n	%
Time in Practice		
First 1/2 hour	7,076	36.5%
Second 1/2 hour	4,606	23.8%
>2 hours into practice	2,298	11.9%
1-2 hours into practice	5,382	27.8%
Total	**19,362**	**100%**

Figure 11.4 Player Position of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

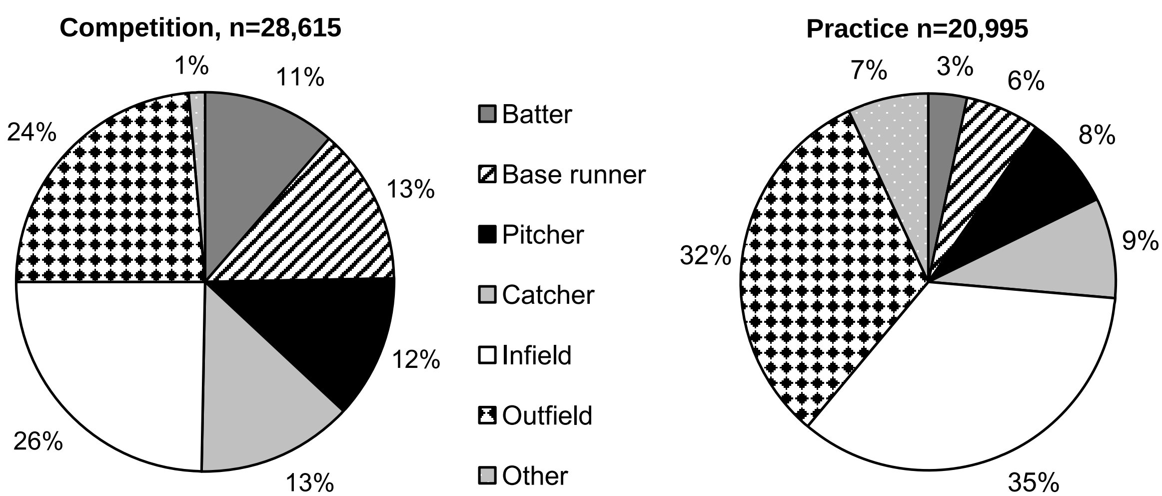
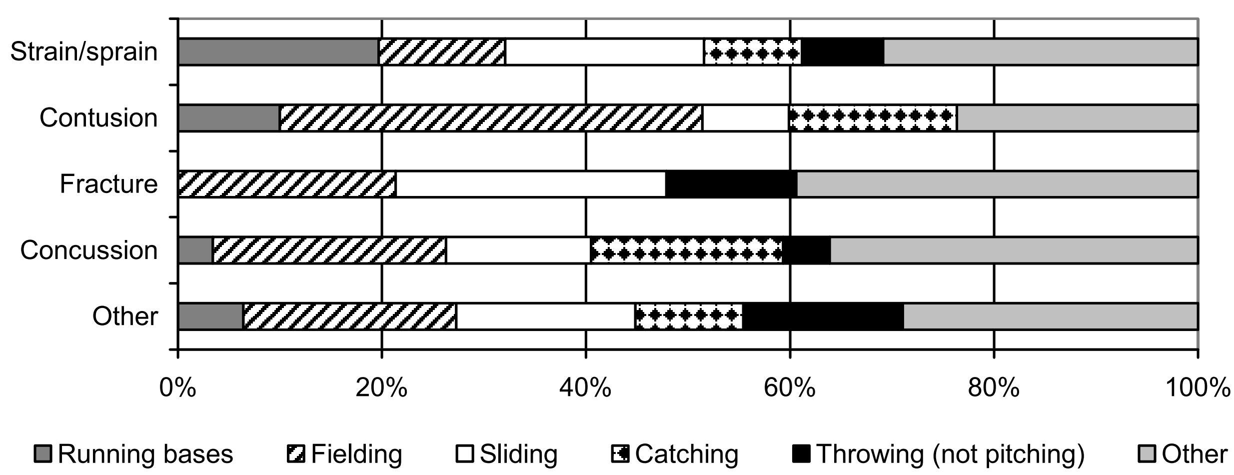


Table 11.9 Activities Leading to Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
Fielding	5,863	20.5%	4,320	20.5%	10,183	20.5%
Sliding	7,342	25.7%	1,535	7.3%	8,877	17.9%
Batting	4,628	16.2%	1,927	9.1%	6,554	13.2%
Running bases	2,735	9.6%	2,807	13.3%	5,542	11.2%
Catching	3,705	12.9%	1,582	7.5%	5,287	10.6%
Throwing (not pitching)	1,090	3.8%	3,160	15.0%	4,250	8.6%
Pitching	2,225	7.8%	576	2.7%	2,802	5.6%
Conditioning	0	0.0%	1,783	8.5%	1,783	3.6%
General play	337	1.2%	957	4.5%	1,293	2.6%
Other	690	2.4%	2,422	11.5%	3,113	6.3%
Total	**28,615**	**100%**	**21,069**	**100%**	**49,684**	**100%**

Figure 11.5 Activity Resulting in Softball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year



XII. Gender Differences within Sports

12.1 Boys' and Girls' Soccer

Table 12.1 Comparison of Boys' and Girls' Soccer Injury Rates, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' soccer	Girls' soccer*	RR (95% CI)†
Total	1.62	**2.07**	**1.27 (1.10-1.47)**
Competition	3.43	**4.59**	**1.34 (1.12-1.61)**
Practice	0.87	**1.00**	1.16 (0.91-1.47)

*Throughout this chapter, rate ratios (RR) and injury proportion ratios (IPR) compare the gender with a higher injury rate/proportion (bolded) to the gender with a lower injury rate/proportion.
†Throughout this chapter, statistically significant RR and IPR are bolded.

Table 12.2 Comparison of Body Sites of Boys' and Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Body Site			
Ankle	16.5%	**18.3%**	1.11 (0.75-1.64)
Knee	11.8%	**15.7%**	1.33 (0.87-2.05)
Head/face	12.4%	**18.5%**	1.49 (0.99-2.25)
Hip/thigh/upper leg	17.5%	**17.6%**	1.01 (0.69-1.47)
Hand/wrist	**6.4%**	2.7%	2.40 (0.93-6.22)
Shoulder	**3.8%**	1.3%	2.87 (1.09-7.55)
Trunk	**5.8%**	4.3%	1.36 (0.58-3.19)
Lower leg	**13.6%**	6.1%	**2.24 (1.25-4.01)**
Arm/elbow	1.6%	**2.1%**	1.28 (0.36-4.61)
Foot	**9.8%**	7.0%	1.40 (0.73-2.66)
Neck	0.4%	**1.8%**	4.02 (0.61-26.59)
Other	0.4%	**4.7%**	**11.63 (3.07-43.97)**
Total	**100%**	**100%**	---

Table 12.3 Comparison of Diagnoses of Boys' and Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Diagnosis			
Strain/sprain	44.7%	**51.8%**	1.16 (0.96-1.40)
Contusion	**13.2%**	7.9%	**1.68 (1.03-2.75)**
Fracture	**15.3%**	5.7%	**2.67 (1.50-4.72)**
Concussion	9.5%	**16.3%**	**1.71 (1.07-2.73)**
Other	17.2%	**18.3%**	1.06 (0.71-1.59)
Total	**100%**	**100%**	---

Table 12.4 Most Common Boys' and Girls' Soccer Injury Diagnoses*, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Diagnosis			
Ankle strain/sprain	13.7%	**17.2%**	1.25 (0.83-1.90)
Head/face concussion	9.5%	**16.3%**	**1.71 (1.07-2.73)**
Hip/thigh/upper leg strain/sprain	13.8%	**15.7%**	1.13 (0.75-1.72)
Knee strain/sprain	5.0%	**7.8%**	1.57 (0.83-2.97)
Hand/wrist fracture	**5.3%**	1.0%	**5.33 (1.17-24.33)**

*Only includes diagnoses accounting for >5% of boys' or girls' soccer injuries.

Table 12.5 Comparison of Time Loss of Boys' and Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Time Loss			
1-2 days	**15.1%**	8.5%	**1.77 (1.11-2.80)**
3-6 days	28.4%	**30.7%**	1.08 (0.81-1.44)
7-9 days	16.5%	**22.2%**	1.35 (0.92-1.97)
10-21 days	17.3%	**20.2%**	1.16 (0.81-1.68)
22 days or more	**16.7%**	10.0%	**1.67 (1.04-2.68)**
Other	6.0%	**8.3%**	1.39 (0.73-2.65)
Total	**100%**	**100%**	---

Table 12.6 Comparison of Mechanisms of Boys' and Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Soccer Mechanism			
Contact with another player	29.1%	**31.5%**	1.08 (0.83-1.42)
Stepped on/fell on/kicked	**11.4%**	8.9%	1.28 (0.76-2.15)
Rotation around a planted foot/inversion	**13.8%**	12.1%	1.14 (0.70-1.87)
Overuse, heat illness, conditioning, etc.	16.3%	**22.3%**	1.37 (0.92-2.04)
Contact with ball	11.0%	**11.2%**	1.02 (0.60-1.71)
Uneven playing surface	**2.7%**	1.7%	1.55 (0.63-3.82)
Slide tackle	**8.7%**	3.5%	**2.47 (1.37- 4.46)**
Contact with goal	**0.5%**	0.0%	---
Other	6.5%	**8.7%**	1.35 (0.76-2.41)
Total	**100%**	**100%**	---

Table 12.7 Comparison of Activities of Boys' and Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Soccer Activity			
General play	23.2%	**35.8%**	**1.54 (1.14-2.09)**
Defending	11.2%	**14.2%**	1.27 (0.79-2.04)
Chasing loose ball	9.5%	**12.2%**	1.29 (0.91-1.03)
Ball handling/dribbling	**13.2%**	6.9%	**1.92 (1.13-3.22)**
Goaltending	**9.4%**	5.8%	1.64 (0.89-2.93)
Shooting (foot)	**6.8%**	5.8%	1.18 (0.57-2.42)
Heading ball	**5.4%**	4.2%	1.30 (0.62-2.74)
Passing (foot)	**6.9%**	4.4%	1.57 (0.70-3.48)
Receiving pass	3.6%	**4.2%**	1.19 (0.54-2.61)
Other	**10.8%**	6.4%	**1.69 (1.01-2.85)**
Total	**100%**	**100%**	---

12.2 Boys' and Girls' Basketball

Table 12.8 Comparison of Boys' and Girls' Basketball Injury Rates, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' basketball	Girls' basketball	RR (95% CI)*
Total	1.35	**1.54**	1.14 (0.97-1.33)
Competition	2.32	**3.13**	**1.35 (1.09-1.67)**
Practice	**0.95**	0.87	1.09 (0.86-1.38)

Table 12.9 Comparison of Body Sites of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Body Site			
Ankle	29.8%	**31.1%**	1.05 (0.81-1.35)
Knee	12.6%	**16.5%**	1.31 (0.86-2.00)
Head/face	15.7%	**19.5%**	1.24 (0.85-1.79)
Hip/thigh/upper leg	**8.2%**	3.0%	**2.71 (1.49-4.92)**
Hand/wrist	**9.9%**	9.4%	1.05 (0.61-1.82)
Shoulder	4.1%	**4.8%**	1.71 (0.52-2.66)
Trunk	**5.1%**	3.8%	1.33 (0.59-3.04)
Lower leg	2.1%	**5.1%**	2.46 (0.94-6.43)
Arm/elbow	**3.6%**	0.5%	**6.61 (2.16-20.21)**
Foot	**8.1%**	4.4%	1.85 (0.90-3.84)
Neck	0.0%	**0.8%**	---
Other	0.9%	**1.1%**	1.23 (0.31-4.90)
Total	**100%**	**100%**	---

Table 12.10 Comparison of Diagnoses of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Diagnosis			
Strain/sprain	47.9%	**53.5%**	1.12 (0.95-1.32)
Contusion	**10.8%**	6.3%	1.73 (0.93-3.21)
Fracture	**10.5%**	9.4%	1.11 (0.65-1.90)
Concussion	5.1%	**13.4%**	**2.64 (1.53-4.54)**
Other	**25.7**%	17.4%	**1.48 (1.06-2.08)**
Total	100%	100%	---

Table 12.11 Most Common Boys' and Girls' Basketball Injury Diagnoses*, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Diagnosis			
Ankle strain/sprain	28.9%	**30.4%**	1.05 (0.81-1.36)
Knee other	**6.2%**	2.9%	**2.13 (1.00-4.58)**
Head/face other	**6.2%**	3.4%	1.82 (0.82-4.04)
Head/face concussion	5.1%	**13.4%**	**2.64 (1.53-4.54)**
Knee strain/sprain	4.7%	**10.6%**	**2.27 (1.17-4.43)**

*Only includes diagnoses accounting for >5% of boys' or girls' basketball injuries.

Table 12.12 Comparison of Time Loss of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Time Loss			
1-2 days	**19.2%**	14.2%	1.35 (0.92-1.98)
3-6 days	26.1%	**30.8%**	1.18 (0.89-1.56)
7-9 days	18.3%	**18.8%**	1.03 (0.72-1.47)
10-21 days	18.2%	**21.0%**	1.15 (0.83-1.62)
22 days or more	**13.3%**	8.4%	**1.58 (0.95-2.62)**
Other	4.9%	**6.8%**	1.37 (0.73-2.57)
Total	**100%**	**100%**	---

Table 12.13 Comparison of Mechanisms of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Basketball Mechanism			
Collision with another player	**26.7%**	26.2%	1.02 (0.77-1.35)
Jumping/landing	**25.9%**	22.3%	1.16 (0.86-1.58)
Overuse, heat illness, conditioning, etc.	8.8%	**9.2%**	1.04 (0.62-1.74)
Rotation around a planted foot/inversion	9.4%	**15.6%**	**1.66 (1.08-2.54)**
Stepped on/fell on/kicked	**8.1%**	6.4%	1.27 (0.73-2.22)
Contact with ball	3.6%	**8.1%**	**2.22 (1.04-4.72)**
Other	**17.5%**	12.3%	1.42 (0.92-2.18)
Total	**100%**	**100%**	---

Table 12.14 Comparison of Activities of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Basketball Activity			
Rebounding	**22.5%**	21.6%	1.04 (0.76-1.42)
General play	**25.1%**	20.9%	1.20 (0.88-1.64)
Defending	**14.8%**	14.6%	1.02 (0.66-1.55)
Chasing loose ball	**11.8%**	8.1%	1.45 (0.89-2.36)
Shooting	**10.2%**	9.4%	1.10 (0.62-1.93)
Conditioning	1.7%	**4.2%**	**2.39 (1.05-5.45)**
Ball handling/dribbling	6.2%	**6.6%**	1.07 (0.58-1.96)
Receiving pass	3.1%	**9.1%**	**2.92 (1.29-6.60)**
Other	4.4%	**5.4%**	1.24 (0.61-2.53)
Total	**100%**	**100%**	---

12.3 Boys' Baseball and Girls' Softball

Table 12.15 Comparison of Baseball and Softball Injury Rates, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Baseball	Softball	RR (95% CI)
Total	0.78	**1.04**	**1.34 (1.06-1.68)**
Competition	1.32	**1.62**	1.23 (0.91-1.67)
Practice	0.48	**0.72**	**1.49 (1.05-2.12)**

Table 12.16 Comparison of Body Sites of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Baseball	Softball	IPR (95% CI)
Body Site			
Ankle	5.4%	**13.7%**	**2.52 (1.13-5.62)**
Knee	5.4%	**15.5%**	**2.85 (1.12-7.24)**
Head/face	**23.2%**	20.1%	1.15 (0.71-1.87)
Hip/thigh/upper leg	**7.8%**	6.5%	1.19 (0.54-2.63)
Hand/wrist	15.3%	**16.7%**	1.09 (0.61-1.96)
Shoulder	**18.2%**	7.6%	**2.39 (1.15-4.98)**
Trunk	4.4%	**4.5%**	1.03 (0.30-3.55)
Lower leg	**5.2%**	5.0%	1.03 (0.38-2.81)
Arm/elbow	**10.7%**	7.2%	1.50 (0.70-3.21)
Foot	**3.8%**	2.5%	1.53 (0.52-4.56)
Neck	0.2%	**0.7%**	3.54 (0.68-18.43)
Other	**0.4%**	0.0%	---
Total	**100%**	**100%**	---

Table 12.17 Comparison of Diagnoses of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Baseball	Softball	IPR (95% CI)
Diagnosis			
Strain/sprain	38.4%	**41.1%**	1.07 (0.79-1.45)
Contusion	**18.1%**	13.8%	1.32 (0.74-2.33)
Fracture	**14.8%**	13.0%	1.14 (0.61-2.13)
Concussion	4.7%	**12.7%**	**2.73 (1.19-6.27)**
Other	**23.9%**	19.4%	1.23 (0.76-2.01)
Total	**100%**	**100%**	---

Table 12.18 Most Common Baseball and Softball Injury Diagnoses*, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Baseball	Softball	IPR (95% CI)
Diagnosis			
Ankle strain/sprain	5.4%	**11.8%**	2.16 (0.96-4.87)
Hand/wrist fracture	5.8%	**8.9%**	1.54 (0.63-3.77)
Head/face contusion	**10.2%**	5.3%	1.93 (0.69-5.39)
Hip/thigh/upper leg strain/sprain	**6.5%**	5.4%	1.22 (0.49-3.00)
Shoulder strain/sprain	**13.4%**	0.0%	**5.11 (1.24-21.16)**

*Only includes diagnoses accounting for >5% of baseball or softball injuries.

Table 12.19 Comparison of Time Loss of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Baseball	Softball	IPR (95% CI)
Time Loss			
1-2 days	**19.0%**	18.6%	1.02 (0.60-1.75)
3-6 days	24.2%	**28.9%**	1.20 (0.80-1.78)
7-9 days	**16.6%**	13.8%	1.20 (0.68-2.13)
10-21 days	**19.3%**	16.5%	1.18 (0.70-1.98)
22 days or more	**15.6%**	12.3%	1.27 (0.64-2.52)
Other	5.3%	**9.9%**	1.87 (0.71-4.96)
Total	**100%**	**100%**	---

Table 12.20 Comparison of Mechanisms of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Baseball	Softball	IPR (95% CI)
Baseball/Softball Mechanism			
Overuse, heat illness, conditioning, etc.	10.9%	**11.2%**	1.02 (0.49-2.13)
Contact with another player	15.9%	**18.5%**	1.16 (0.65-2.08)
Contact with bases	8.8%	**11.8%**	1.35 (0.68-2.70)
Throwing - not pitching	**5.3%**	4.0%	1.33 (0.52-3.43)
Throwing - pitching	**7.9%**	5.1%	1.56 (0.56-4.33)
Contact with thrown ball (non-pitch)	5.6%	**10.4%**	1.84 (0.78-4.34)
Rotation around a planted foot/inversion	**4.0%**	3.3%	1.22 (0.44-3.35)
Hit by batted ball	**17.9%**	6.6%	**2.71 (1.36-5.41)**
Hit by pitch	3.8%	**7.3%**	1.93 (0.77-4.87)
Other	20.0%	**22.0%**	1.10 (0.67-1.79)
Total	**100%**	**100%**	---

Table 12.21 Comparison of Activities of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2008-09 School Year

	Baseball	Softball	IPR (95% CI)
Baseball/Softball Activity			
Fielding a batted ball	**22.3%**	12.7%	**1.76 (1.03-2.99)**
Fielding a thrown ball	4.7%	**7.8%**	1.68 (0.59-4.74)
Running bases	**17.4%**	11.2%	1.56 (0.83-2.93)
Pitching	**14.7%**	5.6%	**2.61 (1.16-5.89)**
Batting	**13.7%**	13.2%	1.04 (0.56-1.92)
Sliding	8.1%	**17.9%**	**2.20 (1.09-4.42)**
Throwing (not pitching)	4.9%	**8.6%**	1.74 (0.76-3.98)
General play	**6.9%**	2.6%	**2.66 (1.10-6.45)**
Conditioning	1.4%	**3.6%**	2.56 (0.32-20.54)
Catching	1.5%	**10.6%**	**7.33 (2.57-20.92)**
Other	4.5%	**6.3%**	1.38 (0.44-4.37)
Total	**100%**	**100%**	---

XIII. Trends over Time

Table 13.1 Injury Rates by Sport, Type of Exposure, and Year, High School Sports-Related Injury Surveillance Study, US, 2005-09 School Years

	2005-06	2006-07	2007-08	2008-09	p-value for trend*
Overall total	2.51	2.59	2.31	2.01	0.111
Competition	4.63	4.88	4.45	4.05	0.198
Practice	1.69	1.75	1.52	1.26	0.106
Boys' football total	4.36	4.45	4.18	3.50	0.114
Competition	12.09	13.50	12.80	11.26	0.571
Practice	2.54	2.68	2.47	1.92	0.198
Boys' soccer total	**2.43**	**2.27**	**1.75**	**1.62**	**0.031**
Competition	4.22	4.31	3.63	3.43	0.092
Practice	**1.58**	**1.45**	**0.96**	**0.87**	**0.040**
Girls' soccer total	2.36	2.51	2.35	2.07	0.276
Competition	5.21	5.43	5.15	4.59	0.227
Practice	1.10	1.31	1.16	1.00	0.552
Girls' volleyball total	**1.64**	**1.37**	**1.22**	**0.89**	**0.009**
Competition	1.92	1.40	1.43	0.90	0.061
Practice	**1.48**	**1.36**	**1.12**	**0.88**	**0.010**
Boys' basketball total	**1.89**	**1.75**	**1.39**	**1.35**	**0.041**
Competition	2.98	2.87	2.23	2.32	0.109
Practice	**1.46**	**1.28**	**1.04**	**0.95**	**0.013**
Girls' basketball total	2.01	2.09	1.61	1.54	0.121
Competition	3.60	3.60	3.30	3.13	0.052
Practice	1.37	1.44	0.90	0.87	0.127
Boys' wrestling total	2.50	2.51	2.27	2.17	0.064
Competition	**3.93**	**3.80**	**3.70**	**3.35**	**0.044**
Practice	2.04	2.06	1.76	1.75	0.114
Boys' baseball total	1.19	1.25	0.93	0.78	0.094
Competition	1.77	2.01	1.37	1.32	0.222
Practice	**0.87**	**0.82**	**0.68**	**0.48**	**0.031**
Girls' softball total	1.13	1.11	1.29	1.04	0.890
Competition	1.78	1.96	1.86	1.62	0.479
Practice	0.79	0.65	0.98	0.72	0.891

*Statistically significant tests for trend are bolded.

Table 13.2 Nationally Estimated Number of Injuries by Sport, Type of Exposure, and Year, High School Sports-Related Injury Surveillance Study, US, 2005-09 School Years

	2005-06	2006-07	2007-08	2008-09
Overall total	**1,442,533**	**1,472,849**	**1,419,723**	**1,248,126**
Competition	**759,334**	**766,512**	**763,034**	**690,525**
Practice	**683,199**	**706,337**	**656,689**	**557,601**
Boys' football total	516,150	574,367	616,665	527,321
Competition	280,919	292,316	311,780	288,637
Practice	235,231	282,051	304,885	238,684
Boys' soccer total	218,760	171,874	159,351	149,229
Competition	119,703	93,295	99,785	87,082
Practice	99,058	78,579	59,566	62,147
Girls' soccer total	185,770	230,769	215,850	192,108
Competition	122,803	149,231	146,102	123,312
Practice	62,967	81,538	69,748	68,796
Girls' volleyball total	81,813	80,493	72,261	56,609
Competition	32,677	27,423	26,539	19,764
Practice	49,136	53,069	45,722	36,845
Boys' basketball total	100,058	96,670	82,612	79,230
Competition	44,826	46,109	36,766	40,152
Practice	55,232	50,561	45,846	39,078
Girls' basketball total	103,566	102,831	73,283	64,933
Competition	53,812	53,703	45,236	38,277
Practice	49,753	49,128	28,047	26,656
Boys' wrestling total	105,542	101,139	91,625	88,996
Competition	36,259	38,750	40,698	39,029
Practice	69,283	62,389	50,927	49,967
Boys' baseball total	67,560	60,296	44,760	39,869
Competition	33,639	33,494	22,803	25,584
Practice	33,922	26,802	21,957	14,285
Girls' softball total	63,313	54,411	63,316	49,831
Competition	34,696	32,191	33,325	28,688
Practice	28,618	22,220	29,991	21,143

Table 13.3 Body Site of Injury by Year, High School Sports-Related Injury Surveillance Study, US, 2005-09 School Years*

	2005-06 n=1,480,557	2006-07 n=1,464,926	2007-08 n=1,411,621	2008-09 n=1,248,126
Body Site				
Ankle	22.7%	19.8%	18.5%	16.4%
Knee	14.2%	16.6%	14.6%	14.8%
Head/face	12.3%	12.4%	12.4%	15.3%
Hip/thigh/upper leg	10.8%	10.5%	10.2%	10.3%
Shoulder	7.9%	8.0%	10.1%	9.3%
Hand/wrist	8.0%	7.5%	9.1%	8.5%
Trunk	6.2%	6.7%	6.5%	6.6%
Lower leg	4.6%	5.2%	5.7%	5.8%
Arm/elbow	4.1%	3.9%	4.6%	4.1%
Foot	4.0%	4.0%	4.2%	5.0%
Neck	2.2%	1.9%	1.8%	1.9%
Other	3.2%	3.6%	2.4%	2.1%
Total	**100%**	**100%**	**100%**	**100%**

*Throughout this chapter, n's represent the total number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Table 13.4 Injury Diagnosis by Year, High School Sports-Related Injury Surveillance Study, US, 2005-09 School Years

	2005-06, n=1,444,172	2006-07, n=1,466398	2007-08 n=1,414,139	2008-09 n=1,248,126
Diagnosis				
Strain/sprain	52.0%	48.2%	48.3%	45.7%
Contusion	12.2%	13.7%	12.4%	11.5%
Fracture	9.8%	8.9%	10.2%	10.9%
Concussion	9.1%	8.4%	9.2%	11.8%
Other	16.8%	20.9%	19.9%	20.2%
Total	**100%**	**100%**	**100%**	**100%**

Table 13.5 Most Common Injury Diagnoses by Year, High School Sports-Related Injury Surveillance Study, US, 2005-09 School Years

	2005-06 n=1,435,954	2006-07 n=1,463,273	2007-08 n=1,410,654	2008-09 n= 1,248,126
Diagnosis				
Ankle strain/sprain	20.6%	17.8%	17.3%	15.0%
Head/face concussion	9.0%	8.4%	9.2%	11.7%
Knee strain/sprain	7.6%	8.8%	7.8%	7.9%
Hip/thigh/upper leg strain/sprain	7.9%	7.7%	7.3%	7.7%
Knee other	4.3%	4.9%	4.7%	4.5%
Shoulder other	3.1%	3.7%	4.1%	4.0%
Hand/wrist fracture	3.2%	3.3%	4.0%	4.0%
Shoulder strain/sprain	3.4%	2.9%	3.4%	3.7%
Trunk strain/sprain	2.8%	2.7%	3.2%	2.8%
Hand/wrist strain/sprain	3.1%	2.5%	3.8%	2.9%

Table 13.6 Time Loss of Injuries by Year, High School Sports-Related Injury Surveillance Study, US, 2005-09 School Years

	2005-06 n=1,378,145	2006-07 n=1,423,183	2007-08 n=1,355,981	2008-09 n= 1,248,126
Time Loss				
1-2 days	22.5%	26.6%	22.8%	13.7%
3-6 days	30.0%	28.5%	28.8%	28.5%
7-9 days	15.3%	14.7%	15.8%	17.7%
10-21 days	14.9%	14.1%	16.7%	19.7%
22 days or more	17.2%	16.1%	15.9%	20.3%
Total	**100%**	**100%**	**100%**	**100%**

Table 13.7 Injuries Requiring Surgery by Year, High School Sports-Related Injury Surveillance Study, US, 2005-09 School Years

	2005-06 n=1,429,072	2006-07 n=1,428,960	2007-08 n=1,380,872	2008-09 n= 1,248,126
Need for surgery				
Required surgery	5.3%	6.4%	6.1%	6.7%
Did not require surgery	94.7%	93.6%	93.9%	93.3%
Total	**100%**	**100%**	**100%**	**100%**

IX. Reporter Demographics & Compliance

During the 2008-09 school year, 118 ATCs were invited to participate in the study at the beginning of the school year. In addition, 5 ATCs were invited to participate during the school year to replace a previously enrolled ATC who was no longer able to participate. ATCs were expected to report for every week in which they were enrolled. For example, an ATC who joined the study as a replacement school in week 10 was not expected to report for weeks 1-9. Overall, 107 enrolled ATCs reported an average of 42 study weeks. The majority of ATCs (90%) reported all the weeks during which they were enrolled, with only 8 ATCs (7%) missing over 10 weeks. Internal validity checks yielded 100% sensitivity, 99.6% specificity, a positive predictive value of 96.7%, and a negative predictive value of 100%.

Prior to the start of the 2008-09 High School RIO™ study, participating ATCs were asked to complete a short demographics survey. Three-quarters (80%) of participating high schools were public schools, with the remainder being private. All but 2 participating ATCs provided services to athletes of their high school on 5 or more days each week. Nearly 90% (88.8%) of ATCs participating during the 2008-09 study year had previously participated in the High School RIO™ study.

An online "End of Season" survey gave all participating ATCs (both in the original study as well as in the expanded study) the opportunity to provide feedback on their experiences with High School RIO™. This survey was completed by 110 ATCs (64%). Average reporting time burdens were 17 minutes for the weekly exposure report and 7 minutes for the injury report form. Using a 5 point Likert scale, RIO™ was overwhelmingly reported to be either very easy (62.7%) or somewhat easy (30.9%) to use (5 and 4 on the Likert scale, respectively), with ATCs being either very satisfied (64.5%) or somewhat satisfied (31.8%) with the study (5 and 4 on the Likert scale, respectively). Suggestions provided by ATCs, such as the addition or clarification of questions or answer choices, will be used to improve the National High School Sports-Related Injury Surveillance Study for the 2009-10 school year.

X. Summary

High school sports play an important role in the adoption and maintenance of a physically active lifestyle among millions of US adolescents. Too often injury prevention in this population is overlooked as sports-related injuries are thought to be unavoidable. In reality, sports-related injuries are largely preventable through the application of evidence-based preventive interventions. Such preventive interventions can include educational campaigns, introduction of new/improved protective equipment, rule changes, other policy changes, etc. The morbidity, mortality, and disability caused by high school sports-related injuries can be reduced through the development and implementation of improved injury diagnosis and treatment modalities as well as through effective prevention strategies. However, surveillance of exposure based injury rates in a nationally representative sample of high school athletes and subsequent epidemiologic analysis of patterns of injury are needed to drive evidence-based prevention practices.

Prior to the implementation of the High School Sports-Related Injury Surveillance Study by Dr. Comstock, the study of high school sports-related injuries had largely been limited by an inability to calculate injury rates due to a lack of exposure data (i.e., frequency of participation in athletic activities including training, practice, and competition), an inability to compare findings across groups (i.e., sports/activities, genders, schools, and levels of competition), or an inability to generalize findings from small non-representative samples. The value of national injury surveillance studies that collect injury, exposure, and risk factor data from representative samples has been well demonstrated by the National Collegiate Athletic Association's Injury Surveillance System (NCAA ISS). Data collected by the NCAA ISS since 1982 has been used to develop preventive interventions including changes in coaching habits, increased use of protective equipment, and rule changes which have had proven success in reducing injuries among collegiate athletes. For example, NCAA ISS data has been used to develop several interventions intended to reduce the number of preseason heat-related football injuries including the elimination of consecutive days of multiple practices, daily hour limitations, and a gradual increase in equipment for conditioning and heat acclimation. Additionally, several committees have considered NCAA ISS data when making recommendations including the NCAA Committee on Competitive Safeguards and Medical Aspects of Sports' recommendation for mandatory eye protection in women's lacrosse, the NCAA Men's Ice Hockey Rules Committee's recommendation for stricter penalties for hitting from behind, checking into the boards, and not wearing a mouthpiece, and the NCAA Men's Basketball Rules Committee's recent discussions of widening the free-throw lane to prevent injuries related to player contact. Unfortunately, because an equivalent injury surveillance system to collect injury and exposure data from a nationally representative sample of high school athletes had not previously existed, injury prevention efforts targeted to reduce injury rates in this population were based largely upon data collected from collegiate athletes. This is unacceptable because distinct biophysiological differences (e.g., lower muscle mass, immature growth plates, etc.) means high school athletes are not merely miniature versions of their collegiate counterparts.

The successful implementation and maintenance of the National High School Sports-Related Injury Surveillance Study demonstrates the value of a national injury surveillance system at the high school level. Dr. Comstock and her research staff are committed to maintaining a permanent national high school sports injury surveillance system.

While the health benefits of a physically active lifestyle including sports participation are undeniable, participants are at risk of injury because a certain endemic level of injury can be expected during any physical activity, especially those with a competitive component. However, injury rates among high school athletes should be reduced to the lowest possible level without discouraging adolescents from engaging in this important form of physical activity. This goal can best be accomplished by monitoring injury rates and patterns of injury among high school athletes over time; investigating the etiology of preventable injuries; and developing, implementing, and evaluating evidence-based preventive interventions. Surveillance systems such as the model used for this study are critical in achieving these goals.

Kentucky Medical Association
Medical Aspects of Sports Committee
Recommendation to the Kentucky High School Athletic Association and KHSAA Member Schools

RECOMMENDATIONS FOR COOLING METHODS DUE TO HEAT RELATED ILLNESS

Released: June, 2009

Exertional heat stroke (EHS) is relatively uncommon among exercise associated medical conditions, but is a frequent cause of exercise related death. 3 athletes have died of EHS in Kentucky in the past 5 years. The majority of medical evidence shows that early institution of body cooling is the most effective method of decreasing mortality in EHS. This paper contains recommendations regarding the methods of body cooling, including tubs, ice bags, iced towels (towels with water that have been frozen) water, fans, and shade. The recommendations are classified as essential (foundational to the implementation of treatment, should have resources and personnel directed towards implementation), and desirable (important in maximal implementation, should have resources and personnel directed towards implementation as budget and resources allow). The recommendations are only guidelines, are not intended as a standard of care, and should not be considered as such. These guidelines should be considered in the care of athletes who can be expected to be at risk of EHS due to the sport or the environmental situation of the activity. Sports especially at risk include football with and without equipment, soccer, and long distance track. Other sports and activities, such as cycling, golf, baseball, tennis, track and field, and band, may also be at risk due to long duration exposure to extreme environmental conditions.

It is essential that the school and school officials:

- Establish a written plan for emergency treatment of EHS, and conduct drills in the implementation of the plan
- Know how to assess environmental conditions and determine when extreme conditions exist
- Identify a specific spot at the athletic facility that has shade
- Have immediate access to ice and bags to contain ice
- Have access to water, and provide water breaks as outlined in the KMA/KHSAA Heat Illness and Prevention Policy
- Know the most effective sites for application of ice to the body

It is highly desirable that the school and school officials

- Obtain and use, when environmental conditions are determined to be extreme, a tub or pool, filled with water and ice before practice or game, to be used in body immersion for maximal cooling, and how have personnel trained in this technique.

It is desirable that schools and school officials:

- Have a certified athletic trainer (AT,C) on staff to develop and implement these guidelines
- Have immediate access to water
- Provide shade breaks
- Provide fans when environmental conditions are determined to be extreme
- Have close access to an air conditioned room
- Have access to and use iced towels that can be rotated to appropriate areas of the body, including the axilla, groin, and back of the neck

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KENTUCKY MEDICAL ASSOCIATION / KENTUCKY HIGH SCHOOL ATHLETIC ASSOCIATION
PROCEDURE FOR AVOIDING HEAT INJURY / ILLNESS THROUGH ANALYSIS OF HEAT INDEX AND RESTRUCTURING OF ACTIVITIES
Complete listing of support documents available at http://www.khsaa.org/sportsmedicine/

Original Procedure Made by the Kentucky Medical Association Committee on Physical Education and Medical Aspects of Sports to and for the Kentucky High School Athletic Association and adopted by the KHSAA Board of Control as recommendation for all schools, May, 2002
On site Procedures Revised by KHSAA Board of Control, February 13, 2003
On site procedures further Revised and Made Mandatory for all schools by the KHSAA Board of Control, May, 2005
On site procedures further revised with respect to testing instruments, March, 2007

INTRODUCTION

Following months of study, after one year of implementation and in an effort to help protect the health and safety of student-athletes participating in high school sports, the Kentucky Medical Association Committee on Physical Education and Medical Aspects of Sports issued a recommended procedure to the Kentucky High School Athletic Association for immediate implementation in 2002. This procedure called for the determination of the Heat Index (using on site devices to measure Temperature and Relative Humidity), and a guideline for activity to be conducted at that time based on the Heat Index reading. Though other procedures and measurements were considered, the application of the Heat Index appeared to be most readily implementable on a state wide basis, and appeared to be reliably tested in other areas.

Through the first five years of use of the procedure, minor adjustments were made in the reporting requirements, and the on site devices to be used. In May, 2005, the Board of Control through its policies directed that all member school comply with the testing and reporting requirements. In October, 2006, the member schools of the Association overwhelming approved at their Annual Meeting, a proposal to make such reporting not simply a Board of Control policy, but a school supported and approved Bylaw as it approved Proposal 9 to amend KHSAA Bylaw 17 (full details are available at
http://www.khsaa.org/annualmeeting/20062007/annualmeetingproposals20062007.pdf)

In March, 2007, the Kentucky Medical Association Committee on Physical Education and Medical Aspects of Sports recommended the elimination of all devices with the exception of the Digital Sling Psychrometer as a means of measuring at the competition/practice site.

GENERAL PROCEDURE

The procedure calls for the determination of the Temperature and Relative Humidity at the practice / contest site using a Digital Sling psychrometer It is important to note that media-related temperature readings (such as the Weather Channel, local radio, etc.), or even other readings in the general proximity are not permitted as they may not yield defensible results when considering the recommended scale. The readings must be made at the site.
Neither the KHSAA nor KMA has endorsed any particular brand of psychrometer and receives no endorsement fee or other consideration for any device sold. There are several models on the market that will properly perform the functions, including companies such as Medco and others. The KHSAA or your local Certified Athletic Trainer has easy access to catalogs with this type of equipment. In addition, the KHSAA web site has a variety of links to various dealers.

INDOOR AND OUTDOOR VENUES

While much of the original discussion concerning this package centered on outdoor sports, the Kentucky Medical Association Committee on Physical Education and Medical Aspects of Sports has advised the KHSAA that indoor sports, particularly in times of year or facilities where air conditioning may not be available, should be included in the testing. Such has been approved by the Board of Control as policy requirement. The recommendations contained in this package clearly cover both indoor and outdoor activity, as well as contact and non-contact sports.

PROCEDURE FOR TESTING

Thirty (30) minutes prior to the start of activity, temperature and humidity readings should be taken at the practice / competition site.

The information should be recorded on KHSAA Form GE20 and these records shall be available for inspection upon request. All schools will be required to submit this form. For 2007, there will be online reporting for submitting this form.

The temperature and humidity should be factored into the Heat Index Calculation and Chart and a determination made as to the Heat Index. If schools are utilizing a digital sling psychrometer that calculates the Heat Index, that number may be used to apply to the regulation table.

If a reading is determined whereby activity is to be decreased (above 95 degrees Heat Index), then re-readings would be required every thirty (30) minutes to determine if further activity should be eliminated or preventative steps taken, or if an increased level of activity can resume.

Using the following scale, activity must be altered and / or eliminated based on this Heat Index as determined –

Under 95 degrees Heat Index	❖ All sports ➢ Provide ample amounts of water. This means that water should always be available and athletes should be able to take in as much water as they desire. ➢ Optional water breaks every 30 minutes for 10 minutes in duration ➢ Ice-down towels for cooling ➢ Watch/monitor athletes carefully for necessary action.
95 degrees to 99 degrees Heat Index	❖ All sports ➢ Provide ample amounts of water. This means that water should always be available and athletes should be able to take in as much water as they desire. ➢ Mandatory water breaks every 30 minutes for 10 minutes in duration ➢ Ice-down towels for cooling ➢ Watch/monitor athletes carefully for necessary action. ❖ Contact sports and activities with additional equipment ➢ Helmets and other possible equipment removed while not involved in contact. ❖ Reduce time of outside activity. Consider postponing practice to later in the day. ❖ Re-check temperature and humidity every 30 minutes to monitor for increased Heat Index.
100 degrees to 104 degrees Heat Index	❖ All sports ➢ Provide ample amounts of water. This means that water should always be available and athletes should be able to take in as much water as they desire. ➢ Mandatory water breaks every 30 minutes for 10 minutes in duration ➢ Ice-down towels for cooling ➢ Watch/monitor athletes carefully for necessary action. ➢ Alter uniform by removing items if possible ➢ Allow for changes to dry t-shirts and shorts. ➢ Reduce time of outside activity as well as indoor activity if air conditioning is unavailable. ➢ Postpone practice to later in day. ❖ Contact sports and activities with additional equipment ➢ Helmets and other possible equipment removed if not involved in contact or necessary for safety. If necessary for safety, suspend activity. ❖ Re-check temperature and humidity every 30 minutes to monitor for increased Heat Index.
Above 104 degrees Heat Index	❖ All Sports ➢ Stop all outside activity in practice and/or play, and stop all inside activity if air conditioning is unavailable.

This procedure is to be used until such time as the temperature is below 80 degrees as no combination of heat and humidity at that level will result in a need to curtail activity. The KHSAA will use September 15 as the standard date for the return of the Heat Index forms but reminds its member schools that the monitoring shall continue until such a time that no combination of heat and humidity at that level will result in a need to curtail activity.

SUMMARY

Though much more scientific information and other alternative methods for determining Heat Index and participation restrictions are being studied, these initial steps should help ensure the health and safety of the participants in high school sports. Adherence to these guidelines represents a conscious effort by the interscholastic community to emphasize health and safety on a much higher level than any loss of competitive preparation. Any further revisions or enhancements will be distributed to the members of the KHSAA.

Heat Index Calculation and Chart

Temperature (in Fahrenheit)

Relative Humidity at Site

	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
100	84	87	91	95	99	103	107	112	116	121	126	132	137	143	149	155	161	168	174	181	188
99	84	87	91	94	98	102	106	111	116	120	125	131	136	142	147	153	160	166	172	179	186
98	84	87	90	94	98	102	106	110	115	120	124	130	135	140	146	152	158	164	171	177	184
97	84	87	90	94	97	101	105	110	114	119	124	129	134	139	145	151	157	163	169	176	182
96	83	87	90	93	97	101	105	109	113	118	123	128	133	138	144	149	155	161	167	174	180
95	83	86	90	93	97	100	104	108	113	117	122	127	132	137	142	148	154	160	166	172	179
94	83	86	89	93	96	100	104	108	112	116	121	126	131	136	141	147	152	158	164	170	177
93	83	86	89	92	96	99	103	107	111	116	120	125	130	135	140	145	151	157	162	169	175
92	83	86	89	92	95	99	103	106	111	115	119	124	129	133	139	144	149	155	161	167	173
91	83	86	89	92	95	98	102	106	110	114	118	123	127	132	137	143	148	154	159	165	171
90	83	86	88	91	95	98	102	105	109	113	117	122	126	131	136	141	147	152	158	164	170
89	83	85	88	91	94	98	101	105	109	113	117	121	125	130	135	140	145	151	156	162	168
88	83	85	88	91	94	97	101	104	108	112	116	120	125	129	134	139	144	149	155	160	166
87	83	85	88	91	94	97	100	104	107	111	115	119	124	128	133	138	143	148	153	159	164
86	83	85	88	90	93	96	100	103	107	110	114	118	123	127	132	136	141	146	152	157	163
85	83	85	87	90	93	96	99	102	106	110	113	117	122	126	130	135	140	145	150	155	161
84	82	85	87	90	93	96	99	102	105	109	113	117	121	125	129	134	139	144	149	154	159
83	82	85	87	90	92	95	98	101	105	108	112	116	120	124	128	133	137	142	147	152	158
82	82	85	87	89	92	95	98	101	104	108	111	115	119	123	127	132	136	141	146	151	156
81	82	84	87	89	92	94	97	100	104	107	110	114	118	122	126	131	135	140	144	149	155
80	82	84	86	89	91	94	97	100	103	106	110	113	117	121	125	129	134	138	143	148	153
79	82	84	86	89	91	94	96	99	102	106	109	113	116	120	124	128	133	137	142	146	151
78	82	84	86	88	91	93	96	99	102	105	108	112	115	119	123	127	131	136	140	145	150
77	82	84	86	88	90	93	96	98	101	104	108	111	115	118	122	126	130	135	139	144	148
76	82	84	86	88	90	93	95	98	101	104	107	110	114	117	121	125	129	133	138	142	147
75	82	84	85	88	90	92	95	97	100	103	106	109	113	116	120	124	128	132	136	141	145
74	82	83	85	87	89	92	94	97	100	103	106	109	112	116	119	123	127	131	135	140	144
73	82	83	85	87	89	91	94	96	99	102	105	108	111	115	118	122	126	130	134	138	143
72	82	83	85	87	89	91	93	96	99	101	104	107	111	114	117	121	125	129	133	137	141
71	81	83	85	87	89	91	93	96	98	101	104	107	110	113	116	120	124	127	131	136	140
70	81	83	85	86	88	90	93	95	98	100	103	106	109	112	116	119	123	126	130	134	138
69								95	97	100	102	105	108	111	115	118	122	125	129	133	137
68								94	97	99	102	105	108	111	114	117	121	124	128	132	136
67								94	96	99	101	104	107	110	113	116	120	123	127	131	135
66								93	96	98	101	103	106	109	112	115	119	122	126	129	133
65								93	95	98	100	103	105	108	111	114	118	121	125	128	132
64								93	95	97	99	102	105	108	110	114	117	120	123	127	131
63								92	94	97	99	101	104	107	110	113	116	119	122	126	130
62								92	94	96	98	101	103	106	109	112	115	118	121	125	128
61								91	93	96	98	100	103	105	108	111	114	117	120	124	127
60								91	93	95	97	100	102	105	107	110	113	116	119	123	126
59								91	93	95	97	99	102	104	107	109	112	115	118	122	125
58								90	92	94	96	99	101	103	106	109	111	114	117	120	124
57								90	92	94	96	98	100	103	105	108	111	113	116	119	123
56								90	92	93	95	98	100	102	105	107	110	113	115	118	122
55								89	91	93	95	97	99	101	104	106	109	112	114	117	120
54								89	91	93	94	96	99	101	103	106	108	111	114	116	119
53								89	90	92	94	96	98	100	103	105	107	110	113	116	118
52								88	90	92	94	96	98	100	102	104	107	109	112	115	117
51								88	90	91	93	95	97	99	101	104	106	108	111	114	116
50								88	89	91	93	95	97	99	101	103	105	108	110	113	115
49								88	89	91	92	94	96	98	100	102	105	107	109	112	115
48								87	89	90	92	94	96	97	100	102	104	106	109	111	114
47								87	88	90	92	93	95	97	99	101	103	105	108	110	113
46								87	88	90	91	93	95	96	98	100	103	105	107	109	112
45								87	88	89	91	92	94	96	98	100	102	104	106	109	111
44								86	88	89	91	92	94	96	97	99	101	103	106	108	110
43								86	87	89	90	92	93	95	97	99	101	103	105	107	109
42								86	87	88	90	91	93	95	96	98	100	102	104	106	109
41								86	87	88	90	91	93	94	96	98	100	101	104	106	108
40								85	87	88	89	91	92	94	95	97	99	101	103	105	107
39								85	86	88	89	90	92	93	95	97	98	100	102	104	106
38								85	86	87	89	90	91	93	95	96	98	100	102	104	106
37								85	86	87	88	90	91	93	94	96	97	99	101	103	105
36								85	86	87	88	89	91	92	94	95	97	99	100	102	104
35								85	86	87	88	89	90	92	93	95	96	98	100	102	104
34								84	85	86	88	89	90	92	93	94	96	98	99	101	103
33								84	85	86	87	89	90	91	93	94	96	97	99	101	102
32								84	85	86	87	88	90	91	92	94	95	97	98	100	102
31								84	85	86	87	88	89	91	92	93	95	96	98	99	101
30								84	85	86	87	88	89	90	92	93	94	96	97	99	101
29								84	85	86	87	88	89	90	91	93	94	95	97	98	100
28								84	84	85	86	88	89	90	91	92	94	95	97	98	100
27								83	84	85	86	87	88	90	91	92	93	95	96	98	99
26								83	84	85	86	87	88	89	91	92	93	94	96	97	99
25								83	84	85	86	87	88	89	90	91	93	94	95	97	98
24								83	84	85	86	87	88	89	90	91	92	94	95	96	98
23								83	84	85	86	87	88	89	90	91	92	93	95	96	97
22								83	84	85	86	87	88	89	90	91	92	93	94	96	97
21								83	84	85	85	86	87	88	89	91	92	93	94	95	97
20								83	84	85	85	86	87	88	89	90	91	93	94	95	96
19	78	79	79	80	81	81	82	83	84	84	85	86	87	88	89	90	91	92	94	95	96
18	78	78	79	80	80	81	82	83	84	84	85	86	87	88	89	90	91	92	93	94	96
17	78	78	79	80	80	81	82	83	84	84	85	86	87	88	89	90	91	92	93	94	95

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99	84	87	91	94	98	102	106	111	116	120	125	131	136	142	147	153	160	166	172	179	186
98	84	87	90	94	98	102	106	110	115	120	124	130	135	140	146	152	158	164	171	177	184
97	84	87	90	94	97	101	105	110	114	119	124	129	134	139	145	151	157	163	169	176	182
96	83	87	90	93	97	101	105	109	113	118	123	128	133	138	144	149	155	161	167	174	180
95	83	86	90	93	97	100	104	108	113	117	122	127	132	137	142	148	154	160	166	172	179
94	83	86	89	93	96	100	104	108	112	116	121	126	131	136	141	147	152	158	164	170	177
93	83	86	89	92	96	99	103	107	111	116	120	125	130	135	140	145	151	157	162	169	175
92	83	86	89	92	95	99	103	106	111	115	119	124	129	133	139	144	149	155	161	167	173
91	83	86	89	92	95	98	102	106	110	114	118	123	127	132	137	143	148	154	159	165	171
90	83	86	88	91	95	98	102	105	109	113	117	122	126	131	136	141	147	152	158	164	170
89	83	85	88	91	94	98	101	105	109	113	117	121	125	130	135	140	145	151	156	162	168
88	83	85	88	91	94	97	101	104	108	112	116	120	125	129	134	139	144	149	155	160	166
87	83	85	88	91	94	97	100	104	107	111	115	119	124	128	133	138	143	148	153	159	164
86	83	85	88	90	93	96	100	103	107	110	114	118	123	127	132	136	141	146	152	157	163
85	83	85	87	90	93	96	99	102	106	110	113	117	122	126	130	135	140	145	150	155	161
84	82	85	87	90	93	96	99	102	105	109	113	117	121	125	129	134	139	144	149	154	159
83	82	85	87	90	92	95	98	101	105	108	112	116	120	124	128	133	137	142	147	152	158
82	82	85	87	89	92	95	98	101	104	108	111	115	119	123	127	132	136	141	146	151	156
81	82	84	87	89	92	94	97	100	104	107	110	114	118	122	126	131	135	140	144	149	155
80	82	84	86	89	91	94	97	100	103	106	110	113	117	121	125	129	134	138	143	148	153
79	82	84	86	89	91	94	96	99	102	106	109	113	116	120	124	128	133	137	142	146	151
78	82	84	86	88	91	93	96	99	102	105	108	112	115	119	123	127	131	136	140	145	150
77	82	84	86	88	90	93	96	98	101	104	108	111	115	118	122	126	130	135	139	144	148
76	82	84	86	88	90	93	95	98	101	104	107	110	114	117	121	125	129	133	138	142	147
75	82	84	85	88	90	92	95	97	100	103	106	109	113	116	120	124	128	132	136	141	145
74	82	83	85	87	89	92	94	97	100	103	106	109	112	116	119	123	127	131	135	140	144
73	82	83	85	87	89	91	94	96	99	102	105	108	111	115	118	122	126	130	134	138	143
72	82	83	85	87	89	91	93	96	99	101	104	107	111	114	117	121	125	129	133	137	141
71	81	83	85	87	89	91	93	96	98	101	104	107	110	113	116	120	124	127	131	136	140
70	81	83	85	86	88	90	93	95	98	100	103	106	109	112	116	119	123	126	130	134	138
69								95	97	100	102	105	108	111	115	118	122	125	129	133	137
68								94	97	99	102	105	108	111	114	117	121	124	128	132	136
67								94	96	99	101	104	107	110	113	116	120	123	127	131	135
66								93	96	98	101	103	106	109	112	115	119	122	126	129	133
65								93	95	98	100	103	105	108	111	114	118	121	125	128	132
64								93	95	97	99	102	105	108	110	114	117	120	123	127	131
63								92	94	97	99	101	104	107	110	113	116	119	122	126	130
62								92	94	96	98	101	103	106	109	112	115	118	121	125	128
61								91	93	96	98	100	103	105	108	111	114	117	120	124	127
60								91	93	95	97	100	102	105	107	110	113	116	119	123	126
59								91	93	95	97	99	102	104	107	109	112	115	118	122	125
58								90	92	94	96	99	101	103	106	109	111	114	117	120	124
57								90	92	94	96	98	100	103	105	108	111	113	116	119	123
56								90	92	93	95	98	100	102	105	107	110	113	115	118	122
55								89	91	93	95	97	99	101	104	106	109	112	114	117	120
54								89	91	93	94	96	99	101	103	106	108	111	114	116	119
53								89	90	92	94	96	98	100	103	105	107	110	113	116	118
52								88	90	92	94	96	98	100	102	104	107	109	112	115	117
51								88	90	91	93	95	97	99	101	104	106	108	111	114	116
50								88	89	91	93	95	97	99	101	103	105	108	110	113	115
49								88	89	91	92	94	96	98	100	102	105	107	109	112	115
48								87	89	90	92	94	96	97	100	102	104	106	109	111	114
47								87	88	90	92	93	95	97	99	101	103	105	108	110	113
46								87	88	90	91	93	95	96	98	100	103	105	107	109	112
45								87	88	89	91	92	94	96	98	100	102	104	106	109	111
44								86	88	89	91	92	94	96	97	99	101	103	106	108	110
43								86	87	89	90	92	93	95	97	99	101	103	105	107	109
42								86	87	88	90	91	93	95	96	98	100	102	104	106	109
41								86	87	88	90	91	93	94	96	98	100	101	104	106	108
40								85	87	88	89	91	92	94	95	97	99	101	103	105	107
39								85	86	88	89	90	92	93	95	97	98	100	102	104	106
38								85	86	87	89	90	91	93	95	96	98	100	102	104	106
37								85	86	87	88	90	91	93	94	96	97	99	101	103	105
36								85	86	87	88	89	91	92	94	95	97	99	100	102	104
35								85	86	87	88	89	90	92	93	95	96	98	100	102	104
34								84	85	86	88	89	90	92	93	94	96	98	99	101	103
33								84	85	86	87	89	90	91	93	94	96	97	99	101	102
32								84	85	86	87	88	90	91	92	94	95	97	98	100	102
31								84	85	86	87	88	89	91	92	93	95	96	98	99	101
30								84	85	86	87	88	89	90	92	93	94	96	97	99	101
29								84	85	86	87	88	89	90	91	93	94	95	97	98	100
28								84	84	85	86	88	89	90	91	92	94	95	97	98	100
27								83	84	85	86	87	88	90	91	92	93	95	96	98	99
26								83	84	85	86	87	88	89	91	92	93	94	96	97	99
25								83	84	85	86	87	88	89	90	91	93	94	95	97	98
24								83	84	85	86	87	88	89	90	91	92	94	95	96	98
23								83	84	85	86	87	88	89	90	91	92	93	95	96	97
22								83	84	85	86	87	88	89	90	91	92	93	94	96	97
21								83	84	85	85	86	87	88	89	91	92	93	94	95	97
20								83	84	85	85	86	87	88	89	90	91	93	94	95	96
19	78	79	79	80	81	81	82	83	84	84	85	86	87	88	89	90	91	92	94	95	96
18	78	78	79	80	80	81	82	83	84	84	85	86	87	88	89	90	91	92	93	94	96
17	78	78	79	80	80	81	82	83	84	84	85	86	87	88	89	90	91	92	93	94	95

Heat Index	Guidelines
Under 95 degrees Heat Index	▪ All sports ▪ Provide ample amounts of water. This means that water should always be available and athletes should be able to take in as much water as they desire. ▪ Optional water breaks every 30 minutes for 10 minutes in duration ▪ Ice-down towels for cooling ▪ Watch/monitor athletes carefully for necessary action.
95 degrees to 99 degrees Heat Index	▪ All sports ▪ Provide ample amounts of water. This means that water should always be available and athletes should be able to take in as much water as they desire. ▪ Mandatory water breaks every 30 minutes for 10 minutes in duration ▪ Ice-down towels for cooling ▪ Watch/monitor athletes carefully for necessary action. ▪ Contact sports and activities with additional equipment ▪ Helmets and other possible equipment removed if not involved in contact. ▪ Reduce time of outside activity. Consider postponing practice to later in the day. ▪ Re-check temperature and humidity every 30 minutes to monitor for increased Heat Index.
100 degrees to 104 degrees Heat Index	▪ All sports ▪ Provide ample amounts of water. This means that water should always be available and athletes should be able to take in as much water as they desire. ▪ Mandatory water breaks every 30 minutes for 10 minutes in duration ▪ Ice-down towels for cooling ▪ Watch/monitor athletes carefully for necessary action. ▪ Alter uniform by removing items if possible ▪ Allow for changes to dry t-shirts and shorts. ▪ Reduce time of outside activity as well as indoor activity if air conditioning is unavailable. ▪ Postpone practice to later in day. ▪ Contact sports and activities with additional equipment ▪ Helmets and other possible equipment removed if not involved in contact or necessary for safety. If necessary for safety, suspend activity. ▪ Re-check temperature and humidity every 30 minutes to monitor for increased Heat Index.
Above 104 degrees Heat Index	▪ All Sports ▪ Stop all outside activity in practice and/or play, and stop all inside activity if air conditioning is unavailable.

KHSAA Form GE20
Rev. 06/05

KENTUCKY HIGH SCHOOL ATHLETIC ASSOCIATION
HEAT INDEX MEASUREMENT AND RECORD

School: ____________________

Sport: ____________________

DATE	TIME	TEMP	HUMIDITY	HEAT INDEX (from chart)	ACTIVITY REVISION??	SIGNATURE

Using the following scale, activity should be altered and / or eliminated based on this Heat Index as determined –

Under 95 degrees Heat Index	Provide ample amounts of water. This means that water should always be available and athletes should be able to take in as much water as they desire. Optional water breaks every 30 minutes for 10 minutes in duration. Ice-down towels for cooling . Watch/monitor athletes carefully for necessary action.
95 degrees to 99 degrees Heat Index	Provide ample amounts of water. This means that water should always be available and athletes should be able to take in as much water as they desire. Mandatory water breaks every 30 minutes for 10 minutes in duration. Ice-down towels for cooling. Watch/monitor athletes carefully for necessary action. Contact sports and activities with additional equipment. Helmets and other possible equipment removed if not involved in contact. Reduce time of outside activity. Consider postponing practice to later in the day. Re-check temperature and humidity every 30 minutes to monitor for increased Heat Index.
100 degrees to 104 degrees Heat Index	All sports - Provide ample amounts of water. This means that water should always be available and athletes should be able to take in as much water as they desire. Mandatory water breaks every 30 minutes for 10 minutes in duration. Ice-down towels for cooling. Watch/monitor athletes carefully for necessary action. Alter uniform by removing items if possible. Allow for changes to dry t-shirts and shorts. Reduce time of outside activity as well as indoor activity if air conditioning is unavailable. Postpone practice to later in day. Contact sports and activities with additional equipment. Helmets and other possible equipment removed if not involved in contact or necessary for safety. If necessary for safety, suspend activity. Re-check temperature and humidity every 30 minutes to monitor for increased Heat Index.
Above 104 degrees Heat Index	Stop all outside activity in practice and/or play, and stop all inside activity if air conditioning is unavailable.

National Federation of State High School Association
PO Box 690, Indianapolis, IN 46206 Ph. 317.972.6900 Fx: 317.822.5700

Heat Stress and Athletic Participatic

Early fall football, cross country, soccer and field hockey practices are conduct very hot and humid weather in many parts of the United States. Due to the equi and uniform needed in football, most of the heat problems have been associatec football. From 1995 through the 2000 football season there have been 14 high heat stroke deaths in football. This is not acceptable. There are no excuses for heatstroke deaths, if the proper precautions are taken. During hot weather condi the athlete is subject to the following:

HEAT CRAMPS – Painful cramps involving abdominal muscles and extremiti caused by intense, prolonged exercise in the heat and depletion of salt and wate profuse sweating.

HEAT SYNCOPE – Weakness fatigue and fainting due to loss of salt and wat sweat and exercise in the heat. Predisposes to heat stroke.

HEAT EXHAUSTION (WATER DEPLETION) – Excessive weight loss, re sweating, elevated skin and core body temperature, excessive thirst, weakness, headache and sometimes unconsciousness.

HEAT EXHAUSTION (SALT DEPLETION) – Exhaustion, nausea, vomitin muscle cramps, and dizziness due to profuse sweating and inadequate replacem body salts.

HEAT STROKE – An acute medical emergency related to thermoregulatory f Associated with nausea, seizures, disorientation, and possible unconsciousness coma. It may occur suddenly without being preceded by any other clinical sign individual is usually unconscious with a high body temperature and a hot dry sk stroke victims, contrary to popular belief, may sweat profusely).

It is believed that the above-mentioned heat stress problems can be controlled p certain precautions are taken. According to the American Academy of Pediatric Committee on Sports Medicine, heat related illnesses are all preventable.(Spor Medicine: Health Care for Young Athletes, American Academy of Pediatrics, J 2000). The following practices and precautions are recommended:

1. Each athlete should have a physical examination with a medical history wh entering a program and an annual health history update. History of previous hea illness and type of training activities before organized practice begins should be included. State High School Associations recommendations should be followed

2. It is clear that top physical performance can only be achieved by an athlete in top physical condition. Lack of physical fitness impairs the performance of a athlete who participates in high temperatures. Coaches should know the **PHYS CONDITION** of their athletes and set practice schedules accordingly.

3. Along with physical conditioning the factor of acclimatization to heat is important. Acclimatization is the process of becoming adjusted to heat and it is essential to provide for **GRADUAL ACCLIMATIZATION TO HOT WEA** It is necessary for an athlete to exercise in the heat if he/she is to become acclin to it. It is suggested that a graduated physical conditioning program be used anc 80% acclimatization can be expected to occur after the first 7-10 days. Final sta acclimatization to heat are marked by increased sweating and reduced salt concentration in the sweat.

4. The old idea that water should be withheld from athletes during workouts ha **SCIENTIFIC FOUNDATION**. The most important safeguard to the health of athlete is the replacement of water. Water must be on the field and readily avail the athletes at all times. It is recommended that a minimum 10-minute water br scheduled for every half hour of heavy exercise in the heat. Athletes should rest shaded area during the break. **WATER SHOULD BE AVAILABLE IN UNLIMITED QUANTITIES**.

5. Check and be sure athletes are drinking the water. Replacement by thirst al inadequate. Test the air prior to practice or game using a wet bulb, globe, tempe index (WBGT index) which is based on the combined effects of air temperature relative humidity, radiant heat and air movement. The following precautions ar recommended when using the WBGT Index: (ACSM's Guidelines for the Tear Physician, 1991)

Below 64 – Unlimited activity

65-72 – Moderate risk

74-82 – High risk

82 plus – Very high risk

6. There is also a weather guide for activities that last 30 minutes or more (Fo Mathews, 1981) which involves know the relative humidity and air temperature

AIR TEMP	DANGER ZONE	CRITICAL ZONE
70 F	80% RH	100% RH
75 F	70% RH	100% RH
80 F	50% RH	80% RH
85 F	40% RH	68% RH
90 F	30% RH	55% RH
95 F	20% RH	40% RH
100 F	10% RH	30% RH

RH = RELATIVE HUMIDITY

One other method of measuring the relative humidity is the use of a sling psychrometer, which measures wet bulb temperature. The wet bulb temperature be measured prior to practice and the intensity and duration of practice adjusted accordingly. Recommendations are as follows:

Under 60 F …………………. Safe but always observe athletes

61-65 F …………………….. Observe players carefully

66-70 F …………………….. Caution

71-75 F …………………….. Shorter practice sessions and more frequent wate ………………………………and rest breaks

75 plus F …………………… Danger level and extreme caution

7. Cooling by evaporation is proportional to the area of the skin exposed. In extremely hot and humid weather reduce the amount of clothing covering the b much as possible. NEVER USE RUBBERIZED CLOTHING.

8. Athletes should weigh each day before and after practice and WEIGHT CH CHECKED. Generally a 3 percent weight loss through sweating is safe and ove percent weight loss is in the danger zone. Over a 3 percent weight loss the athle should not be allowed to practice in hot and humid conditions. Observe the athl closely under all conditions. Do not allow athletes to practice until they have adequately replaced their weight.

9. Observe athletes carefully for signs of trouble, particularly athletes who los significant weight and the eager athlete who constantly competes at his/her cap Some trouble signs are nausea, incoherence, fatigue, weakness, vomiting, cram weak rapid pulse, visual disturbance and unsteadiness.

10. Teams that encounter hot weather during the season through travel or follo unseasonably cool period, should be physically fit but will not be environmenta Coaches in this situation should follow the above recommendations and substit more frequently during games.

11. Know what to do in case of an emergency and have your emergency plans with copies to all your staff. Be familiar with immediate first aid practice and prearranged procedures for obtaining medical care, including ambulance servic

HEAT STROKE – *THIS IS A MEDICAL EMERGENCY* – DELA COULD BE FATAL. Immediately cool body while waiting for transfer to a hospital. Remove clothing and place ice bags on the neck, in the axilla (armpit) the groin areas. Fan athlete and spray with cold water to enhance evaporation.

HEAT EXHAUSTION – *OBTAIN MEDICAL CARE AT ONCE*. Cool body would for heat stroke while waiting for transfer to hospital. Give fluids if athlet to swallow and is conscious.

SUMMARY – The main problem associated with exercising in the hot weather water loss through sweating. Water loss is best replaced by allowing the athlete unrestricted access to water. Water breaks two or three times every hour are bet one break an hour. Probably the best method is to have water available at all tin to allow the athlete to drink water whenever he/she needs it. Never restrict the a of water an athlete drinks, and be sure the athletes are drinking the water. The s amount of salt lost in sweat is adequately replaced by salting food at meals. Tal your medical personnel concerning emergency treatment plans.

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GUIDE LINE 2c

Prevention of Heat Illness

June 1975 • Revised June 1998

Practice or competition in hot and/or humid environmental conditions poses special problems for student-athletes. Heat stress and resulting heat illness is a primary concern in these conditions. Although deaths from heat illness are rare, constant surveillance and education are necessary to prevent heat-related problems. The following practices should be observed:

1. An initial complete medical history and physical evaluation, followed by the completion of a yearly health-status questionnaire before practice begins, should be required. A history of previous heat illness, and the type and duration of training activities for the previous month, also are essential.

2. Prevention of heat illness begins with aerobic conditioning, which provides partial acclimatization to the heat. Student-athletes should gradually increase exposure to hot and/or humid environmental conditions over a period of seven to 10 days to achieve heat acclimatization. Each exposure should involve a gradual increase in the intensity and duration of exercise until the exercise is comparable to that likely to occur in competition. When conditions are extreme, training or competition should be held during a cooler time of day. Hydration should be maintained during training and acclimatization.

3. Clothing and protective gear can increase heat stress. Dark colors absorb solar radiation, and clothing and protective gear interfere with the evaporation of sweat and other avenues of heat loss. Frequent rest periods should be scheduled so that the gear and clothing can be loosened to allow heat loss. During the acclimatization process, it may be advisable to use a minimum of protective gear and clothing and to practice in T-shirts, shorts, socks and shoes. Excessive tape and outer clothing that restrict sweat evaporation should be avoided. Rubberized suits should never be used.

4. To identify heat stress conditions, regular measurements of environmental conditions are recommended. Use the ambient temperature and humidity to assess heat stress (see Figure 1). Utilize the wet-bulb temperature, dry-bulb temperature and globe temperature to assess the potential impact of humidity, air temperature and solar radiation. A wet-bulb temperature higher than 75 degrees Fahrenheit (24 degrees Celsius) or warm-weather humidity above 90 percent may represent dangerous conditions, especially if the sun is shining or the athletes are not acclimatized. A wet-bulb globe temperature (WBGT) higher than 82 degrees Fahrenheit (28 degrees Celsius) suggests that careful control of all activity be undertaken.

5. Dehydration (hypohydration) must be avoided not only because it hinders performance, but also

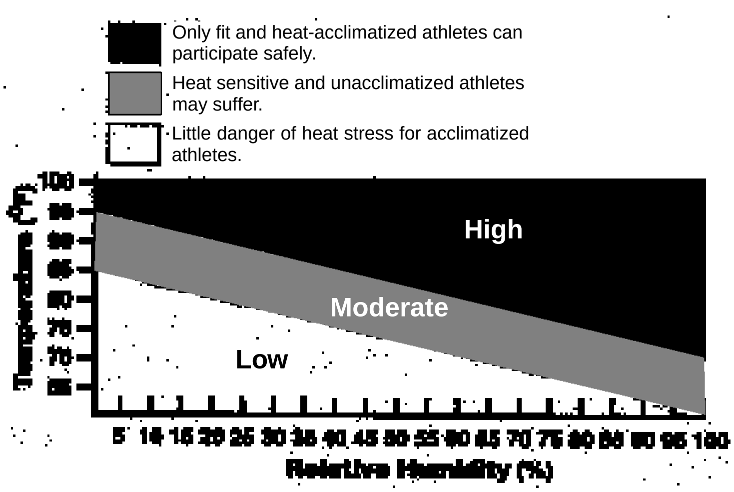

Figure 1: Temperature-Humidity Activity Index

because it can result in profound heat illness. Fluid replacement must be readily available. Student-athletes should be encouraged to drink as much and as frequently as comfort allows. They should drink one to two cups of water in the hour preceeding practice or competition, and continue drinking during activity (every 15-20 minutes). For activity up to two hours in duration, most weight loss represents water loss, and that fluid loss should be replaced as soon as possible. Following activity, the athlete should rehydrate with a volume that exceeds the amount lost during the activity. A two-pound weight loss represents approximately one quart of fluid loss.

Carbohydrate/electrolyte drinks, while not necessary to maintain performance, seem to enhance fluid intake. If carbohydrate-replacement fluids are provided, care must be taken to ensure adequate gastric emptying of the fluid. Therefore, carbohydrate concentration should not exceed eight percent. Electrolyte solutions are seldom necessary since sodium and potassium should be maintained with a normal diet.

6. By recording the body weight of each student-athlete before and after workout or practice, progressive hypohydration or loss of body fluids can be detected, and the potential harmful effects of hypohydration can be avoided. Those who lose five percent of their body weight or more over a period of several days should be evaluated medically and their activity restricted until rehydration has occurred.

7. Some student-athletes may be more susceptible to heat illness. Susceptible individuals include those with: inadequate acclimatization or aerobic fitness, excess body fat, a history of heat illness, a febrile condition, inadequate rehydration, and those who regularly push themselves to capacity. Also, prescription and over-the-counter drugs, such as antihistamines and pseudoephedrine, may increase the risk of heat illness.

Prevention of Heat Illness

8. Student-athletes should be informed of and monitored for signs of heat illness such as: cessation of sweating, weakness, cramping, rapid and weak pulse, pale or flushed skin, excessive fatigue, nausea, unsteadiness, disturbance of vision and incoherency. If heat illness is suspected, prompt emergency treatment is recommended. When training in hot and/or humid conditions, athletes should train with a partner or be under observation by a coach or athletic trainer.

First aid for heat illness

Heat exhaustion—Symptoms usually include profound weakness and exhaustion, and often dizziness, syncope, muscle cramps and nausea. Heat exhaustion is a form of shock due to depletion of body fluids. First aid should include rest in a cool, shaded environment. Fluids should be given orally. A physician should determine the need for electrolytes and additional medical care. Although rapid recovery is not unusual, student-athletes suffering from heat exhaustion should not be allowed to practice or compete for the remainder of that day.

Heatstroke—Heatstroke is a medical emergency. Medical care must be obtained at once; a delay in treatment can be fatal. This condition is characterized by a very high body temperature and usually (but not always) a hot, dry skin, which indicates failure of the primary temperature-regulating mechanism (sweating), and possibly seizure or coma. First aid includes immediate cooling of the body without causing the student-athlete to shiver. Recommended methods for cooling include using ice, immersion in cold water, or wetting the body and fanning vigorously. Victims of heatstroke should be hospitalized and monitored carefully.

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AMERICAN COLLEGE of SPORTS MEDICINE®

POSITION STAND

Exertional Heat Illness during Training and Competition

This pronouncement was written for the American College of Sports Medicine by Lawrence E. Armstrong, Ph.D., FACSM (Chair); Douglas J. Casa, Ph.D., ATC, FACSM; Mindy Millard-Stafford, Ph.D., FACSM, Daniel S. Moran, Ph.D., FACSM; Scott W. Pyne, M.D., FACSM; and Wiliam O. Roberts, M.D., FACSM.

SUMMARY

Exertional heat illness can affect athletes during high-intensity or long-duration exercise and result in withdrawal from activity or collapse during or soon after activity. These maladies include exercise associated muscle cramping, heat exhaustion, or exertional heatstroke. While certain individuals are more prone to collapse from exhaustion in the heat (i.e., not acclimatized, using certain medications, dehydrated, or recently ill), exertional heatstroke (EHS) can affect seemingly healthy athletes even when the environment is relatively cool. EHS is defined as a rectal temperature greater than 40°C accompanied by symptoms or signs of organ system failure, most frequently central nervous system dysfunction. Early recognition and rapid cooling can reduce both the morbidity and mortality associated with EHS. The clinical changes associated with EHS can be subtle and easy to miss if coaches, medical personnel, and athletes do not maintain a high level of awareness and monitor at-risk athletes closely. Fatigue and exhaustion during exercise occur more rapidly as heat stress increases and are the most common causes of withdrawal from activity in hot conditions. When athletes collapse from exhaustion in hot conditions, the term heat exhaustion is often applied. In some cases, rectal temperature is the only discernable difference between severe heat exhaustion and EHS in on-site evaluations. Heat exhaustion will generally resolve with symptomatic care and oral fluid support. Exercise associated muscle cramping can occur with exhaustive work in any temperature range, but appears to be more prevalent in hot and humid conditions. Muscle cramping usually responds to rest and replacement of fluid and salt (sodium). Prevention strategies are essential to reducing the incidence of EHS, heat exhaustion, and exercise associated muscle cramping.

INTRODUCTION

This document replaces, in part, the 1996 Position Stand titled "Heat and Cold Illnesses during Distance Running" (9) and considers selected heat related medical conditions (EHS, heat exhaustion, and exercise associated muscle cramping) that may affect active people in warm or hot environments. These recommendations are intended to reduce the morbidity and mortality of exertional heat-related illness during physical activity, but individual physiologic responses to exercise and daily health status are variable, so compliance with these recommendations will not guarantee protection.

Heat illness occurs world wide with prolonged intense activity in almost every venue (e.g., cycling, running races, American football, soccer). EHS (1,27,62,64,65,109,132, 154,160,164) and heat exhaustion (54,71,149,150) occur most frequently in hot-humid conditions, but can occur in cool conditions, during intense or prolonged exercise (133). Heat exhaustion and exercise related muscle cramps do not typically involve excessive hyperthermia, but rather are a result of fatigue, body water and/or electrolyte depletion, and/or central regulatory changes that fail in the face of exhaustion.

This document will address recognition, treatment, and incidence reduction for heat exhaustion, EHS, and exercise associated muscle cramping, but does not include anesthesia-induced malignant hyperthermia, sunburn, anhidrotic heat exhaustion, or sweat gland disorders that are classified in other disease categories, because these disorders may or may not involve exercise or be solely related to heat exposure. Hyponatremia also occurs more frequently during prolonged activity in hot conditions, but is usually associated with excessive fluid intake and is addressed in the ACSM Exercise and Fluid Replacement Position Stand.

Evidence statements in this document are based on the strength of scientific evidence with regard to clinical outcomes. Because research ethics preclude the use of human subjects in the study of EHS and other exertional heat illnesses, this document employs the following criteria: A, recommendation based on consistent and good-quality patient- or subject-oriented evidence; B, recommendation based on inconsistent or limited-quality patient- or subject-oriented evidence; C, recommendation based on consensus, usual practice, opinion, disease-oriented evidence, or a case series for studies of diagnosis, treatment, prevention, or screening.

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General Background: Exhaustion, Hyperthermia, and Dehydration

Exhaustion is a physiologic response to work defined as the inability to continue exercise and occurs with heavy exertion in all temperature ranges. As ambient temperature increases beyond 20°C (68°F) and heat stress rises, the time to exhaustion decreases (58). From a clinical perspective it is difficult to distinguish athletes with exhaustion in cool conditions from those who collapse in hot conditions. Exercise that must be stopped due to exhaustion is likely triggered by some combination of hyperthermia-induced reduction of peripheral muscle activation due to decreased central activation (brain fatigue) (110,118), hydration level, peripheral effect of hyperthermia on muscle fatigue, depletion of energy stores, electrolyte imbalance, and/or other factors. Some combination of central, spinal cord, and peripheral responses to hyperthermia factor into the etiology of withdrawal or collapse from exhaustion during activity; the exact mechanisms have yet to be explained (90,114–116,171). The exercise-related exhaustion that occurs in hot conditions may be an extension of this phenomenon, but it is more pronounced, because depletion of energy stores occurs faster in hotter conditions, especially when athletes are not acclimatized to exercise in the heat (71). When physiologic exhaustion results in collapse, the clinical syndrome is often referred to as heat exhaustion. In both hot and cool environments, postexercise collapse also may be due to postural hypotension rather than heat exhaustion and postural changes usually resolve with leg elevation and rest in less than 30 min.

There are several variables that affect exhaustion in athletes including duration and intensity of exercise, environmental conditions, acclimatization to exercise-heat stress, innate work capacity ($\dot{V}O_{2max}$), physical conditioning, hydration status, and personal factors like medications, supplements, sleep, and recent illness. In human studies of exercise time to exhaustion at a fixed exercise load, both individuals and groups show a decrease in exercise capacity (time to exhaustion) and an increase in perceived exertion as environmental temperature and/or relative humidity increase and/or as total body water decreases. The combined effects of heat stress and dehydration reduce exercise capacity and performance to a greater degree than either alone. Compared to more moderate conditions, an athlete in hot conditions must either slow the pace to avoid collapse or maintain the pace and risk collapse before the task is completed.

Evidence statement. Dehydration reduces endurance exercise performance, decreases time to exhaustion, increases heat storage (11,12,16,41,57,141). *Evidence category A.*

Exertional hyperthermia, defined as a core body temperature above 40°C (104°F) (71,85,86,149,150), occurs during athletic or recreational activity and is influenced by exercise intensity, environmental conditions, clothing, equipment, and individual factors. Hyperthermia occurs during exercise when muscle-generated heat accumulates faster than heat dissipates via increased sweating and skin blood flow (3). Heat production during intense exercise is 15–20 times greater than at rest, and can raise core body temperature by 1°C (1.8°F) every 5 min if no heat is removed from the body (105). Prolonged hyperthermia may lead to EHS, a life-threatening condition with a high mortality rate if not promptly recognized and treated with body cooling.

The removal of body heat is controlled by central nervous system (CNS) centers in the hypothalamus and spinal cord, and peripheral centers in the skin and organs. Heat flow to maintain a functional core temperature requires a temperature gradient from the body core to the body shell. If the skin temperature remains constant, the gradient increases as the core temperature increases during exercise, augmenting heat removal. If the shell or skin temperature also rises during exercise, as a result of either the environment or internal heat production, the core to skin gradient may be lost (i.e., reducing heat dissipation) and the core temperature increases.

Wide variations of heat tolerance exist among athletes. The extent to which elevated body temperature below 40°C diminishes exercise performance and contributes to heat exhaustion (110) is unknown, but there is considerable attrition from exercise when rectal temperatures reach 39–40°C (144). In controlled laboratory studies, precooling the body will extend the time to exhaustion and preheating will shorten the time to exhaustion, but in both circumstances athletes tend to terminate exercise due to fatigue at a rectal temperature of about 40°C (104°F) (61).

In recent years, the importance of hyperthermia in fatigue and collapse has been investigated. These studies have shown that the brain temperature is always higher than core temperature and heat removal is decreased in the hyperthermic brain compared to control (119). Also, as brain temperature increases from 37 to 40°C during exercise, cerebral blood flow and maximal voluntary muscular force output decrease with concurrent changes in brain wave activity and perceived exertion (110,118). Brain hyperthermia may explain why some exercising individuals collapse with exhaustion, while others are able to override central nervous system controls and push themselves to continue exercising strenuously and develop life-threatening EHS.

It is not unusual for some athletes to experience prolonged hyperthermia without noticeable medical impairment, especially during competition. Elevated rectal temperatures up to 41.9°C (107.4°F) have been noted in soccer players, American football lineman, road runners, and marathoners who show no symptoms or signs of heat related physical changes (21,42,46,98,125,129,130,132,161,165,176). This is significant because some athletes tolerate rectal temperatures well above the widely accepted threshold for EHS of >40°C without obvious clinical sequelae (71,85,86,104,149,150).

Dehydration occurs during prolonged exercise, more rapidly in hot environments when participants lose

SPECIAL COMMUNICATIONS

considerably more sweat than can be replaced by fluid intake (3,72,126). When fluid deficits exceed 3–5% of body weight, sweat production and skin blood flow begin to decline (19) reducing heat dissipation. Water deficits of 6–10% of body weight occur in hot weather, with or without clinically significant losses of sodium (Na^+) and chloride (Cl^-) (25,45,71,100,102,155,173) and reduce exercise tolerance by decreasing cardiac output, sweat production, and skin and muscle blood flow (12,41,57,71,101, 141,142). Dehydration may be either a direct (i.e., heat exhaustion, exercise associated muscle cramps) or indirect (i.e., heatstroke) factor in heat illness (10). Excessive sweating also results in salt loss, which has been implicated in exercise associated muscle cramps and in salt loss hyponatremia during long-duration (>8 h) endurance events in the heat.

In one study illustrating the cumulative affects of heat stress, a male soldier (32 yr, 180 cm, 110.47 kg, 41.4 $mL \cdot kg^{-1} \cdot min^{-1}$) participating in monitored, multiday, high-intensity exercise regimen at 41.2°C (106.0°F), 39% RH was asymptomatic with a postexercise rectal temperature of 38.3–38.9°C on days 3–7 (16). From the morning of day 5 to day 8, he lost 5.4 kg of body weight (4.8%) and had an increase of baseline heart rate, skin temperature and rectal temperature during days 6 and 7. On day 8, he developed heat exhaustion with unusual fatigue, muscular weakness, abdominal cramps, and vomiting with a rectal temperature of 39.6°C (103.3°F). His blood endorphin and cortisol levels were 6 and 2 times greater, respectively, than the other study subjects on day 8, indicating severe exercise-heat intolerance. Thirteen other males who maintained body weight near their prestudy baseline completed this protocol without incident. Because day-to-day dehydration affects heat tolerance, physical signs and hydration status should be monitored to reduce the incidence of heat exhaustion in hot environments.

When humans exercise near maximal levels, splanchnic and skin blood flow decrease as skeletal muscle blood flow increases to provide plasma glucose, remove heat, and remove metabolic products from working muscles (70). As the central controls for blood flow distribution fatigue due to a core temperature increase, the loss of compensatory splanchnic and skin vasoconstriction results in reduction of the total vascular resistance and worsens cardiac insufficiency (71,84). The loss of splanchnic vasoconstriction during exhaustion has been reproduced in a laboratory rat model and supports the assertion that loss of splanchnic vasoconstriction plays a role in heat exhaustion in athletes (70,73,84). This mechanism partially explains why exertional collapse is less likely to occur in cool environments, where cool, vasoconstricted skin helps maintain both cardiac filling and mean arterial pressure, and prolongs the time to exhaustion.

How EHS and heat exhaustion evolve, and in what sequence, are not completely understood (106). Some athletes tolerate hot conditions, dehydration, and hyperthermia well and are seemingly unaffected, while others discontinue activity in relatively less stressful conditions. The path that leads to EHS has been assumed to pass through heat exhaustion, however anecdotal and case study data seem to refute that notion as EHS can occur in relatively fresh athletes who develop symptomatic hyperthermia in 30–60 min of road racing in hot, humid conditions with no real signs of dehydration or heat exhaustion. If these athletes have heat exhaustion, then the duration and transition must be very short. Heat exhaustion should be protective for athletes in that, once exercise is stopped, the risk of developing exertional heat stroke is reduced because exercise-induced metabolic heat production decreases and heat dissipation to the environment increases. A program of prudent exercise in the heat along with acclimatization, improved cardiorespiratory physical fitness, and reasonable fluid replacement during exercise reduce the risk and incidence of both problems.

Evidence statement. Exertional heatstroke (EHS) is defined in the field by rectal temperature >40°C at collapse and by central nervous system changes. *Evidence category B*.

EXERTIONAL HEAT ILLNESSES

Exertional Heatstroke

Etiology. Exertional heatstroke (EHS) is defined by hyperthermia (core body temperature >40°C) associated with central nervous system disturbances and multiple organ system failure. When the metabolic heat produced by muscle during activity outpaces body heat transfer to the surroundings, the core temperature rises to levels that disrupt organ function. Almost all EHS patients exhibit sweat-soaked and pale skin at the time of collapse, as opposed to the dry, hot, and flushed skin that is described in the presentation of non-exertion-related (classic) heatstroke (162).

Predisposing factors. Although strenuous exercise in a hot-humid environment, lack of heat acclimatization, and poor physical fitness are widely accepted as the primary factors leading to EHS, even highly trained and heat-acclimatized athletes develop EHS while exercising at a high intensity if heat dissipation is inadequate relative to metabolic heat production (18,34,71). The greatest risk for EHS exists when the wet bulb globe temperature (WBGT) exceeds 28°C (82°F) (20,81,156) during high-intensity exercise (>75% $\dot{V}O_{2max}$) and/or strenuous exercise that lasts longer than 1 h as outlined below in "Monitoring the Environment." EHS also can occur in cool (8–18°C [45–65°F]) to moderate (18–28°C [65–82°F]) environments (14,56,132,133), suggesting that individual variations in susceptibility (14,22,55,56,66) may be due to inadequate physical fitness, incomplete heat acclimatization, or other temporary factors like viral illness or medications (81,133).

Evidence statement. Ten to 14 days of exercise training in the heat will improve heat acclimatization and reduce the risk of EHS. *Evidence category C*.

The risk of EHS rises substantially when athletes experience multiple stressors such as a sudden increase in physical training, lengthy initial exposure to heat, vapor barrier protective clothing, sleep deprivation (14), inadequate hydration, and poor nutrition. The cumulative effect of heat exposure on previous days raises the risk of EHS, especially if the ambient temperature remains elevated overnight (14,168). Over-the-counter drugs and nutritional supplements containing ephedrine, synephrine, ma huang and other sympathomimetic compounds may increase heat production (23,121), but require verification as a cause of hyperthermia by controlled laboratory studies or field trials.

Appropriate fluid ingestion before and during exercise minimizes dehydration and reduces the rate at which core body temperature rises (46,60). However, hyperthermia may occur in the absence of significant dehydration when a fast pace or high-intensity exercise generates more metabolic heat than the body can remove (18,34,165). Skin disease (i.e., *miliaria rubra*), sunburn, alcohol use, drug abuse (i.e., ecstasy), antidepressant medications (69), obesity, age >40 yr, genetic predisposition to malignant hyperthermia, and a history of heat illness also have been linked to an increased risk of EHS in athletes (14,55, 85,150). Athletes should not exercise in a hot environment if they have a fever, respiratory infection, diarrhea, or vomiting (14,81). A study of 179 heat casualties at a 14-km race over 9 yr showed that 23% reported a recent gastrointestinal or respiratory illness (128). A similar study of 10 military patients with EHS reported that three had a fever and six recalled at least one warning sign of impending illness prior to collapse (14).

In American football, EHS usually occurs during the initial 4 d of preseason practice, which for most players takes place during the hottest and most humid time of the summer when athletes are the least fit. This emphasizes the importance of gradually introducing activity to induce acclimatization, carefully monitoring changes in behavior or performance during practices, and selectively modifying exercise (i.e., intensity, duration, rest periods) in high-risk conditions. Three factors may influence the early season EHS risk in American football players: (a) failure of coaches to adjust the intensity of the practice to the current environmental conditions, following the advice of the sports medicine staff; (b) unfit and unacclimatized players practicing intensely in the heat; and (c) vapor barrier equipment introduced before acclimatization.

One study of 10 EHS cases (14) reported that eight incidents occurred during group running at a 12.1–13.8 $km \cdot h^{-1}$ pace in environmental temperatures of ≥25°C (77°F), suggesting that some host factor altered exercise-heat tolerance on the day that EHS occurred. Heat tolerance is often less in individuals who have the lowest maximal aerobic power (i.e., $\dot{V}O_{2max} \leq 40$ $mL \cdot kg^{-1} \cdot min^{-1}$) (14,64,96). To maintain pace when running in a group, these less fit individuals must function at higher exercise intensities to maintain the group's pace and are likely to have higher rectal temperatures at the end of a run compared to individuals with a higher $\dot{V}O_{2max}$. Air flow and heat dissipation also are reduced for runners in a pack.

More clinical and scientific reports of EHS involve males, and some hypotheses have been advanced (14). First, men may simply be in more EHS prone situations (i.e., military combat and American football). Second, men may be predisposed because of gender-specific hormonal, physiological, psychological, or morphological (i.e., muscle mass, body surface area-to-mass ratio) differences. Women, however, are not immune to the disorder, and the number of women who experience EHS may rise with the increased participation of women in strenuous sports.

Evidence statement. The following conditions increase the risk of EHS: obesity, low physical fitness level, lack of heat acclimatization, dehydration, a previous history of EHS, sleep deprivation, sweat gland dysfunction, sunburn, viral illness, diarrhea, or certain medications. *Evidence category B*. Physical training, cardiorespiratory fitness, and heat acclimatization reduce the risk of EHS. *Evidence category C*.

Pathophysiology. The underlying pathophysiology of EHS occurs when internal organ tissue temperatures rise above critical levels, cell membranes are damaged, and cell energy systems are disrupted, giving rise to a characteristic clinical syndrome (56,149). As a cell is heated beyond its thermal threshold (i.e., about 40°C), a cascade of events occurs that disrupts cell volume, metabolism, acid–base balance, and membrane permeability leading initially to cell and organ dysfunction and finally to cell death and organ failure (71,91,175). This complex cascade of events explains the variable onset of brain, cardiac, renal, gastrointestinal, hematologic, and muscle dysfunction among EHS patients.

The extent of multisystem tissue morbidity and the mortality rate are directly related to the area in degree-minutes under the body core temperature vs. time graph and

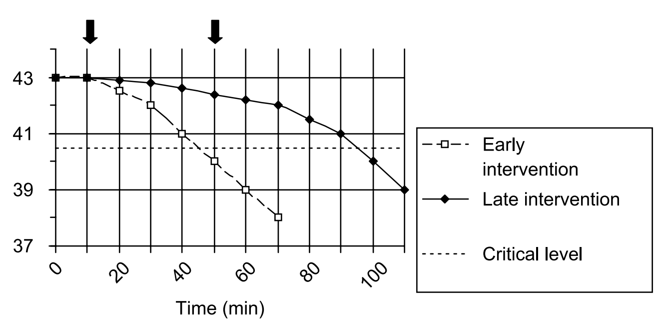

FIGURE 1— Cooling curves for early and late cooling interventions. The area under the early intervention curve above 40.5°C (the dashed line) in degree-minutes is approximately 60 while the area under the late intervention curve (cooling at 50 min) is >145. The prognosis based on area under the cooling curve for the late intervention is poor. Cooling can be delayed when heat stoke is not recognized early in the evaluation or if the athlete is transported before cooling is initiated. The arrow marks the start of cooling at 10 min for early intervention and 50 min for late intervention.

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the length of time required to cool central organs to <40°C (14,20,47,48). Tissue thresholds and the duration of temperature elevation, rather than the peak core body temperature, determine the degree of injury (72). When cooling is rapidly initiated and both the body temperature and cognitive function return to the normal range within an hour of onset of symptoms, most EHS patients recover fully (47,48). EHS victims who are recognized and cooled immediately theoretically tolerate about 60°C·min (120°F·min; area under the cooling curve) above 40.5°C without lasting sequelae (see Fig. 1). Conversely, athletes with EHS who go unrecognized or are not cooled quickly, and have more than 60°C·min of temperature elevation above 40.5°C, tend to have increased morbidity and mortality. Outcomes of 20 "light" and 16 "severe" cases of EHS during military training (150) showed that coma was relatively brief in light cases when hyperthermia was limited to <1 h, despite evidence of multiple organ involvement that was confirmed with elevated serum muscle and liver enzymes (74,172). Severe EHS cases were moribund at the time of admission and died early with evident central nervous system damage (150). The primary difference between light and severe EHS cases appears to be the length of time between collapse and the initiation of cooling therapy (14,20,47,48).

Hyperthermia of heart muscle tissue directly suppresses cardiac function, but the dysfunction is reversible with body cooling, as demonstrated by echocardiography (133). Cardiac tissue hyperthermia reduces cardiac output, oxygen delivery to tissues, and the vascular transport of heat from deep tissues to the skin. Cardiac insufficiency or failure associated with hyperthermia accelerates the elevation of core temperature and increases tissue hypoxia, metabolic acidosis and organ dysfunction. The concurrent heating of the brain begins a cascade of cerebral and hypothalamic failure that also accelerates cell death by disrupting the regulation of blood pressure and blood flow. Interestingly, direct hyperthermia-induced brain dysfunction may lead to collapse that can be "lifesaving," if stopping exercise allows the body to cool or the collapse triggers medical evaluation that leads to cooling therapy.

Exercise stimulates increased blood flow to working muscle. During a maximal effort, for example, approximately 80–85% of maximal cardiac output is distributed to active muscle tissue (139). As core temperature increases during exercise, the thermoregulatory response increases peripheral vasodilatation and blood flow to the cutaneous vascular beds to augment body cooling. The brain also regulates blood pressure during exercise by decreasing blood flow to splanchnic organs. This decreased intestinal blood flow limits vascular heat exchange in the gut and promotes bowel tissue hyperthermia and ischemia. Gut cell membrane breakdown allows lipopolysaccharide fragments from intestinal gram-negative bacteria to leak into the systemic circulation, increasing the risk of endotoxic shock. Dehydration can accentuate these effects on the GI tract and speed the process.

Rhabdomyolysis, the breakdown of muscle fibers, occurs in EHS as muscle tissue exceeds the critical temperature threshold of cell membranes (i.e., about 40°C). Although eccentric and concentric muscle overuse is a common cause of rhabdomyolysis, muscle membrane permeability increases due to hyperthermia and occurs earlier in exercise when the muscle tissues are hyperthermic (71,74). As heat decomposes cell membranes, myoglobin is released and may cause renal tubular toxicity and obstruction if renal blood flow is inadequate. Intracellular potassium is also released into the extracellular space, increasing serum levels and potentially inducing cardiac arrhythmias. Heating renal tissue above its critical threshold can directly suppress renal function and induce acute renal failure that is worsened by sustained hypotension, crystallization of myoglobin, disseminated intravascular coagulation, and the metabolic acidosis associated with exercise (31,70,153).

Incidence. The incidence of EHS varies from event to event and increases with rising ambient temperature and relative humidity. Limited data exist regarding the incidence of EHS during athletic activities. While fatal outcomes are often reported in the press, there is limited reporting of non fatal EHS unless it involves high profile athletes. In most cases, fatal EHS is a rare event that strikes "at random" in sports like American football, especially during the initial four days of preseason conditioning, where the incidence of fatal EHS was about 1 in 350,000 participants from 1995 through 2002 (131). Fatal EHS in American football players often occurs when air temperature is 26–30°C (78–86°F) and relative humidity is 50–80% (87). EHS is observed more often during road racing and other activities that involve continuous, high-intensity exercise. The Twin Cities Marathon, which is run in cool conditions, averages <1 EHS per 10,000 finishers (136); this incidence rises as the WBGT rises. In contrast, one popular 11.5-km road race, staged in hot and humid summer conditions (WBGT 21–27°C), averages 10–20 EHS cases per 10,000 entrants (18,34). The same race course, run in cool conditions, had no cases of EHS (A Crago, M.D., personal communication). Such a high incidence burdens the medical care system and suggests that the summer event is not scheduled at the safest time for the runners.

Recognition. Immediate recognition of EHS cases is paramount to survival (68). The appearance of signs and symptoms depends on the degree and duration of hyperthermia (14,48,71,81,150). The symptoms and signs are often nonspecific and include disorientation, confusion, dizziness, irrational or unusual behavior, inappropriate comments, irritability, headache, inability to walk, loss of balance and muscle function resulting in collapse, profound fatigue, hyperventilation, vomiting, diarrhea, delirium, seizures, or coma. Thus, any change of personality or performance should trigger an assessment for EHS, especially in hot-humid conditions. In collision sports like American football, EHS has been initially mistaken for concussion; among nonathletes, EHS also has been initially misdiagnosed as psychosis.

A body core temperature estimate is vital to establishing an EHS diagnosis, and rectal temperature should be measured in any athlete who collapses or exhibits signs or symptoms consistent with EHS. Ear (aural canal or tympanic membrane), oral, skin over the temporal artery, and axillary temperature measurements should not be used to diagnose EHS because they are spuriously lowered by the temperature of air, skin, and liquids that contact the skin (18,134,135). Oral temperature measurements also are affected by hyperventilation, swallowing, ingestion of cold liquids, and face fanning (33,151). At the time of collapse, systolic blood pressure <100 mm Hg, tachycardia, hyperventilation, and a shocklike appearance (i.e., sweaty, cool skin) are common.

Evidence statement. Ear (i.e., aural), oral, skin, temporal, and axillary temperature measurements should not be used to diagnose or distinguish EHS from exertional heat exhaustion. *Evidence category B*. Early symptoms of EHS include clumsiness, stumbling, headache, nausea, dizziness, apathy, confusion, and impairment of consciousness (71,85,149,161). *Evidence category B*.

Treatment. EHS is a life-threatening medical emergency that requires immediate whole body cooling for a satisfactory outcome (14,44,48,72,82,85,120,132,149). Cooling should be initiated and, if there are no other life-threatening complications, completed on-site prior to evacuation to the hospital emergency department. Athletes who rapidly become lucid during cooling usually have the best prognosis.

The most rapid whole body cooling rates (i.e., range 0.15–0.24°C·min^{-1}) have been observed with cold water and ice water immersion therapy (13,43,47,63,78,83,111, 125,163), and both have the lowest morbidity and mortality rates (47). An aggressive combination of rapidly rotating ice water-soaked towels to the head, trunk and extremities and ice packs to the neck, axillae and groin, (e.g., as currently used at the Twin Cities, Chicago, and Marine Corps marathons) provides a reasonable rate of cooling (i.e., range 0.12–0.16°C·min^{-1}). Ice packs to the neck, axilla, and groin will decrease body temperature in the range of 0.04–0.08°C·min^{-1} (13). Warm air mist and fanning techniques provide slower whole body cooling rates and are most effective only when the relative humidity is low because this method depends heavily on evaporation for cooling efficacy. Although some patients exhibit a misleading "lucid interval" that often delays the diagnosis, observation and cooling therapy should continue until rectal temperature and mental acuity indicate that treatment is successful. Road race competitors, with rectal temperatures of >42°C and profound CNS dysfunction, who are identified and treated immediately in ice water baths, often leave the medical tent without hospitalization or discernable sequelae (18,34,134).

Evidence statement. Cold water immersion provides the fastest whole body cooling rate and the lowest morbidity and mortality for EHS. *Evidence category A*. When water immersion is unavailable, ice water towels/ sheets combined with ice packs on the head, trunk, and extremities provide effective but slower whole body cooling. *Evidence category C*.

A medical record should be completed for each athlete who receives treatment (2,132). This provides a record of care and information that can be used to improve the medical plan for future EHS incidents. Table 1 lists the equipment and supplies needed to evaluate and treat exertional heat illnesses that may occur during an athletic event.

TABLE 1. Suggested equipment and supplies for treatment of heat related illness.

Stretchers
Cots
Wheelchairs
Bath towels
High temperature rectal thermometers (>43°C, >110°F)
Disposable latex-free gloves
Stethoscopes
Blood pressure cuffs
Intravenous (IV) tubing and cannulation needles
D5%NS and NS IV fluids in 1-L bags
3% saline IV fluid in 250-mL bags
Sharps and biohazard disposal containers
Alcohol wipes, tape, and gauze pads
Tables for medical supplies
Water supply for tubs or ice water buckets
Tub for immersion therapy
Fans for cooling
Oxygen tanks with regulators and masks
Ice, crushed or cubed
Plastic bags
Oral rehydration fluids
Cups for oral fluids
Glucose blood monitoring kits
Sodium analyzer and chemistry chips
Diazepam IV 5 mg or midazolam IV 1 mg vials
Defibrillator (automatic or manual)

[a] Revised from references (2) and (117).

EHS casualties often present with cardiovascular collapse and shock. Immediate cooling can reverse these conditions but, if prolonged core temperature elevation and multiple organ failure exist, the victim will require extensive intervention beyond body cooling and fluid replacement. Clinical, hematological, serum chemistry, and diagnostic imaging assessments should be initiated during cooling when possible, but tests that delay body cooling should not be employed unless they are critical to survival (39). Clinical markers of disseminated intravascular coagulation, prolonged elevation of liver and muscle enzymes in the serum, multiple organ failures, and prolonged coma are associated with a grave prognosis.

Preserving intravascular volume with normal saline (NS) infusion improves renal blood flow to protect the kidney from rhabdomyolysis and improves tissue perfusion in all organs for heat exchange, oxygenation, and removal of waste products. Dantrolene, a direct muscle relaxant that alters muscle contractility and calcium channel flow in membranes, purportedly is effective for treating rhabdomyolysis and athletes who have a genetic predisposition to malignant hyperthermia (104), but additional investigations are needed to clarify its efficacy in

EHS. The sheer volume of dantrolene needed to reverse malignant hyperthermia precludes its routine use in the field, but empiric use may be considered in EHS athletes who do not respond to aggressive cooling techniques. Seizures triggered by heat-induced brain dysfunction can be controlled with intravenous benzodiazepines until the brain is cooled and the electrochemical instability is reversed. Treatment of multiple organ system failure associated with prolonged EHS is beyond the scope of this position paper; accepted protocols can be found in most medical texts and handbooks.

Return to training or competition. There are no evidence-based recommendations regarding the return of athletes to training after an episode of EHS. For the majority of patients who receive prompt cooling therapy, the prognosis for full recovery and rapid return to activity is good (47,48,123,147). Nine out of 10 prior heatstroke patients tested about two months after an EHS episode demonstrated normal thermoregulation, exercise-heat tolerance, and heat acclimatization with normal sweat gland function, whole body sodium and potassium balance, and blood constituents (14). One of these patients was found to be heat intolerant during laboratory testing at 2 and 7 months after EHS, but was heat tolerant at 1 yr. Physiological and psychological recovery from EHS may require longer than a year, especially in those who experience severe hepatic injury (28,140).

Five recommendations have been proposed for the return to training and competition (37).

1. Refrain from exercise for at least 7 d following release from medical care.
2. Follow up in about 1 wk for physical exam and repeat lab testing or diagnostic imaging of affected organs that may be indicated, based on the physician's evaluation.
3. When cleared for activity, begin exercise in a cool environment and gradually increase the duration, intensity, and heat exposure for 2 wk to acclimatize and demonstrate heat tolerance.
4. If return to activity is difficult, consider a laboratory exercise-heat tolerance test about one month post-incident (14,98,103,138).
5. Clear the athlete for full competition if heat tolerance exists after 2–4 wk of training.

Evidence statement. EHS casualties may return to practice and competition when they have reestablished heat tolerance. *Evidence category B.*

Exertional Heat Exhaustion

Exhaustion defined as the inability to continue to exercise, occurs with heavy exertion in all temperatures and may or may not be associated with physical collapse. From a clinical perspective it is difficult to distinguish athletes who collapse with exhaustion in cool conditions from those in hot conditions. Exertional heat exhaustion was first described between 1938 and 1944 in medical reports (6,30,169,170) involving laborers and military personnel in the deserts of North Africa (4) and Iraq (89). These reports differentiated heat syncope (i.e., orthostatic hypotension) from heat exhaustion involving significant fluid-electrolyte losses and cardiovascular insufficiency (67,93,170,167). Heat exhaustion is also postulated to be the result of central failure that protects the body against overexertion in stressful situations (99). This paradigm suggests that heat exhaustion is a brain-mediated "safety brake" against excess activity in any environment (114,115,158).

Etiology. Heat exhaustion related to dehydration is more common in hot conditions. Rectal temperature can be elevated in heat exhaustion, because circulatory insufficiency predisposes to elevated core body temperatures (16). Laboratory and field studies have shown that exercise in 34–39°C (93–102°F) at 40–50% $\dot{V}O_{2max}$ does not induce heat exhaustion unless dehydration is present, and that identical exercise performed in a cool environment does not induce heat exhaustion (35,143).

Several lines of evidence suggest that heat exhaustion results from the central fatigue that induces widespread peripheral vascular dilation and associated collapse (11). A Saudi Arabian research group (146) measured echocardiography images of heat exhaustion patients who had participated in consecutive days of desert walking during a religious pilgrimage. These images showed that heat exhaustion involved tachycardia and high cardiac output with peripheral vasodilatation, characteristic of high output heart failure. The vasodilatation lowered peripheral vascular resistance resulting in hypotension and cardiovascular insufficiency. The blood volume pooled in the skin and extremities reduces intravascular heat transport from the core to the body surface and, in turn, heat loss from the skin surface. If the air humidity is high, evaporative cooling is impaired because the air is nearly saturated with moisture, signaling the body to increase cutaneous blood flow to support nonevaporative radiation and convection heat loss. This likely explains why both EHS and heat exhaustion occur more frequently on humid days.

Predisposing factors. There are several factors that predispose athletes to heat exhaustion, including the variables that affect exhaustion during exercise. Three studies of underground miners identified that the following factors were associated with an increasing number of heat exhaustion cases: a body mass index > 27 $kg \cdot m^{-2}$; work during the hottest months of the year; elevated urine specific gravity, hematocrit, hemoglobin, or serum osmolality suggesting inadequate fluid intake; an air temperature > 33°C and an air velocity < 2.0 $m \cdot s^{-1}$ (50–52).

Evidence statement. Dehydration and high body mass index increase the risk of exertional heat exhaustion. *Evidence category B.* Ten to 14 days of exercise training in the heat will improve heat acclimatization and reduce the risk of exertional heat exhaustion. *Evidence category C.*

Incidence. Heat exhaustion is the most common heat-related disorder observed in active populations (5,75, 79,85,97), but the incidence has not been systematically tracked with respect to sport participation. The incidence among religious pilgrims, who walked in the desert at 35–50°C (95–122°F) and had variable fitness and age, was 4 per 10,000 individuals per day (5). Reserve soldiers participating in summer maneuvers at 49–54°C (120–130°F) were affected at a rate of 13 per 10,000 individuals per day (97). Presumably fit competitors running in a 14-km road race with mild air temperatures of 11–20°C (52–68°F) were affected at the rate of 14 per 10,000 individuals per day (127), demonstrating the effects of increased intensity in less stressful heat. During a 6-day youth soccer tournament with early morning WBGT > 28°C (82°F), 34 players out of 4000 (85 per 10,000 incidence) were treated for heat exhaustion with a large increase in cases on the second day of the tournament, demonstrating the effects of cumulative exposure (54). These groups demonstrate the interactions of exercise duration, exercise intensity, and environment on the incidence of exertional heat exhaustion.

Recognition. The signs and symptoms of heat exhaustion are neither specific nor sensitive. During the acute stage of heat exhaustion the blood pressure is low, the pulse and respiratory rates are elevated, and the patient appears sweaty, pale, and ashen. Other signs and symptoms include headache, weakness, dizziness, "heat sensations" on the head or neck, chills, "goose flesh", nausea, vomiting, diarrhea, irritability, and decreased muscle coordination (71,72,76). Muscle cramps may or may not accompany heat exhaustion (70). In the field, rectal temperature measurement may discriminate between severe heat exhaustion (<40°C, 104°F) and EHS (>40°C) (36). If rectal temperature cannot be measured promptly, empiric heatstroke cooling therapy should be considered, especially if there are CNS symptoms. One study systematically examined the role of exercise in heat exhaustion by observing 14 healthy males (15) who ran 8.3–9.8 $km \cdot d^{-1}$ on a treadmill at 63–72% $\dot{V}O_{2max}$ for eight consecutive days in a 41°C (106°F), 39% RH environment and all the common signs and symptoms of heat exhaustion occurred in this study group (see section above titled, "Recognition").

Treatment. An athlete with the clinical picture of exertional heat exhaustion should be moved to a shaded or air conditioned area, have excess clothing removed, placed in the supine position with legs elevated, and have the heart rate, blood pressure, respiratory rate, rectal temperature, and central nervous system status monitored closely. The vast majority of athletes will resolve their collapse with leg elevation, oral fluids, and rest. Heat exhaustion does not always involve elevated core temperature, but cooling therapy will often improve the medical status. An athlete with suspected heat exhaustion who does not improve with these simple measures should be transported to an emergency facility.

Oral fluids are preferred for rehydration in athletes who are conscious, able to swallow well, and not losing fluids via vomiting or diarrhea. As long as the blood pressure, pulse, and rectal temperature are normal and no ongoing fluid losses exist, intravenous fluids should not be required. Intravenous fluid administration facilitates rapid recovery from heat exhaustion (50–52,72) in those who are unable to ingest oral fluids or have more severe dehydration. The decision to utilize intravenous fluids in dehydrated casualties hinges on the patient's orthostatic pulse, blood pressure change, other clinical signs of dehydration, and ability to ingest oral fluids. Progressive clouding of consciousness should trigger a detailed evaluation for hyperthermia, hypothermia, hyponatremia, hypoglycemia, and other medical problems (112,113). Muscle twitching or cramping that is not easily relieved by stretching may be associated with symptomatic hyponatremia. If dehydration is not clinically obvious in the collapsed athlete with suspected heat exhaustion, consider dilutional hyponatremia as a potential cause of the collapse before administering intravenous fluids (102).

The most commonly recommended IV fluids for rehydrating athletes are NS or 5% dextrose in NS. For empirical field treatment, the primary goal is intravascular volume expansion with saline, to protect organ function and improve blood pressure in athletes with signs of shock. The 5% dextrose solution provides glucose for cell energy. Current protocols suggest starting with NS unless the blood glucose is low. Intravenous fluids (1–4 L) have been used to speed recovery in miners (50–52) and are also used during the half time of soccer matches and American football games, although this practice is not evidence based nor recommended.

The vast majority of athletes with heat exhaustion recover on site and, when clinically stable, may be discharged in the company of a friend or relative with instructions for continued rest and rehydration. A simple check of urine volume and color (i.e., pale yellow or straw color) for the next 48 h will help gauge the recovery process. Prognosis is best when mental acuity was not altered and the athlete becomes alert quickly, following rest and fluids. An athlete with severe heat exhaustion should be instructed to follow-up with a physician (29,36,132).

Return to training or competition. An immediate return to exercise or labor following heat exhaustion is not prudent or advised. Athletes with milder forms of heat exhaustion can often return to training or work within 24–48 h, with instructions for gradually increasing the intensity and volume of activity. Neither rest nor body cooling allows heat exhaustion cases to recover to full exercise capacity on the same day (3). In a series of 106 cases of heat exhaustion in underground miners, 4 were sent to the hospital for treatment and 102 were treated on site and released to home. Of 77 miners who returned to work the next day, 30 had persistent mild symptoms of headache and fatigue, and were not allowed to return to normal work duties that day.

Of the asymptomatic miners, 46 of 47 returned to normal duties while 22 of the 30 symptomatic miners were restricted to an air conditioned environment. All of these workers were back to full duties by the third day and none required further medical treatment (52). Serious complications are very rare. Athletes who are rehydrated during games with intravenous fluids and allowed to return to play often are profuse sweaters suffering from dehydration, rather than true heat exhaustion casualties.

Exercise-Associated Muscle Cramps (Exertional Heat Cramps)

Etiology. Exercise associated muscle cramps (EAMC), also called heat cramps, are painful spasms of skeletal muscles that are commonly observed following prolonged, strenuous exercise, often in the heat (95). EAMC is especially prevalent in tennis and American football players (26). EAMC is common in long distance races, where intensity or duration often exceeds that experienced during daily training.

Cramps that occur in the heat are thought by some to differ from EAMC (71) because the cramping is accentuated by large sodium and water losses and that cramps in the heat may present with different signs and symptoms (24,25,71,88). EAMC in the heat often appear unheralded and occur in the legs, arms or abdomen (25,71,92,94,95, 166), although runners, skaters, and skiers who exercise to fatigue in moderate to cool temperatures present in a similar clinical manner. Tennis players who experience recurrent heat cramps are reportedly able to feel a cramp coming on and can abort the cramps with rest and fluids (24). Few investigations have measured fluid-electrolyte balance in EAMC patients, but some have reported whole body sodium deficiencies (24,25,26,88,92,166). Some individuals have a peculiar susceptibility to EAMC that may be related to genetic or metabolic abnormalities in skeletal muscle or lipid metabolism (159).

Predisposing factors. Three factors are usually present in EAMC: exercise-induced muscle fatigue, body water loss, and large sweat Na^+ loss (24,26,85). EAMC seems to be more frequent in long-duration, high-intensity events; indeed, the competitive schedule of certain athletic events may predispose to EAMC. In multiday tennis tournaments, competitors often play more than one match a day, with only an hour between matches. This format induces muscle fatigue, impedes both fluid and electrolyte replacement between matches, and often results in debilitating EAMC (24,25). A similar scenario occurs during the two-a-day practices or competitions and/or other multiday tournaments, both of which are associated with large sweat losses.

Pathophysiology. Sweat Na^+ losses that are replaced with hypotonic fluid have been proposed as the primary cause of EAMC (24,25,32,53,71,92,95,96,166). Sugar cane cutters who experienced EAMC were found to have low urinary Na^+ levels (versus healthy laborers) and the authors concluded a whole body Na^+ deficit existed (92,95). A young tennis player with a history of recurring EAMC successfully treated this disorder by increasing his dietary salt intake (24). In anecdotal reports, steel mill workers prevent EAMC when they increase their consumption of table salt (88,166). Significant quantities of intracellular calcium, magnesium, and potassium (K^+) are not lost during activity, so painful cramps in hot environments are likely not related to changes in those levels (25).

The resting electrical potentials of nerve and muscle tissues are affected by the concentrations of Na^+, Cl^- and K^+ on both sides of the cell membrane. Intracellular dilution or water expansion is believed to play a role in the development of EAMC (88,95). EAMC apparently are less likely to occur when interstitial or extracellular edema is observed (88).

Incidence. The incidence of EAMC has not been reported in any large epidemiologic study of athletes. In a 12-yr summary of marathon medical encounters, there were 1.2 cases of EAMC per 1000 race entrants and cramping accounted for 6.1% of medical encounters (136).

Recognition. In EAMC, the affected muscle or muscle group is contracted tightly causing pain that is sometimes excruciating. The affected muscles often appear to be randomly involved, and as one bundle of muscle fibers relax, an adjacent bundle contracts, giving the impression that the spasms wander (88). Twitches first may appear in the quadriceps and subsequently in another muscle group (25). Most EAMC spasms last 1–3 min, but the total series may span 6–8 h (95). Intestinal cramps (i.e., due to gaseous bloating or diarrhea) and gastrointestinal infections have been mistaken for abdominal EAMC (71,95).

EAMC can be confused with tetany. However, the characteristic flexion at metacarpophalangeal joints and the extension at interphalangeal joints of the fingers, give the hand its typical tetany appearance. Tetany rarely occurs concurrent with heat cramps, but is commonly observed in hyperventilation syndrome, hypokalemia associated with diuretic use, and in wrestlers who lose weight via dehydration (95).

Treatment. EAMC responds well to rest, prolonged stretch with the muscle groups at full length, and oral NaCl ingestion in fluids or foods (i.e., 1/8–1/4 teaspoon of table salt added to 300–500 mL of fluids or sports drink, 1–2 salt tablets with 300–500 mL of fluid, bullion broth, or salty snacks). Intravenous NS fluids provide rapid relief from severe EAMC (88,95) in some cases. Calcium salts, sodium bicarbonate, quinine, and dextrose have not produced consistent benefits when treating EAMC (25,95). In refractory muscle cramping, intravenous benzodiazepines effectively relieve muscle cramps through central mechanisms. The use of these medications requires close monitoring and excludes athletes from return to activity. Cramping also occurs in dilutional hyponatremia, so protracted cramping without clinical signs of dehydration should trigger the measurement of serum Na+ before administering IV NS to treat the spasms.

Return to training or competition. Many athletes with EAMC are able to return to play during the same game with rest and fluid replacement, while some require at least a day to recover following treatment. If the muscle cramping is associated with heat exhaustion or symptomatic hyponatremia (71), the recommendations for the more severe problem should guide the return to play.

Prevention. EAMC that occur in hot conditions seem to be prevented by maintaining fluid and salt balance. Athletes with high sweat Na^+ levels and sweat rates, or who have a history of EAMC, may need to consume supplemental Na^+ during prolonged activities to maintain salt balance (25,71,137) and may need to increase daily dietary salt to 5–10 $g \cdot d^{-1}$ when sweat losses are large (95,166). This is especially important during the heat acclimatization phase of training. Calculating sweat Na^+ losses and replacing that Na^+ during and after activity allowed two athletes with previously debilitating EAMC to compete successfully in hot conditions (24). There are anecdotal reports of EAMC resolution in American football and in soccer players who increase their oral salt intake before, during, and after activity.

ATHLETE SAFETY AND REDUCTION OF HEAT RELATED ILLNESS

Events should be scheduled to avoid extremely hot and humid months, based on the historical local weather data. During summer months, all events, games, and practices should be scheduled during the cooler hours of the day (e.g., early morning). Unseasonably hot days in spring and fall will increase the risk of exertional heat illnesses because competitors are often not sufficiently acclimatized.

Heat acclimatization is the best known protection against both EHS and heat exhaustion. Acclimatization requires gradually increasing the duration and intensity of exercise during the initial 10–14 d of heat exposure, although maximal protection may take up to 12 wk (17). In a study of mortality, the minimum temperatures at which fatal heat stroke occurred decreased at higher latitudes (i.e., northern Europe), and the minimum temperature for fatal cases increased as the summer months progressed at the same latitude (80). Thus, natural heat acclimatization that occurs from living in a given geographic area and the recommended exercise limits and modifications, must consider regional climatic differences. Fitness also confers some protection such that prolonged, near-maximal exertion should be avoided before acquired physical fitness and heat acclimatization are sufficient to support high-intensity, long-duration exercise training or competition (59,122,124,152). Event-specific physical training in the heat reduces the incidence of heat exhaustion (36) by enhancing cardiovascular function and fluid-electrolyte homeostasis.

All athletes should be monitored for signs and symptoms of heat strain, especially during the acclimatization period and when environmental conditions become more stressful, because early recognition decreases both the severity of the episode and the time lost from activity. Athletes, who are adequately rested, nourished, hydrated, and acclimatized to heat are at less risk for heat exhaustion (67). If an athlete experiences recurrent episodes of heat exhaustion, a careful review of fluid intake, diet, whole-body sodium balance,

TABLE 2. WBGT levels for modification or cancellation of workouts or athletic competition for healthy adults.[a,f]

WBGT [b]			Training and Noncontinuous Activity	
°F	°C	Continuous Activity and Competition	Nonacclimatized, Unfit, High-Risk Individuals [c]	Acclimatized, Fit, Low-Risk Individuals [c,d]
≤50.0	≤10.0	Generally safe; EHS can occur associated with individual factors	Normal activity	Normal activity
50.1–65.0	10.1–18.3	Generally safe; EHS can occur	Normal activity	Normal activity
65.1–72.0	18.4–22.2	Risk of EHS and other heat illness begins to rise; high-risk individuals should be monitored or not compete	Increase the rest:work ratio. Monitor fluid intake.	Normal activity
72.1–78.0	22.3–25.6	Risk for all competitors is increased	Increase the rest:work ratio and decrease total duration of activity.	Normal activity. Monitor fluid intake.
78.1–82.0	25.7–27.8	Risk for unfit, nonacclimatized individuals is high	Increase the rest:work ratio; decrease intensity and total duration of activity.	Normal activity. Monitor fluid intake.
82.1–86.0	27.9–30.0	Cancel level for EHS risk	Increase the rest:work ratio to 1:1, decrease intensity and total duration of activity. Limit intense exercise. Watch at-risk individuals carefully	Plan intense or prolonged exercise with discretion[f]; watch at-risk individuals carefully
86.1–90.0	30.1–32.2		Cancel or stop practice and competition.	Limit intense exercise[f] and total daily exposure to heat and humidity; watch for early signs and symptoms
≥90.1	>32.3		Cancel exercise.	Cancel exercise uncompensable heat stress[e] exists for all athletes[f]

[a] revised from reference (38).
[b] wet bulb globe temperature.
[c] while wearing shorts, T-shirt, socks and sneakers.
[d] acclimatized to training in the heat at least 3 wk.
[e] internal heat production exceeds heat loss and core body temperature rises continuously, without a plateau.
[f] Differences of local climate and individual heat acclimatization status may allow activity at higher levels than outlined in the table, but athletes and coaches should consult with sports medicine staff and should be cautious when exceeding these limits.

TABLE 3. Modifying practice sessions for exercising children.

WBGT		
°F	°C	Restraints on Activities
<75.0	<24.0	All activities allowed, but be alert for prodromes of heat-related illness in prolonged events
75.0–78.6	24.0–25.9	Longer rest periods in the shade; enforce drinking every 15 min
79.0–84.0	26.0–29.0	Stop activity of unacclimatized persons and high-risk persons; limit activities of all others (disallow long-distance races, cut the duration of other activities)
>85.0	>29.0	Cancel all athletic activities

Notes:
1. Source: reference (7).
2. These guidelines do not account for clothing. Although the effects of the uniform clothing and protective equipment (i.e., American football) on sweating and body temperature in younger athletes are unknown, uniforms should be considered when determining playing/practice limitations based on the WBGT.
3. Eight to 10 practices are recommended for heat acclimatization (30–45 min each; one per day or one every other day).
4. Differences of local climate and individual heat acclimatization status may allow activity at higher levels than outlined in the table, but athletes and coaches should consult with sports medicine staff and should be cautious when exceeding these limits.

recovery interval, and heat acclimatization should be undertaken and corrected (36). Athletes should have a monitored fluid replacement plan (8,9) to stay within 2% of the baseline body weight (i.e., initial weight in multiday events or practices) (30).

Activity modification in high-risk situations. The events posing the greatest risk of EHS, heat exhaustion and EAMC involve high-intensity exercise in a hot-humid environment. Athletes may not have adequate experience to withdraw voluntarily, and often assume that the act of conducting a competition or practice implies safe conditions for the activity. The internal motivation of athletes to succeed under any circumstances plays a role in EHS risk and must be recognized by coaches and administrators when making the decision to conduct an event in high-risk conditions.

One athlete experiencing heat-related symptoms (i.e., the "weak link") often indicates that other exertional heat casualties will soon follow (75,97). Medical providers, event directors, coaches and athletes should be prepared to postpone, reschedule, modify, or cancel activities when environmental conditions pose undue risk, based on predetermined safety guidelines established for that event. The pressures exerted by parents, peers, coaches, administrators, and competition may encourage ill, fatigued, or dehydrated athletes to participate when the environmental conditions are unsafe.

Independent of an athlete's heat acclimatization or fitness, practice sessions and competitions should be modified with unlimited fluid access, longer and/or more rest breaks to facilitate heat dissipation, shorter playing times to decrease heat production, and/or delays when the moderate or higher environment risk categories exist (Table 2). The following factors should be considered when modifying training or events: environmental conditions, heat acclimatization status of participants, fitness and age of participants, intensity and duration of exercise, time of day, clothing or uniform requirements, sleep deprivation, nutrition, availability of fluids, frequency of fluid intake, and playing surface heat reflection and radiation (i.e., grass, asphalt) (157). During high heat stress conditions, remove equipment and extra clothing to reduce heat storage. Allow a minimum of 3, and preferably 6, hours of recovery and rehydration time between practice sessions and games.

Evidence Statement. Practice and competition should be modified on the basis of air temperature, relative humidity, sun exposure, heat acclimatization status, age, and equipment requirements by decreasing the duration and intensity of exercise and by removing clothing. *Evidence category C.*

Monitoring the environment. Event organizers should monitor the weather conditions before and during practice and competition. Ideally, heat stress should be measured at the event site for the most accurate meteorological data. Factors that affect heat injury risk include ambient temperature, relative humidity, wind speed, and solar radiant heat; as a minimum standard, the

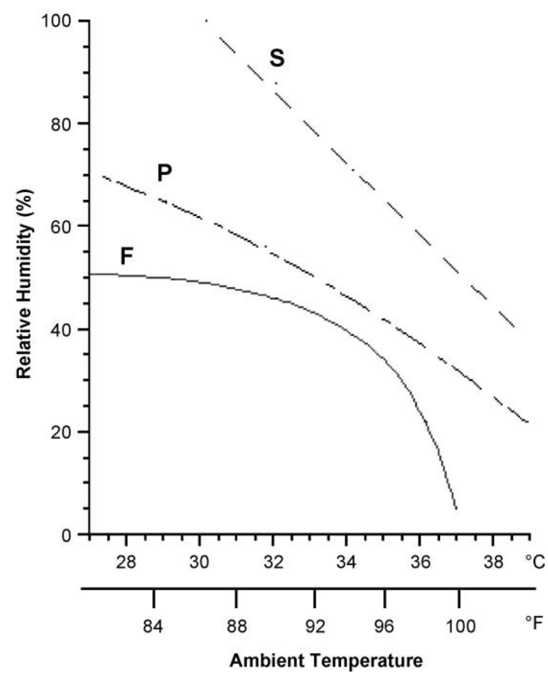

FIGURE 2— Environmental conditions that are critical for American football players wearing different clothing ensembles [S refers to a clothing ensemble of shorts, socks and sneakers; P (practice uniform) refers to helmet, undershirt, shoulder pads, jersey, shorts, socks and sneakers; F (full game uniform) refers to helmet, undershirt, shoulder pads, jersey, shorts, socks, sneakers, game pants, thigh pads and knee pads]. The zone above and to the right of each clothing ensemble (F, P, S) represents uncompensable heat stress with rising core temperature during exercise [redrawn with permission from reference (87); illustrates exercise at 35% $\dot{V}O_{2max}$; uncompensable heat stress is defined in Table 2, footnote f]. The zone below and to the left of lines F, P and S represents compensable heat stress with heat balance possible.

dry bulb temperature and relative humidity should be considered in the decision to modify activity. The WBGT is used in athletic, military, and industrial settings (49,76,162,174) to gauge heat risk because it incorporates measurements of radiant heat (T_{bg}) and air water content (T_{wb}). The WBGT is calculated using the following formula (174):

$$WBGT = (0.7T_{wb}) + (0.2T_{bg}) + (0.1T_{db})$$

where T_{wb} is the wet bulb temperature, T_{bg} is the black globe temperature, and T_{db} is the shaded dry bulb temperature (49). T_{wb} is measured with a dry bulb thermometer that is covered with a water-saturated cloth wick. T_{bg} is measured by inserting a dry bulb thermometer into a standard black metal globe. Both T_{wb} and T_{bg} are measured in direct sunlight. In this formula, T_{wb} accounts for 70% of the WBGT.

A portable monitor that measures the WBGT is useful to determine heat stress on site (49,77,162,174), but cost limits this use in many situations. Devices that measure temperature, relative humidity and wet bulb temperature can be purchased for less than $75. These measurements can be mathematically converted to WBGT using shareware provided by a nonprofit source (177). When the WBGT is not available, on-site ambient temperature and relative humidity data can be applied to standardized algorithms or charts to estimate heat risk.

The risk of EHS and exertional heat exhaustion (while wearing shorts, socks, shoes, and a T-shirt) due to environmental stress can be stratified into three activity categories, as depicted in Table 2; these involve either continuous activity and competition, or training and noncontinuous activity. Large posters or signs should be displayed at the athletic venue or along the race course, to describe the risk of heat exhaustion and EHS. If the WBGT index is above 28°C (82°F), consideration should be given to canceling or rescheduling continuous competitive events until less stressful conditions prevail (117). Table 3, regarding children, presents a modified version of a previous publication (7). Although children have been considered "less heat tolerant" in the past, current data collected on boys does not necessarily support this belief (78,148). However, until more research is available, it is prudent to regard children as an "at risk" group. The decision to modify activity is often in the hands of coaches, who must be willing to make safety related changes for practices and games, based on environmental conditions.

Uniforms. Before athletes are acclimatized to heat, the effect of uniforms on body heat storage is significant, especially in American football. Helmets, protective pads, gloves and garments trap heat and reduce heat dissipation. Exercise-related metabolic heat production raises core body temperature without a plateau and readily induces an "uncompensable" heat stress situation. Athletes should

TABLE 4. Evidence-based statements, evaluated in terms of the strength of supporting scientific evidence. Criteria (column 2) are defined in the Summary section.

	Level of Evidence	References
Dehydration reduces endurance exercise performance, decreases time to exhaustion, increases heat storage.	A	11,12,16,41,57,141
Exertional heatstroke (EHS) is defined in the field by rectal temperature >40°C at collapse and by central nervous system changes.	B	37,39,56,71,150,156,175
The following conditions increase the risk of EHS or exertional heat exhaustion: obesity, low physical fitness level, lack of heat acclimatization, dehydration, a previous history of EHS, sleep deprivation, sweat gland dysfunction, sunburn, viral illness, diarrhea, or certain medications.	B	14,22,45,55,60,66,69,85,99,149,150,164,173
Physical training and cardiorespiratory fitness reduce the risk of EHS.	C	17,29,59,122,124,152
Cold water immersion provides the fastest whole body cooling rate and the lowest morbidity and mortality for EHS.	A	2,13,14,43,44,47,48,49,63,68,72,82,83,85,111,125,134,149,175
When water immersion is unavailable, ice water towels/sheets combined with ice packs on the head, trunk, and extremities provide effective but slower whole body cooling.	C	
Dehydration and high body mass index increase the risk of exertional heat exhaustion.	B	17,29,59,122,124,152
10–14 days of exercise training in the heat will improve heat acclimatization and reduce the risk of EHS.	B	14,17,85,175
10–14 days of exercise training in the heat will improve heat acclimatization and reduce the risk of exertional heat exhaustion.	B	14,17,85,175
EHS casualties may return to practice and competition when they have reestablished heat tolerance.	B	14,38,55,56,81,103,138
Ear (i.e., aural), oral, skin, temporal, and axillary temperature measurements should not be used to diagnose or distinguish EHS from exertional heat exhaustion.	B	18,36,39,134,135
Early symptoms of EHS include clumsiness, stumbling, headache, nausea, dizziness, apathy, confusion, and impairment of consciousness.	B	71,85,149,161
Practice and competition should be modified on the basis of air temperature, relative humidity, sun exposure, heat acclimatization status, age, and equipment requirements by decreasing the duration and intensity of exercise and by removing clothing.	C	38,49,108,157,174
Athletes should exercise with a partner in high-risk conditions, each being responsible for monitoring the other's well being.	C	49,128,157

SPECIAL COMMUNICATIONS

remove as much protective equipment as possible to permit heat loss and to reduce the risks of hyperthermia, especially during acclimatization. Figure 2 demonstrates uncompensable heat stress in varying hot environments; it can guide coaches and athletes who select the practice uniform for a range of environmental conditions.

The National Collegiate Athletic Association (NCAA) regulates the introduction and use of protective padding for collegiate football players to aid heat acclimatization (107, 108). The current regulations allow players to wear helmets during the first 2 d of practice, helmets and shoulder pads during days 3 and 4, and the full uniform after the fifth day. These regulations also reduce the number and duration of workouts during the initial 5 d of summer training to one per day and limit "two a day" sessions to an every-other-day format for the remainder of the season. Although NCAA heat acclimatization strategies were designed for collegiate American football players, the model (107) is also recommended as a minimum standard for younger athletes. Specific recommendations should be uniquely designed for other age groups and sports to improve athlete safety.

Monitoring athletes across consecutive days. Athletes practicing or competing during multiple-day and/or multiple-session same day events in hot and humid conditions should be monitored for signs and symptoms of heat illness and the cumulative effects of dehydration (3,12,41,57,141). Day-to-day body weight measurements (40) and urine color should be used to assess progressive dehydration and increased risk for heat illness. Replace fluid deficits before the next practice session (40). Wireless deep body temperature sensors transmit gastrointestinal temperature (145) and can be used to monitor high-risk athletes who have a history of EHS, although this is not a practical strategy for most athletes and will pose a potential risk for an athlete who might require an MRI.

Education. The education of athletes, coaches, administrators, medical providers (especially on site personnel and community emergency response teams) can help with reduction, recognition, and treatment of heat related illness. Counsel athletes about the importance of being well-hydrated, well-fed, well-rested, and acclimatized to heat. Have athletes "buddy up" to monitor each other for signs of subtle changes of performance or behavior.

Evidence statement. Athletes should exercise with a partner in high-risk conditions, each being responsible for the other's well being. *Evidence category C.*

CONCLUSION

The challenges of hot environments and exercise are complex and difficult to fully comprehend because athletes are variably affected during high-intensity exercise in hot-humid environments. EHS, the most severe form of heat illness, cannot be studied in the laboratory because the risks of severe hyperthermia are ethically unacceptable for human research. Thus, our knowledge depends on the judicious field documentation of athletes who push beyond normal physiological limits. The survival of these athletes depends on prompt recognition and the most effective cooling therapy (i.e., ice water immersion or rapidly rotating ice water towels combined with ice packs) to limit tissue exposure due to destructive hyperthermia. The existing evidence is summarized in Table 4.

This Position Stand replaces, in part, the 1996 Position Stand "Heat and Cold Illnesses during Running," Med. Sci. Sport Exerc. 28(12):i–x, 1996.

This pronouncement was reviewed for the American College of Sports Medicine by the Pronouncements Committee and by Anne L. Friedlander, Ph.D.; James P. Knochel, M.D.; Christopher T. Minson, Ph.D., FACSM; Denise L. Smith, Ph.D., FACSM; and Jeffrey J. Zachwieja, Ph.D., FACSM.

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National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses

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Objective: To present recommendations for the prevention, recognition, and treatment of exertional heat illnesses and to describe the relevant physiology of thermoregulation.

Background: Certified athletic trainers evaluate and treat heat-related injuries during athletic activity in "safe" and high-risk environments. While the recognition of heat illness has improved, the subtle signs and symptoms associated with heat illness are often overlooked, resulting in more serious problems for affected athletes. The recommendations presented here provide athletic trainers and allied health providers with an integrated scientific and practical approach to the prevention, recognition, and treatment of heat illnesses. These recommendations can be modified based on the environmental conditions of the site, the specific sport, and individual considerations to maximize safety and performance.

Recommendations: Certified athletic trainers and other allied health providers should use these recommendations to establish on-site emergency plans for their venues and athletes. The primary goal of athlete safety is addressed through the prevention and recognition of heat-related illnesses and a well-developed plan to evaluate and treat affected athletes. Even with a heat-illness prevention plan that includes medical screening, acclimatization, conditioning, environmental monitoring, and suitable practice adjustments, heat illness can and does occur. Athletic trainers and other allied health providers must be prepared to respond in an expedient manner to alleviate symptoms and minimize morbidity and mortality.

Key Words: heat cramps, heat syncope, heat exhaustion, heat stroke, hyponatremia, dehydration, exercise, heat tolerance

Heat illness is inherent to physical activity and its incidence increases with rising ambient temperature and relative humidity. Athletes who begin training in the late summer (eg, football, soccer, and cross-country athletes) experience exertional heat-related illness more often than athletes who begin training during the winter and spring.[1–5] Although the hot conditions associated with late summer provide a simple explanation for this difference, we need to understand what makes certain athletes more susceptible and how these illnesses can be prevented.

PURPOSE

This position statement provides recommendations that will enable certified athletic trainers (ATCs) and other allied health providers to (1) identify and implement preventive strategies that can reduce heat-related illnesses in sports, (2) characterize factors associated with the early detection of heat illness, (3) provide on-site first aid and emergency management of athletes with heat illnesses, (4) determine appropriate return-to-play procedures, (5) understand thermoregulation and physiologic responses to heat, and (6) recognize groups with special concerns related to heat exposure.

ORGANIZATION

This position statement is organized as follows:

1. Definitions of exertional heat illnesses, including exercise-associated muscle (heat) cramps, heat syncope, exercise (heat) exhaustion, exertional heat stroke, and exertional hyponatremia;
2. Recommendations for the prevention, recognition, and treatment of exertional heat illnesses;
3. Background and literature review of the diagnosis of exertional heat illnesses; risk factors; predisposing medical conditions; environmental risk factors; thermoregulation, heat acclimatization, cumulative dehydration, and cooling therapies;

Table 1. Signs and Symptoms of Exertional Heat Illnesses

Condition	Sign or Symptom*	
Exercise-associated muscle (heat) cramps[6,9–11]		
	Dehydration	
	Thirst	
	Sweating	
	Transient muscle cramps	
	Fatigue	
Heat syncope[10,12]		
	Dehydration	
	Fatigue	
	Tunnel vision	
	Pale or sweaty skin	
	Decreased pulse rate	
	Dizziness	
	Lightheadedness	
	Fainting	
Exercise (heat) exhaustion[6,9,10,13]		
	Normal or elevated body-core temperature	
	Dehydration	
	Dizziness	
	Lightheadedness	
	Syncope	
	Headache	
	Nausea	
	Anorexia	
	Diarrhea	
	Decreased urine output	
	Persistent muscle cramps	
	Pallor	
	Profuse sweating	
	Chills	
	Cool, clammy skin	
	Intestinal cramps	
	Urge to defecate	
	Weakness	
	Hyperventilation	
Exertional heat stroke[6,9,10,14]		
	High body-core temperature (>40°C [104°F])	
	Central nervous system changes	
		Dizziness
		Drowsiness
		Irrational behavior
		Confusion
		Irritability
		Emotional instability
		Hysteria
		Apathy
		Aggressiveness
		Delirium
		Disorientation
		Staggering
		Seizures
		Loss of consciousness
		Coma
	Dehydration	
	Weakness	
	Hot and wet or dry skin	
	Tachycardia (100 to 120 beats per minute)	
	Hypotension	
	Hyperventilation	
	Vomiting	
	Diarrhea	
Exertional hyponatremia[15–18]		
	Body-core temperature <40°C (104°F)	
	Nausea	
	Vomiting	
	Extremity (hands and feet) swelling	
	Low blood-sodium level	
	Progressive headache	
	Confusion	
	Significant mental compromise	
	Lethargy	
	Altered consciousness	
	Apathy	
	Pulmonary edema	
	Cerebral edema	
	Seizures	
	Coma	

*Not every patient will present with all the signs and symptoms for the suspected condition.

4. Special concerns regarding exertional heat illnesses in prepubescent athletes, older athletes, and athletes with spinal-cord injuries;
5. Hospitalization and recovery from exertional heat stroke and resumption of activity after heat-related collapse; and
6. Conclusions.

DEFINITIONS OF EXERTIONAL HEAT ILLNESSES

The traditional classification of heat illness defines 3 categories: heat cramps, heat exhaustion, and heat stroke.[6–8] However, this classification scheme omits several other heat- and activity-related illnesses, including heat syncope and exertional hyponatremia. The signs and symptoms of the exertional heat illnesses are listed in Table 1.

Heat illness is more likely in hot, humid weather but can occur in the absence of hot and humid conditions.

Exercise-Associated Muscle (Heat) Cramps

Exercise-associated muscle (heat) cramps represent a condition that presents during or after intense exercise sessions as an acute, painful, involuntary muscle contraction. Proposed causes include fluid deficiencies (dehydration), electrolyte imbalances, neuromuscular fatigue, or any combination of these factors.[6,9–11,19]

Heat Syncope

Heat syncope, or orthostatic dizziness, can occur when a person is exposed to high environmental temperatures.[19] This condition is attributed to peripheral vasodilation, postural pooling of blood, diminished venous return, dehydration, reduction in cardiac output, and cerebral ischemia.[10,19] Heat syncope usually occurs during the first 5 days of acclimatization, before the blood volume expands,[12] or in persons with heart disease or those taking diuretics.[10] It often occurs after standing for long periods of time, immediately after cessation of activity, or after rapid assumption of upright posture after resting or being seated.

Exercise (Heat) Exhaustion

Exercise (heat) exhaustion is the inability to continue exercise associated with any combination of heavy sweating, dehydration, sodium loss, and energy depletion. It occurs most frequently in hot, humid conditions. At its worst, it is difficult to distinguish from exertional heat stroke without measuring rectal temperature. Other signs and symptoms include pallor, persistent muscular cramps, urge to defecate, weakness, fainting, dizziness, headache, hyperventilation, nausea, anorexia, diarrhea, decreased urine output, and a body-core temperature that generally ranges between 36°C (97°F) and 40°C (104°F).[6,9,10,13,19]

Exertional Heat Stroke

Exertional heat stroke is an elevated core temperature (usually >40°C [104°F]) associated with signs of organ system failure due to hyperthermia. The central nervous system neurologic changes are often the first marker of exertional heat stroke. Exertional heat stroke occurs when the temperature regulation system is overwhelmed due to excessive endogenous heat production or inhibited heat loss in challenging environmental conditions[20] and can progress to complete thermoregulatory system failure.[19,21] This condition is life threatening and can be fatal unless promptly recognized and treated. Signs and symptoms include tachycardia, hypotension, sweating (although skin may be wet or dry at the time of collapse), hyperventilation, altered mental status, vomiting, diarrhea, seizures, and coma.[6,10,14] The risk of morbidity and mortality is greater the longer an athlete's body temperature remains above 41°C (106°F) and is significantly reduced if body temperature is lowered rapidly.[22–24]

Unlike classic heat stroke, which typically involves prolonged heat exposure in infants, elderly persons, or unhealthy, sedentary adults in whom body heat-regulation mechanisms are inefficient,[25–27] exertional heat stroke occurs during physical activity.[28] The pathophysiology of exertional heat stroke is due to the overheating of organ tissues that may induce malfunction of the temperature-control center in the brain, circulatory failure, or endotoxemia (or a combination of these).[29,30] Severe lactic acidosis (accumulation of lactic acid in the blood), hyperkalemia (excessive potassium in the blood), acute renal failure, rhabdomyolysis (destruction of skeletal muscle that may be associated with strenuous exercise), and disseminated intravascular coagulation (a bleeding disorder characterized by diffuse blood coagulation), among other medical conditions, may result from exertional heat stroke and often cause death.[25]

Exertional Hyponatremia

Exertional hyponatremia is a relatively rare condition defined as a serum-sodium level less than 130 mmol/L. Low serum-sodium levels usually occur when activity exceeds 4 hours.[19] Two, often-additive mechanisms are proposed: an athlete ingests water or low-solute beverages well beyond sweat losses (also known as water intoxication), or an athlete's sweat sodium losses are not adequately replaced.[15–18] The low blood-sodium levels are the result of a combination of excessive fluid intake and inappropriate body water retention in the water-intoxication model and insufficient fluid intake and inadequate sodium replacement in the latter. Ultimately, the intravascular and extracellular fluid has a lower solute load than the intracellular fluids, and water flows into the cells, producing intracellular swelling that causes potentially fatal neurologic and physiologic dysfunction. Affected athletes present with a combination of disorientation, altered mental status, headache, vomiting, lethargy, and swelling of the extremities (hands and feet), pulmonary edema, cerebral edema, and seizures. Exertional hyponatremia can result in death if not treated properly. This condition can be prevented by matching fluid intake with sweat and urine losses and by rehydrating with fluids that contain sufficient sodium.[31,32]

RECOMMENDATIONS

The National Athletic Trainers' Association (NATA) advocates the following prevention, recognition, and treatment strategies for exertional heat illnesses. These recommendations are presented to help ATCs and other allied health providers maximize health, safety, and sport performance as they relate to these illnesses. Athletes' individual responses to physiologic stimuli and environmental conditions vary widely. These recommendations do not guarantee full protection from heat-related illness but should decrease the risk during athletic participation. These recommendations should be considered by ATCs and allied health providers who work with athletes at risk for exertional heat illnesses to improve prevention strategies and ensure proper treatment.

Prevention

1. Ensure that appropriate medical care is available and that rescue personnel are familiar with exertional heat illness prevention, recognition, and treatment. Table 2 provides general guidelines that should be considered.[7] Ensure that ATCs and other health care providers attending practices or events are allowed to evaluate and examine any athlete who displays signs or symptoms of heat illness[33,34] and have the authority to restrict the athlete from participating if heat illness is present.

2. Conduct a thorough, physician-supervised, preparticipation medical screening before the season starts to identify athletes predisposed to heat illness on the basis of risk factors[34–36] and those who have a history of exertional heat illness.

3. Adapt athletes to exercise in the heat (acclimatization) gradually over 10 to 14 days. Progressively increase the intensity and duration of work in the heat with a combination of strenuous interval training and continuous exercise.[6,9,14,33,37–44] Well-acclimatized athletes should train for 1 to 2 hours under the same heat conditions that will be present for their event.[6,45,46] In a cooler environment, an athlete can wear additional clothing during training to induce or maintain heat acclimatization. Athletes should maintain proper hydration during the heat-acclimatization process.[47]

4. Educate athletes and coaches regarding the prevention, recognition, and treatment of heat illnesses[9,33,38,39,42,48–51] and the risks associated with exercising in hot, humid environmental conditions.

5. Educate athletes to match fluid intake with sweat and urine losses to maintain adequate hydration.* (See the ''National Athletic Trainers' Association Position Statement: Fluid Replacement in Athletes.''[52]) Instruct athletes to drink sodium-containing fluids to keep their urine clear to light yellow to improve hydration[33,34,52–55] and to replace fluids between practices on the same day and on successive days to maintain less than 2% body-weight change. These strategies will lessen the risk of acute and chronic dehydration and decrease the risk of heat-related events.

*References 9, 29, 37, 38, 40, 41, 43, 52–66.

Table 2. Prevention Checklist for the Certified Athletic Trainer*

1. Pre-event preparation
   - ______Am I challenging unsafe rules (eg, ability to receive fluids, modify game and practice times)?
   - ______Am I encouraging athletes to drink before the onset of thirst and to be well hydrated at the start of activity?
   - ______Am I familiar with which athletes have a history of a heat illness?
   - ______Am I discouraging alcohol, caffeine, and drug use?
   - ______Am I encouraging proper conditioning and acclimatization procedures?
2. Checking hydration status
   - ______Do I know the preexercise weight of the athletes (especially those at high risk) with whom I work, particularly during hot and humid conditions?
   - ______Are the athletes familiar with how to assess urine color? Is a urine color chart accessible?
   - ______Do the athletes know their sweat rates and, therefore, know how much to drink during exercise?
   - ______Is a refractometer or urine color chart present to provide additional information regarding hydration status in high-risk athletes when baseline body weights are checked?
3. Environmental assessment
   - ______Am I regularly checking the wet-bulb globe temperature or temperature and humidity during the day?
   - ______Am I knowledgeable about the risk categories of a heat illness based on the environmental conditions?
   - ______Are alternate plans made in case risky conditions force rescheduling of events or practices?
4. Coaches' and athletes' responsibilities
   - ______Are coaches and athletes educated about the signs and symptoms of heat illnesses?
   - ______Am I double checking to make sure coaches are allowing ample rest and rehydration breaks?
   - ______Are modifications being made to reduce risk in the heat (eg, decrease intensity, change practice times, allow more frequent breaks, eliminate double sessions, reduce or change equipment or clothing requirements, etc)?
   - ______Are rapid weight-loss practices in weight-class sports adamantly disallowed?
5. Event management
   - ______Have I checked to make sure proper amounts of fluids will be available and accessible?
   - ______Are carbohydrate-electrolyte drinks available at events and practices (especially during twice-a-day practices and those that last longer than 50 to 60 minutes or are extremely intense in nature)?
   - ______Am I aware of the factors that may increase the likelihood of a heat illness?
   - ______Am I promptly rehydrating athletes to preexercise weight after an exercise session?
   - ______Are shaded or indoor areas used for practices or breaks when possible to minimize thermal strain?
6. Treatment considerations
   - ______Am I familiar with the most common early signs and symptoms of heat illnesses?
   - ______Do I have the proper field equipment and skills to assess a heat illness?
   - ______Is an emergency plan in place in case an immediate evacuation is needed?
   - ______Is a kiddy pool available in situations of high risk to initiate immediate cold-water immersion of heat-stroke patients?
   - ______Are ice bags available for immediate cooling when cold-water immersion is not possible?
   - ______Have shaded, air-conditioned, and cool areas been identified to use when athletes need to cool down, recover, or receive treatment?
   - ______Are fans available to assist evaporation when cooling?
   - ______Am I properly equipped to assess high core temperature (ie, rectal thermometer)?
7. Other situation-specific considerations

*Adapted with permission from Casa.[7]

Table 3. Wet-Bulb Globe Temperature Risk Chart[62–67]*

WBGT	Flag Color	Level of Risk	Comments
<18°C (<65°F)	Green	Low	Risk low but still exists on the basis of risk factors
18–23°C (65–73°F)	Yellow	Moderate	Risk level increases as event progresses through the day
23–28°C (73–82°F)	Red	High	Everyone should be aware of injury potential; individuals at risk should not compete
>28°C (82°F)	Black	Extreme or hazardous	Consider rescheduling or delaying the event until safer conditions prevail; if the event must take place, be on high alert

*Adapted with permission from Roberts.[67]

6. Encourage athletes to sleep at least 6 to 8 hours at night in a cool environment,[41,35,50] eat a well-balanced diet that follows the Food Guide Pyramid and United States Dietary Guidelines,[56–58] and maintain proper hydration status. Athletes exercising in hot conditions (especially during twice-a-day practices) require extra sodium from the diet or rehydration beverages or both.

7. Develop event and practice guidelines for hot, humid weather that anticipate potential problems encountered based on the wet-bulb globe temperature (WBGT) (Table 3) or heat and humidity as measured by a sling psychrometer (Figure 1), the number of participants, the nature of the activity, and other predisposing risk factors.[14,51] If the WBGT is greater than 28°C (82°F, or ''very high'' as indicated in Table 3, Figure 1), an athletic event should be delayed, rescheduled, or moved into an air-conditioned space, if possible.[69–74] It is important to note that these measures are based on the risk of environmental stress for athletes wearing shorts and a T-shirt; if an

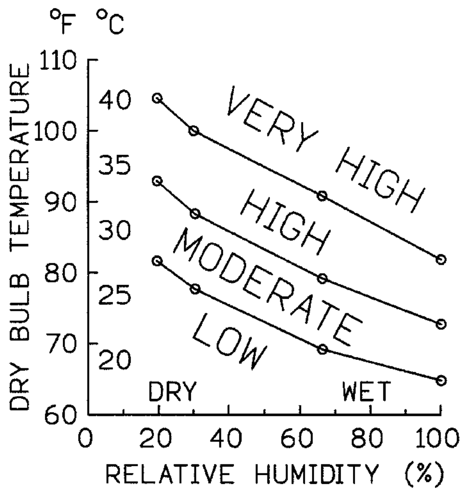

Figure 1. Risk of heat exhaustion or heat stroke while racing in hot environments. However, Figure 2 may be better suited for estimating heat-stroke risk when equipment is worn. Reprinted with permission from Convertino VA, Armstrong LE, Coyle EF, et al. American College of Sports Medicine position stand: exercise and fluid replacement. *Med Sci Sports Exerc.* 1996;28:i–vii.[31]

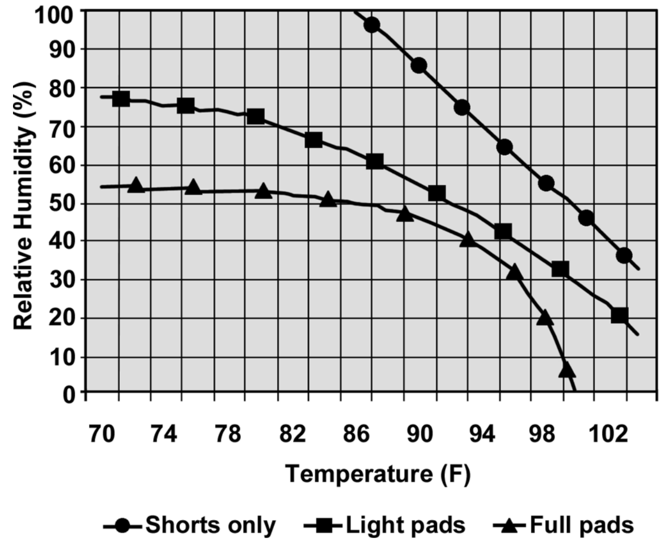

Figure 2. Heat stress risk temperature and humidity graph. Heat-stroke risk rises with increasing heat and relative humidity. Fluid breaks should be scheduled for all practices and scheduled more frequently as the heat stress rises. Add 5° to temperature between 10 AM and 4 PM from mid May to mid September on bright, sunny days. Practices should be modified for the safety of the athletes to reflect the heat-stress conditions. Regular practices with full practice gear can be conducted for conditions that plot to the left of the triangles. Cancel all practices when the temperature and relative humidity plot is to the right of the circles; practices may be moved into air-conditioned spaces or held as walk-through sessions with no conditioning activities.

Conditions that plot between squares and circles: increase rest-to-work ratio with 5- to 10-minute rest and fluid breaks every 15 to 20 minutes; practice should be in shorts only with all protective equipment removed.

Conditions that plot between triangles and squares: increase rest-to-work ratio with 5- to 10-minute rest and fluid breaks every 20 to 30 minutes; practice should be in shorts with helmets and shoulder pads (not full equipment).

Adapted with permission from Kulka J, Kenney WL. Heat balance limits in football uniforms: how different uniform ensembles alter the equation. *Physician Sportsmed.* 2002;30(7):29–39.[68]

athlete is wearing additional clothing (ie, football uniform, wetsuit, helmet), a lower WBGT value could result in comparable risk of environmental heat stress (Figure 2).[75,76] If the event or practice is conducted in hot, humid conditions, then use extreme caution in monitoring the athletes and be proactive in taking preventive steps. In addition, be sure that emergency supplies and equipment are easily accessible and in good working order. The most important factors are to limit intensity and duration of activity, limit the amount of clothing and equipment worn, increase the number and length of rest breaks, and encourage proper hydration.

Modify activity under high-risk conditions to prevent exertional heat illnesses.[19,21] Identify individuals who are susceptible to heat illnesses. In some athletes, the prodromal signs and symptoms of heat illnesses are not evident before collapse, but in many cases, adept medical supervision will allow early intervention.

8. Check the environmental conditions before and during the activity, and adjust the practice schedule accordingly.[29,38,41,42,60] Schedule training sessions to avoid the hottest part of the day (10 AM to 5 PM) and to avoid radiant heating from direct sunlight, especially in the acclimatization during the first few days of practice sessions.[9,29,33,34,38,40,50,60]

9. Plan rest breaks to match the environmental conditions and the intensity of the activity.[33,34] Exercise intensity and environmental conditions should be the major determinants in deciding the length and frequency of rest breaks. If possible, cancel or postpone the activity or move it indoors (if air conditioned) if the conditions are "extreme or hazardous" (see Table 3) or "very high" (see Figure 1) or to the right of the circled line (see Figure 2). General guidelines during intense exercise would include a work:rest ratio of 1:1, 2:1, 3:1, and 4:1 for "extreme or hazardous" (see Table 3) or "very high" (see Figure 1), "high," "moderate," or "low" environmental risk, respectively.[41,77] For activities such as football in which equipment must be considered, please refer to Figure 2 for equipment modifications and appropriate work:rest ratios for various environmental conditions. Rest breaks should occur in the shade if possible, and hydration during rest breaks should be encouraged.

10. Implement rest periods at mealtime by allowing 2 to 3 hours for food, fluids, nutrients, and electrolytes (sodium and potassium) to move into the small intestine and bloodstream before the next practice.[34,50,77]

11. Provide an adequate supply of proper fluids (water or sports drinks) to maintain hydration[9,34,38,40,50,60] and institute a hydration protocol that allows the maintenance of hydration status.[34,49] Fluids should be readily available and served in containers that allow adequate volumes to be ingested with ease and with minimal interruption of exercise.[49,52] The goal should be to lose no more than 2% to 3% of body weight during the practice session (due to sweat and urine losses).[78–82] (See the "National Athletic Trainers' Association Position Statement: Fluid Replacement in Athletes."[52])

12. Weigh high-risk athletes (in high-risk conditions, weigh all athletes) before and after practice to estimate the amount of body water lost during practice and to ensure a return to prepractice weight before the next practice. Following exercise athletes should consume approximately 1–1.25 L (16 oz) of fluid for each kilogram of body water lost during exercise.†

†*References 6, 9, 29, 33, 38, 40, 49, 60, 77, 83.*

13. Minimize the amount of equipment and clothing worn by the athlete in hot or humid (or both) conditions. For example, a full football uniform prevents sweat evaporation from more than 60% of the body.[29,33,40,51,77] Consult Figure 2 for possible equipment and clothing recommendations. When athletes exercise in the heat, they should wear loose-fitting, absorbent, and light-colored clothing; mesh clothing and new-generation cloth blends have been specially designed to allow more effective cooling.‡

14. Minimize warm-up time when feasible, and conduct warm-up sessions in the shade when possible to minimize the radiant heat load in ‘‘high’’ or ‘‘very high’’ or ‘‘extreme or hazardous’’ (see Table 3, Figure 1) conditions.[77]

15. Allow athletes to practice in shaded areas and use electric or cooling fans to circulate air whenever feasible.[66]

16. Include the following supplies on the field, in the locker room, and at various other stations:

- A supply of cool water or sports drinks or both to meet the participants’ needs (see the ‘‘National Athletic Trainers’ Association Position Statement: Fluid Replacement in Athletes’’[52] for recommendations regarding the appropriate composition of rehydration beverages based on the length and intensity of the activity)[29,34,38]
- Ice for active cooling (ice bags, tub cooling) and to keep beverages cool during exercise[29,38]
- Rectal thermometer to assess body-core temperature[39,74,75,87,88]
- Telephone or 2-way radio to communicate with medical personnel and to summon emergency medical transportation[38,39,48]
- Tub, wading pool, kiddy pool, or whirlpool to cool the trunk and extremities for immersion cooling therapy[35,65]

17. Notify local hospital and emergency personnel before mass participation events to inform them of the event and the increased possibility of heat-related illnesses.[41,89]

18. Mandate a check of hydration status at weigh-in to ensure athletes in sports requiring weight classes (eg, wrestling, judo, rowing) are not dehydrated. Any procedures used to induce dramatic dehydration (eg, diuretics, rubber suits, exercising in a sauna) are strictly prohibited.[52] Dehydrated athletes exercising at the same intensity as euhydrated athletes are at increased risk for thermoregulatory strain (see the ‘‘National Athletic Trainers’ Association Position Statement: Fluid Replacement in Athletes’’[52]).

Recognition and Treatment

19. Exercise-associated muscle (heat) cramps:

- An athlete showing signs or symptoms including dehydration, thirst, sweating, transient muscle cramps, and fatigue is likely experiencing exercise-associated muscle (heat) cramps.
- To relieve muscle spasms, the athlete should stop activity, replace lost fluids with sodium-containing fluids, and begin mild stretching with massage of the muscle spasm.
- Fluid absorption is enhanced with sports drinks that contain sodium.[52,60,87] A high-sodium sports product may be added to the rehydration beverage to prevent or relieve cramping in athletes who lose large amounts of sodium in their sweat.[19] A simple salted fluid consists of two 10-grain salt tablets dissolved in 1 L (34 oz) of water. Intravenous fluids may be required if nausea or vomiting limits oral fluid intake; these must be ordered by a physician.[6,7,52,90,91]
- A recumbent position may allow more rapid redistribution of blood flow to cramping leg muscles.

20. Heat syncope:

- If an athlete experiences a brief episode of fainting associated with dizziness, tunnel vision, pale or sweaty skin, and a decreased pulse rate but has a normal rectal temperature (for exercise, 36°C to 40°C [97°F to 104°F]), then heat syncope is most likely the cause.[19]
- Move the athlete to a shaded area, monitor vital signs, elevate the legs above the level of the head, and rehydrate.

21. Exercise (heat) exhaustion:

- Cognitive changes are usually minimal, but assess central nervous system function for bizarre behavior, hallucinations, altered mental status, confusion, disorientation, or coma (see Table 1) to rule out more serious conditions.
- If feasible, measure body-core temperature (rectal temperature) and assess cognitive function (see Table 1) and vital signs.[19] Rectal temperature is the most accurate method possible in the field to monitor body-core temperature.[34,74,75,87,88] The ATC should not rely on the oral, tympanic, or axillary temperature for athletes because these are inaccurate and ineffective measures of body-core temperature during and after exercise.[75,89,92]
- If the athlete’s temperature is elevated, remove his or her excess clothing to increase the evaporative surface and to facilitate cooling.[6,93]
- Cool the athlete with fans,[94] ice towels,[29,38] or ice bags because these may help the athlete with a temperature of more than 38.8°C (102°F) to feel better faster.
- Remove the athlete to a cool or shaded environment if possible.
- Start fluid replacement.[6,52,93,95]
- Transfer care to a physician if intravenous fluids are needed[6,52,90,91,96] or if recovery is not rapid and uneventful.

22. Exertional heat stroke:

- Measure the rectal temperature if feasible to differentiate between heat exhaustion and heat stroke. With heat stroke, rectal temperature is elevated (generally higher than 40°C [104°F]).[19]
- Assess cognitive function, which is markedly altered in exertional heat stroke (see Table 1).
- Lower the body-core temperature as quickly as possible.[34,70,77] The fastest way to decrease body temperature is to remove clothes and equipment and immerse the body (trunk and extremities) into a pool or tub of cold water (approximately 1°C to 15°C [35°F to 59°F]).[32,91,92,97–99] Aggressive cooling is the most critical factor in the treatment of exertional heat stroke. Circulation of the tub water may enhance cooling.
- Monitor the temperature during the cooling therapy and recovery (every 5 to 10 minutes).[39,87] Once the athlete’s rectal temperature reaches approximately 38.3°C to 38.9°C (101°F to 102°F), he or she should be removed from the pool or tub to avoid overcooling.[40,100]
- If a physician is present to manage the athlete’s medical care on site, then initial transportation to a medical facility may not be necessary so immersion can continue uninterrupted.

‡*References 8, 9, 29, 33, 38, 40, 53, 59, 84–86.*

If a physician is not present, aggressive first-aid cooling should be initiated on site and continued during emergency medical system transport and at the hospital until the athlete is normothermic.

- Activate the emergency medical system.
- Monitor the athlete's vital signs and other signs and symptoms of heat stroke (see Table 1).[34,95]
- During transport and when immersion is not feasible, other methods can be used to reduce body temperature: removing the clothing; sponging down the athlete with cool water and applying cold towels; applying ice bags to as much of the body as possible, especially the major vessels in the armpit, groin, and neck; providing shade; and fanning the body with air.[39,95]
- In addition to cooling therapies, first-aid emergency procedures for heat stroke may include airway management. Also a physician may decide to begin intravenous fluid replacement.[87]
- Monitor for organ-system complications for at least 24 hours.

23. Exertional hyponatremia:

- Attempt to differentiate between hyponatremia and heat exhaustion. Hyponatremia is characterized by increasing headache, significant mental compromise, altered consciousness, seizures, lethargy, and swelling in the extremities. The athlete may be dehydrated, normally hydrated, or overhydrated.[19]
- Attempt to differentiate between hyponatremia and heat stroke. In hyponatremia, hyperthermia is likely to be less (rectal temperature less than 40°C [104°F]).[19] The plasma-sodium level is less than 130 mEq/L and can be measured with a sodium analyzer on site if the device is available.
- If hyponatremia is suspected, immediate transfer to an emergency medical center via the emergency medical system is indicated. An intravenous line should be placed to administer medication as needed to increase sodium levels, induce diuresis, and control seizures.
- An athlete with suspected hyponatremia should not be administered fluids until a physician is consulted.

24. Return to activity

In cases of exercise-associated muscle (heat) cramps or heat syncope, the ATC should discuss the athlete's case with the supervising physician. The cases of athletes with heat exhaustion who were not transferred to the physician's care should also be discussed with the physician. After exertional heat stroke or exertional hyponatremia, the athlete must be cleared by a physician before returning to athletic participation.[92] The return to full activity should be gradual and monitored.[8,87]

BACKGROUND AND LITERATURE REVIEW

Diagnosis

To differentiate heat illnesses in athletes, ATCs and other on-site health care providers must be familiar with the signs and symptoms of each condition (see Table 1). Other medical conditions (eg, asthma, status epilepticus, drug toxicities) may also present with similar signs and symptoms. It is important to realize, however, that an athlete with a heat illness will not exhibit all the signs and symptoms of a specific condition, increasing the need for diligent observation during athletic activity.

Nonenvironmental Risk Factors

Athletic trainers and other health care providers should be sensitive to the following nonenvironmental risk factors, which could place athletes at risk for heat illness.

Dehydration. Sweating, inadequate fluid intake, vomiting, diarrhea, certain medications,[89,101–103] and alcohol[104,105] or caffeine[106] use can lead to fluid deficit. Body-weight change is the preferred method to monitor for dehydration in the field, but a clinical refractometer is another accurate method (specific gravity should be no more than 1.020).[34,49,107–110] Dehydration can also be identified by monitoring urine color or body-weight changes before, during, and after a practice or an event and across successive days.[53,54]

The signs and symptoms of dehydration are thirst, general discomfort, flushed skin, weariness, cramps, apathy, dizziness, headache, vomiting, nausea, heat sensations on the head or neck, chills, decreased performance, and dyspnea.[52] Water loss that is not regained by the next practice increases the risk for heat illness.[110]

Barriers to Evaporation. Athletic equipment and rubber or plastic suits used for ''weight loss'' do not allow water vapor to pass through and inhibit evaporative, convective, and radiant heat loss.[111,112] Participants who wear equipment that does not allow for heat dissipation are at an increased risk for heat illness.[113] Helmets are also limiting because a significant amount of heat is dissipated through the head.

Illness. Athletes who are currently or were recently ill may be at an increased risk for heat illness because of fever or dehydration.[114–116]

History of Heat Illness. Some individuals with a history of heat illness are at greater risk for recurrent heat illness.[8,117]

Increased Body Mass Index (Thick Fat Layer or Small Surface Area). Obese individuals are at an increased risk for heat illness because the fat layer decreases heat loss.[118] Obese persons are less efficient and have a greater metabolic heat production during exercise. Conversely, muscle-bound individuals have increased metabolic heat production and a lower ratio of surface area to mass, contributing to a decreased ability to dissipate heat.[119–121]

Wet-Bulb Globe Temperature on Previous Day and Night. When the WBGT is high to extreme (see Table 3), the risk of heat-related problems is greater the next day; this appears to be one of the best predictors of heat illness.[121] Athletes who sleep in cool or air-conditioned quarters are at less risk.

Poor Physical Condition. Individuals who are untrained are more susceptible to heat illness than are trained athletes. As the $\dot{V}O_2max$ of an individual improves, the ability to withstand heat stress improves independent of acclimatization and heat adaptation.[122] High-intensity work can easily produce 1000 kcal/h and elevate the core temperature of at-risk individuals (those who are unfit, overweight, or unacclimatized) to dangerous levels within 20 to 30 minutes.[123]

Excessive or Dark-Colored Clothing or Equipment. Excessive clothing or equipment decreases the ability to thermoregulate, and dark-colored clothing or equipment may cause a greater absorption of heat from the environment. Both should be avoided.[113]

Overzealousness. Overzealous athletes are at a higher risk for heat illness because they override the normal behavioral adaptations to heat and decrease the likelihood of subtle cues being recognized.

Lack of Acclimatization to Heat. An athlete with no or minimal physiologic acclimatization to hot conditions is at an increased risk of heat-related illness.[8,37,83,124]

Medications and Drugs. Athletes who take certain medications or drugs, particularly medications with a dehydrating effect, are at an increased risk for a heat illness.[101–106,125–136] Alcohol, caffeine, and theophylline at certain doses are mild diuretics.[106,137,138] Caffeine is found in coffee, tea, soft drinks, chocolate, and several over-the-counter and prescription medications.[139] Theophylline is found mostly in tea and anti-asthma medications.[140]

Electrolyte Imbalance. Electrolyte imbalances do not usually occur in trained, acclimatized individuals who engage in physical activity and eat a normal diet.[141] Most sodium and chloride losses in athletes occur through the urine, but athletes who sweat heavily, are salty sweaters, or are not heat acclimatized can lose significant amounts of sodium during activity.[142] Electrolyte imbalances often contribute to heat illness in older athletes who use diuretics.[143,144]

Predisposing Medical Conditions

The following predisposing medical conditions add to the risk of heat illness.

Malignant Hyperthermia. Malignant hyperthermia is caused by an autosomal dominant trait that causes muscle rigidity, resulting in elevation of body temperature due to the accelerated metabolic rate in the skeletal muscle.[145–147]

Neuroleptic Malignant Syndrome. Neuroleptic malignant syndrome is associated with the use of neuroleptic agents and antipsychotic drugs and an unexpected idiopathic increase in core temperature during exercise.[148–151]

Arteriosclerotic Vascular Disease. Arteriosclerotic vascular disease compromises cardiac output and blood flow through the vascular system by thickening the arterial walls.[115,152]

Scleroderma. Scleroderma is a skin disorder that decreases sweat production, thereby decreasing heat transfer.[149,153]

Cystic Fibrosis. Cystic fibrosis causes increased salt loss in sweat and can increase the risk for hyponatremia.[154,155]

Sickle Cell Trait. Sickle cell trait limits blood-flow distribution and decreases oxygen-carrying capacity. The condition is exacerbated by exercise at higher altitudes.[156,157]

Environmental Risk Factors

When the environmental temperature is above skin temperature, athletes begin to absorb heat from the environment and depend entirely on evaporation for heat loss.[113,158,159] High relative humidity inhibits heat loss from the body through evaporation.[61]

The environmental factors that influence the risk of heat illness include the ambient air temperature, relative humidity (amount of water vapor in the air), air motion, and the amount of radiant heat from the sun or other sources.[2,9,41] The relative risk of heat illness can be calculated using the WBGT equation.[2,43,50,69,77,160,161] Using the WBGT index to modify activity in high-risk settings has virtually eliminated heat-stroke deaths in United States Marine Corps recruits.[159] Wet-bulb globe temperature is calculated using the wet-bulb (wb), dry-bulb (db), and black-globe (bg) temperature with the following equation[49,62,85,162,163]:

$$\mathrm{WBGT} = 0.7\mathrm{T_{wb}} + 0.2\mathrm{T_{bg}} + 0.1\mathrm{T_{db}}$$

When there is no radiant heat load, $\mathrm{T_{db}} = \mathrm{T_{bg}}$, and the equation is reduced[62] to

$$\mathrm{WBGT} = 0.7\mathrm{T_{wb}} + 0.3\mathrm{T_{db}}$$

This equation is used to estimate risk as outlined in Table 3.[13,40,50,61,85] This index was determined for athletes wearing a T-shirt and light pants.[158] The WBGT calculation can be performed using information obtained from electronic devices[42] or the local meteorologic service, but conversion tables for relative humidity and $\mathrm{T_{db}}$ are needed to calculate the wet-bulb temperature.[50,162] The predictive value from the meteorologic service is not as accurate as site-specific data for representing local heat load but will suffice in most situations. When WBGT measures are not possible, environmental heat stress can be estimated using a sling psychrometer (see Figures 1, 2).

Several recommendations have been published for distance running, but these can also be applied to other continuous activity sports. The Canadian Track and Field Association recommended that a distance race should be cancelled if the WBGT is greater than 26.7°C (80°F).[39] The American College of Sports Medicine guidelines from 1996 recommended that a race should be delayed or rescheduled when the WBGT is greater than 27.8°C (82°F).[31,72,73] In some instances, the event will go on regardless of the WBGT; ATCs should then have an increased level of suspicion for heat stroke and focus on hydration, emergency supplies, and detection of exertional heat illnesses.

Thermoregulation

Thermoregulation is a complex interaction among the central nervous system (CNS), the cardiovascular system, and the skin to maintain a body-core temperature of 37°C.[9,43,51,164] The CNS temperature-regulation center is located in the hypothalamus and is the site where the core temperature setpoint is determined.[9,43,82,158,164–166] The hypothalamus receives information regarding body-core and shell temperatures from peripheral skin receptors and the circulating blood; body-core temperature is regulated through an open-ended feedback loop similar to that in a home thermostat system.[158,165,167,168] Body responses for heat regulation include cutaneous vasodilation, increased sweating, increased heart rate, and increased respiratory rate.[38,43,51,164,165]

Body-core temperature is determined by metabolic heat production and the transfer of body heat to and from the surrounding environment using the following heat-production and heat-storage equation[166,167]:

$$S = M \pm R \pm K \pm Cv - E$$

where S is the amount of stored heat, M is the metabolic heat production, R is the heat gained or lost by radiation, K is the conductive heat lost or gained, Cv is the convective heat lost or gained, and E is the evaporative heat lost.

Basal metabolic heat production fasting and at absolute rest is approximately 60 to 70 kcal/h for an average adult, with 50% of the heat produced by the internal organs. Metabolic heat produced by intense exercise may approach 1000 kcal/h,[51,164] with greater than 90% of the heat resulting from muscle metabolism.[9,40,42,166]

Heat is gained or lost from the body by one or more of the following mechanisms[9,85]:

Table 4. Physiologic Responses After Heat Acclimatization Relative to Nonacclimatized State

Physiologic Variable	After Acclimatization (10–14 Days' Exposure)
Heart rate	Decreases[46,145]
Stroke volume	Increases[145,147]
Body-core temperature	Decreases[145]
Skin temperature	Decreases[152]
Sweat output/rate	Increases[46,47,149]
Onset of sweat	Earlier in training[46,145]
Evaporation of sweat	Increases[47,152]
Salt in sweat	Decreases[9,50]
Work output	Increases[46,50]
Subjective discomfort (rating of perceived exertion [RPE])	Decreases[50,145]
Fatigue	Decreases[50]
Capacity for work	Increases[46,50]
Mental disturbance	Decreases[50]
Syncopal response	Decreases[9,50]
Extracellular fluid volume	Increases[50]
Plasma volume	Increases[50,150]

Radiation. The energy is transferred to or from an object or body via electromagnetic radiation from higher to lower energy surfaces.[9,43,51,85,166]

Conduction. Heat transfers from warmer to cooler objects through direct physical contact.[9,43,51,85,166] Ice packs and cold-water baths are examples of conductive heat exchange.

Convection. Heat transfers to or from the body to surrounding moving fluid (including air).[9,43,51,85,166] Moving air from a fan, cycling, or windy day produces convective heat exchange.

Evaporation. Heat transfers via the vaporization of sweat§ and is the most efficient means of heat loss.[51,158,169] The evaporation of sweat from the skin depends on the water saturation of the air and the velocity of the moving air.[170–172] The effectiveness of this evaporation for heat loss from the body diminishes rapidly when the relative humidity is greater than 60%.[9,20,164]

Cognitive performance and associated CNS functions deteriorate when brain temperature rises. Signs and symptoms include dizziness, confusion, behavior changes, coordination difficulties, decreased physical performance, and collapse due to hyperthermia.[168,173] The residual effects of elevated brain temperature depend on the duration of the hyperthermia. Heat stroke rarely leads to permanent neurologic deficits[51]; however, some sporadic symptoms of frontal headache and sleep disturbances have been noted for up to 4 months.[168,174,175] When permanent CNS damage occurs, it is associated with cerebellar changes, including ataxia, marked dysarthria, and dysmetria.[174]

Heat Acclimatization

Heat acclimatization is the physiologic response produced by repeated exposures to hot environments in which the capacity to withstand heat stress is improved.[14,43,75,176,177] Physiologic responses to heat stress are summarized in Table 4. Exercise heat exposure produces progressive changes in thermoregulation that involve sweating, skin circulation, thermoregulatory setpoint, cardiovascular alterations, and endocrine adjustments.[29,43,178] Individual differences affect the onset and decay of acclimatization.[29,45,179] The rate of acclimatization is related to aerobic conditioning and fitness; more conditioned athletes acclimatize more quickly.[43,45,180] The acclimatization process begins with heat exposure and is reasonably protective after 7 to 14 days, but maximum acclimatization may take 2 to 3 months.[45,181,182] Heat acclimatization diminishes by day 6 when heat stress is no longer present.[180,183] Fluid replacement improves the induction and effect of heat acclimatization.[184–187] Extra salt in the diet during the first few days of heat exposure also improves acclimatization; this can be accomplished by encouraging the athlete to eat salty foods and to use the salt shaker liberally during meals.

Cumulative Dehydration

Cumulative dehydration develops insidiously over several days and is typically observed during the first few days of a season during practice sessions or in tournament competition. Cumulative dehydration can be detected by monitoring daily prepractice and postpractice weights. Even though a small decrease in body weight (less than 1%) may not have a detrimental effect on the individual, the cumulative effect of a 1% fluid loss per day occurring over several days will create an increased risk for heat illness and a decrease in performance.[110]

During intense exercise in the heat, sweat rates can be 1 to 2.5 L/h (about 1 to 2.25 kilograms [2 to 5 pounds] of body weight per hour) or more, resulting in dehydration. Unfortunately, the volume of fluid that most athletes drink voluntarily during exercise replaces only about 50% of body-fluid losses.[188] Ideally, rehydration involves drinking at a rate sufficient to replace all of the water lost through sweating and urination.[60,77] If the athlete is not able to drink at this rate, he or she should drink the maximum tolerated. Use caution to ensure that athletes do not overhydrate and put themselves at risk for the development of hyponatremia. However, hydration before an event is essential to help decrease the incidence of heat illnesses. For more information on this topic, see the ''National Athletic Trainers' Association Position Statement: Fluid Replacement in Athletes.''[52]

Cooling Therapies

The fastest way to decrease body-core temperature is immersion of the trunk and extremities into a pool or tub filled with cold water (between 1°C [35°F] and 15°C [59°F]).[39,88,91,97] Conditions that have been associated with immersion therapy include shivering and peripheral vasoconstriction; however, the potential for these should not deter the medical staff from using immersion therapy for rapid cooling. Shivering can be prevented if the athlete is removed from the water once rectal temperature reaches 38.3°C to 38.9°C (101°F to 102°F). Peripheral vasoconstriction may occur, but the powerful cooling potential of immersion outweighs any potential concerns. Cardiogenic shock has also been a proposed consequence of immersion therapy, but this connection has not been proven in cooling heat-stroke patients.[39] Cold-water immersion therapy was associated with a zero percent fatality rate in 252 cases of exertional heat stroke in the military.[89] Other forms of cooling (water spray; ice packs covering the body; ice packs on axillae, groin, and neck; or blowing air) decrease body-core temperature at a slower rate compared with cold-water im-

§*References 9, 40, 43, 50, 51, 85, 159, 165, 166.*

mersion.[97] If immersion cooling is not being used, cooling with ice bags should be directed to as much of the body as possible, especially the major vessels in the armpit, groin, and neck regions (and likely the hands and feet), and cold towels may be applied to the head and trunk because these areas have been demonstrated on thermography[173,189] to have the most rapid heat loss.

SPECIAL CONCERNS

Most research related to heat illness has been performed on normal, healthy adults. Child athletes, older athletes, and athletes with spinal-cord injuries have been studied less frequently. The following are suggestions for special populations or those with special conditions.

Children (Prepubescents)

Exercise in hot environments and heat tolerance are affected by many physiologic factors in children. These include decreased sweat gland activity,[190] higher skin temperatures,[191–193] decreased cardiac output (increased heart rate and lower stroke volume) due to increased peripheral circulation,[194] decreased exercise economy,[195] decreased ability to acclimatize to heat (slower and takes longer),[192] smaller body size (issues related to body surface-to-mass ratio), maturational differences,[190] and predisposing conditions (obesity, hypohydration, childhood illnesses, and other disease states).[190,192,196]

- Decrease the intensity of activities that last longer than 30 minutes,[197] and have the athlete take brief rests[50] if the WBGT is between 22.8°C and 27.8°C (73°F and 82°F); cancel or modify the activity if the WBGT is greater than 27.8°C (82°F).[31,69–73] Modification could involve longer and more frequent rest breaks than are usually permitted within the rules of the sport (eg, insert a rest break before halftime).
- Encourage children to ingest some fluids at least every 15 to 30 minutes during activity to maintain hydration, even if they are not thirsty.[197]
- Use similar precautions as listed earlier for adults.

Older Athletes (>50 Years Old)

The ability of the older athlete to adapt is partly a function of age and also depends on functional capacity and physiologic health status.[198–206]

- The athlete should be evaluated by a physician before exercise, with the potential consequences of predisposing medical conditions and illnesses addressed.[9,34–36] An increase has been shown in the exercise heart rate of 1 beat per minute for each 1°C (1.8°F) increase in ambient temperature above neutral (23.9°C [75°F]).[207] Athletes with known or suspected heart disease should curtail activities at lower temperatures than healthy athletes and should have cardiovascular stress testing before participating in hot environments.
- Older athletes have a decreased ability to maintain an adequate plasma volume and osmolality during exercise,[198,208] which may predispose them to dehydration. Regular fluid intake is critical to avoid hyperthermia.

Athletes with Spinal-Cord Injuries

As sport participation for athletes with spinal-cord injuries increases from beginner to elite levels, understanding the disability,[209,210] training methods, and causes of heat injury will help make competition safer.[211] For example, the abilities to regulate heart rate, circulate the blood volume, produce sweat, and transfer heat to the surface vary with the level and severity of the spinal-cord lesion.[208,212–218]

- Monitor these athletes closely for heat-related problems. One technique for determining hyperthermia is to feel the skin under the arms of the distressed athlete.[211] Rectal temperature may not be as accurate for measuring core temperature as in other athletes due to decreased ability to regulate blood flow beneath the spinal-cord lesion.[218–220]
- If the athlete is hyperthermic, provide more water, lighter clothing, or cooling of the trunk,[211,213] legs,[211] and head.[213]

HOSPITALIZATION AND RECOVERY

After an episode of heat stroke, the athlete may experience impaired thermoregulation, persistent CNS dysfunction,[221,222] hepatic insufficiency, and renal insufficiency.[39,223] For persons with exertional heat stroke and associated multisystem tissue damage, the rate of recovery is highly individualized, ranging up to more than 1 year.[8,86,221] In one study, 9 of 10 patients exhibited normal heat-acclimatization responses, thermoregulation, whole-body sodium and potassium balance, sweat-gland function, and blood values about 2 months after the heat stroke.[8] Transient or persistent heat intolerance was found in a small percentage of patients.[83] For some athletes, a history of exertional heat stroke increases the chance of experiencing subsequent episodes.[39]

An athlete who experiences heat stroke may have compromised heat tolerance and heat acclimatization after physician clearance.[35,224,225] Decreased heat tolerance may affect 15% to 20% of persons after a heat stroke-related collapse,[226,227] and in a few individuals, decreased heat tolerance has persisted up to 5 years.[35,224,228] Additional heat stress may reduce the athlete's ability to train and compete due to impaired cardiovascular and thermoregulatory responses.[115,228–230]

After recovery from an episode of heat stroke or hyponatremia, an athlete's physical activity should be restricted[8,86] and the gradual return to sport individualized by his or her physician. The athlete should be monitored on a daily basis by the ATC during exercise.[86] During the return-to-exercise phase, an athlete may experience some detraining and deconditioning not directly related to the heat exposure.[8,86] Evaluate the athlete over time to determine whether there has been a complete recovery of exercise and heat tolerance.[8,86]

CONCLUSIONS

Athletic trainers and other allied health providers must be able to differentiate exercise-associated muscle (heat) cramps, heat syncope, exercise (heat) exhaustion, exertional heat stroke, and exertional hyponatremia in athletes.

This position statement outlines the NATA's current recommendations to reduce the incidence, improve the recognition, and optimize treatment of heat illness in athletes. Education and increased awareness will help to reduce both the frequency and the severity of heat illness in athletes.

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American Academy of Pediatrics
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Policy Statement

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Climatic Heat Stress and the Exercising Child and Adolescent (RE9845)

AMERICAN ACADEMY OF PEDIATRICS

Committee on Sports Medicine and Fitness

ABSTRACT. For morphologic and physiologic reasons, exercising children do not adapt as effectively as adults when exposed to a high climatic heat stress. This may affect their performance and well-being, as well as increase the risk for heat-related illness. This policy statement summarizes approaches for the prevention of the detrimental effects of children's activity in hot or humid climates, including the prevention of exercise-induced dehydration.

Heat-induced illness is preventable. Physicians, teachers, coaches, and parents need to be aware of the potential hazards of high-intensity exercise in hot or humid climates and to take measures to prevent heat-related illness in children and adolescents.

Exercising children do not adapt to extremes of temperature as effectively as adults when exposed to a high climatic heat stress.[1] The adaptation of adolescents falls in between. The reasons for these differences include:

1. Children have a greater surface area-to-body mass ratio than adults, which causes a greater heat gain from the environment on a hot day and a greater heat loss to the environment on a cold day.
2. Children produce more metabolic heat per mass unit than adults during physical activities that include walking or running.[2]
3. Sweating capacity is considerably lower in children than in adults,[1,3,4] which reduces the ability of children to dissipate body heat by evaporation.

Exercising children are able to dissipate heat effectively in a neutral or mildly warm climate. However, when air temperature exceeds 35°C (95°F), they have a lower exercise tolerance than do adults. The higher the air temperature, the greater the effect on the child.[4-7] It is important to emphasize that humidity is a major component of heat stress, sometimes even more important than air temperature.

On transition to a warmer climate, exercising persons must allow time to become acclimatized. Intense and prolonged exercise undertaken before acclimatization may be detrimental to the child's physical performance and well-being and may lead to heat-related illness, including heat exhaustion or fatal heat stroke.[8] The rate of acclimatization for children is slower than that of adults.[9] A child will need as many as 8 to 10 exposures (30 to 45 minutes each) to the new climate to acclimatize sufficiently. Such exposures can be taken at a rate of one per day or one every other day.

Children frequently do not feel the need to drink enough to replenish fluid loss during prolonged exercise. This may lead to severe dehydration.[10,11] Children with mental retardation are at special risk for not recognizing the need to replace the fluid loss. A major consequence of dehydration is an excessive increase in core body temperature. Thus, the dehydrated child is more prone to heat-related illness than the fully hydrated child.[12,13] For a given level of hypohydration, children are subject to a greater increase in core body temperature than are adults.[10] Although water is an easily available drink, a flavored beverage may be preferable because the child may drink more of it.[14,15] Another important way to enhance thirst is by adding sodium chloride (approximately 15 to 20 mmol/L, or 1 g per 2 pints) to the flavored solution. This has been shown to increase voluntary drinking by 90%, compared with unflavored water.[15] The above concentration is found in commercially available sports drinks. Salt tablets should be avoided, because of their high content of sodium chloride.

The likelihood of heat intolerance increases with conditions that are associated with excessive fluid loss (febrile state, gastrointestinal infection, diabetes insipidus, diabetes mellitus), suboptimal sweating (spina bifida, sweating insufficiency syndrome), excessive sweating (selected cyanotic congenital heart defects), diminished thirst (cystic fibrosis),[11,12] inadequate drinking (mental retardation, young children who may not comprehend the importance of drinking), abnormal hypothalamic thermoregulatory function (anorexia nervosa, advanced undernutrition, prior heat-related illness), and obesity.[7,8]

Proper health habits can be learned by children and adolescents. Athletes who may be exposed to hot climates should follow proper guidelines for heat acclimatization, fluid intake, appropriate clothing, and adjustment of activity according to ambient temperature and humidity. High humidity levels, even when air temperature is not excessive, result in high heat stress.

Based on this information, the American Academy of Pediatrics recommends the following for children and adolescents:

1. The intensity of activities that last 15 minutes or more should be reduced whenever relative humidity, solar radiation, and air temperature are above critical levels. For specific recommendations, see Table 1. One way of increasing rest periods on a hot day is to substitute players frequently.
2. At the beginning of a strenuous exercise program or after traveling to a warmer climate, the intensity and duration of exercise should be limited initially and then gradually increased during a period of 10 to 14 days to accomplish acclimatization to the heat. When such a period is not available, the length of time for participants during practice and competition should be curtailed.
3. Before prolonged physical activity, the child should be well-hydrated. During the activity, periodic drinking should be enforced (eg, each 20 minutes 150 mL [5 oz] of cold tap water or a flavored salted beverage for a child weighing 40 kg (88 lbs) and 250 mL [9 oz] for an adolescent weighing 60 kg (132 lbs)), even if the child does not feel thirsty. Weighing before and after a training session can verify hydration status if the child is weighed wearing little or no clothing.
4. Clothing should be light-colored and lightweight and limited to one layer of absorbent material to facilitate evaporation of sweat. Sweat-saturated garments should be replaced by dry garments. Rubberized sweat suits should never be used to produce loss of weight.

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TABLE 1
Restraints on Activities at Different Levels of Heat Stress*

WBGT		Restraints on Activities
°C	°F	
<24	<75	All activities allowed, but be alert for prodromes of heat-related illness in prolonged events
24.0-25.9	75.0-78.6	Longer rest periods in the shade; enforce drinking every 15 minutes
26-29	79-84	Stop activity of unacclimatized persons and other persons with high risk; limit activities of all others (disallow long-distance races, cut down further duration of other activities)
>29	>85	Cancel all athletic activities

* From the American Academy of Pediatrics, Committee on Sports Medicine and Fitness.[16] WBGT is *not* air temperature. It indicates wet bulb globe temperature, an index of climatic heat stress that can be measured on the field by the use of a psychrometer. This apparatus, available commercially, is composed of 3 thermometers. One (wet bulb [WB]) has a wet wick around it to monitor humidity. Another is inside a hollow black ball (globe [G]) to monitor radiation. The third is a simple thermometer (temperature [T]) to measure air temperature. The heat stress index is calculated as WBGT = 0.7 WB temp + 0.2 G temp + 0.1 T temp.
It is noteworthy that 70% of the stress is due to humidity, 20% to radiation, and only 10% to air temperature.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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American College of Sports Medicine Position Stand: Exercise and Fluid Replacement

Summary

American College of Sports Medicine. Position Stand on Exercise and Fluid Replacement. *Med. Sci. Sports Exerc.*, Vol. 28, No. 1, pp. i–vii, 1996. It is the position of the American College of Sports Medicine that adequate fluid replacement helps maintain hydration and, therefore, promotes the health, safety, and optimal physical performance of individuals participating in regular physical activity. This position statement is based on a comprehensive review and interpretation of scientific literature concerning the influence of fluid replacement on exercise performance and the risk of thermal injury associated with dehydration and hyperthermia. Based on available evidence, the American College of Sports Medicine makes the following general recommendations on the amount and composition of fluid that should be ingested in preparation for, during, and after exercise or athletic competition:

1) It is recommended that individuals consume a nutritionally balanced diet and drink adequate fluids during the 24-h period before an event, especially during the period that includes the meal prior to exercise, to promote proper hydration before exercise or competition.
2) It is recommended that individuals drink about 500 ml (about 17 ounces) of fluid about 2 h before exercise to promote adequate hydration and allow time for excretion of excess ingested water.
3) *During* exercise, athletes should start drinking early and at regular intervals in an attempt to consume fluids at a rate sufficient to replace all the water lost through sweating (i.e., body weight loss), or consume the maximal amount that can be tolerated.
4) It is recommended that ingested fluids be cooler than ambient temperature [between 15° and 22°C (59° and 72°F)] and flavored to enhance palatability and promote fluid replacement. Fluids should be readily available and served in containers that allow adequate volumes to be ingested with ease and with minimal interruption of exercise.
5) Addition of proper amounts of carbohydrates and/or electrolytes to a fluid replacement solution is recommended for exercise events of duration greater than 1 h since it does not significantly impair water delivery to the body and may enhance performance. During exercise lasting less than 1 h, there is little evidence of physiological or physical performance differences between consuming a carbohydrate-electrolyte drink and plain water.
6) During intense exercise lasting longer than 1 h, it is recommended that carbohydrates be ingested at a rate of 30–60 $g \cdot h^{-1}$ to maintain oxidation of carbohydrates and delay fatigue. This rate of carbohydrate intake can be achieved without compromising fluid delivery by drinking 600–1200 $ml \cdot h^{-1}$ of solutions containing 4%–8% carbohydrates ($g \cdot 100\ ml^{-1}$). The carbohydrates can be sugars (glucose or sucrose) or starch (e.g., maltodextrin).
7) Inclusion of sodium (0.5–0.7 $g \cdot l^{-1}$ of water) in the rehydration solution ingested during exercise lasting longer than 1 h is recommended since it may be advantageous in enhancing palatability,

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promoting fluid retention, and possibly preventing hyponatremia in certain individuals who drink excessive quantities of fluid. There is little physiological basis for the presence of sodium in an oral rehydration solution for enhancing intestinal water absorption as long as sodium is sufficiently available from the previous meal.

Introduction

Disturbances in body water and electrolyte balance can adversely affect cellular as well as systemic function, subsequently reducing the ability of humans to tolerate prolonged exercise. Water lost during exercise-induced sweating can lead to dehydration of both intracellular and extracellular fluid compartments of the body. Even a small amount of dehydration (1% body weight) can increase cardiovascular strain as indicated by a disproportionate elevation of heart rate during exercise, and limit the ability of the body to transfer heat from contracting muscles to the skin surface where heat can be dissipated to the environment. Therefore, consequences of body water deficits can increase the probability for impairing exercise performance and developing heat injury.

The specific aim of this position statement is to provide appropriate guidelines for fluid replacement that will help avoid or minimize the debilitating effects of water and electrolyte deficits on physiological function and exercise performance. These guidelines will also address the rationale for inclusion of carbohydrates and electrolytes in fluid replacement drinks.

Hydration before Exercise

Fluid replacement following exercise represents hydration prior to the next exercise bout. Any fluid deficit prior to exercise can potentially compromise thermoregulation during the next exercise session if adequate fluid replacement is not employed. Water loss from the body due to sweating is a function of the total thermal load that is related to the combined effects of exercise intensity and ambient conditions (temperature, humidity, wind speed) (62,87). In humans, sweating can exceed 30 g · min^{-1} (1.8 kg · h^{-1}) (2,31). Water lost with sweating is derived from all fluid compartments of the body, including the blood (hypovolemia) (72), thus causing an increase in the concentration of electrolytes in the body fluids (hypertonicity) (85). People who begin exercise when hypohydrated with concomitant hypovolemia and hypertonicity display impaired ability to dissipate body heat during subsequent exercise (26,28, 61,85,86). They demonstrate a faster rise in body core temperature and greater cardiovascular strain (28,34, 82,83). Exercise performance of both short duration and high power output, as well as prolonged moderate intensity endurance activities, can be impaired when individuals begin exercise with the burden of a previously incurred fluid deficit (1,83), an effect that is exaggerated when activity is performed in a hot environment (81).

During exercise, humans typically drink insufficient volumes of fluid to offset sweat losses. This observation has been referred to as "voluntary dehydration" (33,77). Following a fluid volume deficit created by exercise, individuals ingest more fluid and retain a higher percentage of ingested fluid when electrolyte deficits are also replaced (71). In fact, complete restoration of a fluid volume deficit cannot occur without electrolyte replacement (primarily sodium) in food or beverage (39,89). Electrolytes, primarily sodium chloride, and to a lesser extent potassium, are lost in sweat during exercise. The concentration of Na^+ in sweat averages ~ 50 mmol · 1^{-1} but can vary widely (20–100 mmol · 1^{-1}) depending on the state of heat acclimation, diet, and hydration (6). Despite knowing the typical electrolyte concentration of sweat, determination of a typical amount of total electrolyte loss during thermal or exercise stress is difficult because the amount and composition of sweat varies with exercise intensity and environmental conditions. The normal range of daily U.S. intake of sodium chloride (NaCl) is 4.6 to 12.8 g (~80–220 mmol) and potassium (K^+) is 2–4 g (50–100 mmol) (63). Exercise bouts that produce electrolyte losses in the range of normal daily dietary intake are easily replenished within 24 h following exercise and full rehydration is expected if adequate fluids are provided. When meals are consumed, adequate amounts of electrolytes are present so that the composition of the drink becomes unimportant. However, it is important that fluids be available during meal consumption since most persons rehydrate primarily during and after meals. In the absence of meals, more complete rehydration can be accomplished with fluids containing sodium than with plain water (32,55,71).

To avoid or delay the detrimental effects of dehydration during exercise, individuals appear to benefit from fluid ingested prior to competition. For instance, water ingested 60 min before exercise will enhance thermoregulation and lower heart rate during exercise (34,56). However, urine volume will increase as much as 4 times that measured without preexercise fluid intake. Pragmatically, ingestion of 400–600 ml of water 2 h before exercise should allow renal mechanisms sufficient time to regulate total body fluid volume and osmolality at optimal preexercise levels and help delay or avoid detrimental effects of dehydration during exercise.

Fluid Replacement during Exercise

Without adequate fluid replacement during prolonged exercise, rectal temperature and heart rate will become more elevated compared with a well-hydrated condition (13,19,29,54). The most serious effect of dehydration resulting from the failure to replace fluids during exercise is impaired heat dissipation, which can elevate body core temperature to dangerously high levels (i.e., >40° C). Exercise-induced dehydration causes hypertonicity of body fluids and impairs skin blood flow (26,53,54,65), and has been associated with reduced sweat rate (26,85), thus limiting evaporative heat loss, which accounts for more than 80% of heat loss in a hot-dry environment. Dehydration (i.e, 3% body weight loss) can also elicit significant reduction in cardiac output during exercise since a reduction in stroke volume can be greater than the increase in heart rate (53,80). Since a net result of electrolyte and water imbalance associated with failure to adequately replace fluids during exercise is an increased rate of heat storage, dehydration induced by exercise presents a potential for the development of heat-related disorders (24), including potentially life-threatening heat stroke (88,92). It is therefore reasonable to surmise that fluid replacement that offsets dehydration and excessive elevation in body heat during exercise may be instrumental in reducing the risk of thermal injury (37).

To minimize the potential for thermal injury, it is advocated that water losses due to sweating during exercise be replaced at a rate equal to the sweat rate (5,19,66,73). Inadequate water intake can lead to premature exhaustion. During exercise, humans do not typically drink as much water as they sweat and, at best, voluntary drinking only replaces about two-thirds of the body water lost as sweat (36). It is common for individuals to dehydrate by 2%–6% of their body weight during exercise in the heat despite the availability of adequate amounts of fluid (33,35,66,73). In many athletic events, the volume and frequency of fluid consumption may be limited by the rules of competition (e.g., number of rest periods or time outs) or their availability (e.g., spacing of aid stations along a race course). While large volumes of ingested fluids ($\geq 1\ 1 \cdot h^{-1}$) are tolerated by exercising individuals in laboratory studies, field observations indicate that most participants drink sparingly during competition. For example, it is not uncommon for elite runners to ingest less than 200 ml of fluid during distance events in a cool environment lasting more than 2 h (13,66). Actual rates of fluid ingestion are seldom more than $500\ ml \cdot h^{-1}$ (66,68) and most athletes allow themselves to become dehydrated by 2–3 kg of body weight in sports such as running, cycling, and the triathlon. It is clear that perception of thirst, an imperfect index of the magnitude of fluid deficit, cannot be used to provide complete restoration of water lost by sweating. As such, individuals participating in prolonged intense exercise must rely on strategies such as monitoring body weight loss and ingesting volumes of fluid during exercise at a rate equal to that lost from sweating, i.e., body weight reduction, to ensure complete fluid replacement. This can be accomplished by ingesting beverages that enhance drinking at a rate of one pint of fluid per pound of body weight reduction. While gastrointestinal discomfort has been reported by individuals who have attempted to drink at rates equal to their sweat rates, especially in excess of $1\ 1 \cdot h^{-1}$ (10,13,52,57,66), this response appears to be individual and there is no clear association between the volume of ingested fluid and symptoms of gastrointestinal distress. Further, failure to maintain hydration during exercise by drinking appropriate amounts of fluid may contribute to gastrointestinal symptoms (64,76). Therefore, individuals should be encouraged to consume the maximal amount of fluids during exercise that can be tolerated without gastrointestinal discomfort up to a rate equal to that lost from sweating.

Enhancing palatability of an ingested fluid is one way of improving the match between fluid intake and sweat output. Water palatability is influenced by several factors including temperature and flavoring (25,36). While most individuals prefer cool water, the preferred water temperature is influenced by cultural and learned behaviors. The most pleasurable water temperature during recovery from exercise was 5°C (78), although when water was ingested in large quantities, a temperature of ~15°–21°C was preferred (9,36). Experiments have also demonstrated that voluntary fluid intake is enhanced if the fluid is flavored (25,36) and/or sweetened (27). It is therefore reasonable to expect that the effect of flavoring and water temperature should increase fluid consumption during exercise, although there is insufficient evidence to support this hypothesis. In general, fluid replacement beverages that are sweetened (artificially or with sugars), flavored, and cooled to between 15° and 21° C should stimulate fluid intake (9,25,36,78).

The rate at which fluid and electrolyte balance will be restored is also determined by the rate at which ingested fluid empties from the stomach and is absorbed from the intestine into the blood. The rate at which fluid leaves the stomach is dependent on a complex interaction of several factors, such as volume, temperature, and composition of the ingested fluid, and exercise intensity. The most important factor influencing gastric emptying is the fluid volume in the stomach (52,68,75). However, the rate of gastric emptying of fluid is slowed proportionately with increasing glucose concentration above 8% (15,38). When gastric fluid volume is maintained at 600 ml or more, most individuals can still empty more than $1000\ ml \cdot h^{-1}$ when the fluids contain a 4%–8% carbohydrate concentration (19,68). Therefore, to promote gastric emptying, especially with the presence of 4%–8% carbohydrate in the fluid, it is advantageous to maintain the largest volume of fluid that can be tolerated in the stomach during exercise (e.g., 400–600 ml). Mild to moderate exercise appears to have little or no effect on gastric emptying while heavy exercise at intensities greater than 80% of maximal capacity may slow gastric emptying (12,15). Laboratory and field studies suggest that during prolonged exercise, frequent (every 15–20 min) consumption of moderate (150 ml) to large (350 ml) volumes of fluid is possible. Despite the apparent advantage of high gastric fluid volume for promoting gastric emptying, there should be some caution associated with maintaining high gastric fluid volume. People differ in their gastric emptying rates as well as their tolerance to gastric volumes, and it has not been determined if the ability to tolerate high gastric volumes can be improved by drinking during training. It is also unclear whether complaints of gastrointestinal symptoms by athletes during competition are a function of an unfamiliarity of exercising with a full stomach or because of delays in gastric emptying (57). It is therefore recommended that individuals learn their tolerance limits for maintaining a high gastric fluid volume for various exercise intensities and durations.

Once ingested fluid moves into the intestine, water moves out of the intestine into the blood. Intestinal absorptive capacity is generally adequate to cope with even the most extreme demands (30); and at intensities of exercise that can be sustained for more than 30 min, there appears to be little effect of exercise on intestinal function (84). In fact, dehydration consequent to failure to replace fluids lost during exercise reduces the rate of gastric emptying (64,76), supporting the rationale for early and continued drinking throughout exercise.

Electrolyte and Carbohydrate Replacement during Exercise

There is little physiological basis for the presence of sodium in an oral rehydration solution for enhancing intestinal water absorption as long as sodium is sufficiently available in the gut from the previous meal or in the pancreatic secretions (84). Inclusion of sodium (<50 mmol · 1^{-1}) in fluid replacement drinks during exercise has not shown consistent improvements in retention of ingested fluid in the vascular compartment (20,23,44,45). A primary rationale for electrolyte supplementation with fluid replacement drinks is, therefore, to replace electrolytes lost from sweating during exercise greater than 4–5 h in duration (3). Normal plasma sodium concentration is 140 mmol · 1^{-1}, making sweat (~50 mmol · 1^{-1}) hypotonic relative to plasma. At a sweat rate of 1.5 · h^{-1}, a total sodium deficit of 75 mmol · h^{-1} could occur during exercise. Drinking water can lower elevated plasma electrolyte concentrations back toward normal and restore sweating (85,86), but complete restoration of the extracellular fluid compartment cannot be sustained without replacement of lost sodium (39,70,89). In most cases, this can be accomplished by normal dietary intake (63). If sodium enhances palatability, then its presence in a replacement solution may be justified because drinking can be maximized by improving taste qualities of the ingested fluid (9,25).

The addition of carbohydrates to a fluid replacement solution can enhance intestinal absorption of water (30,84). However, a primary role of ingesting carbohydrates in a fluid replacement beverage is to maintain blood glucose concentration and enhance carbohydrate oxidation during exercise that lasts longer than 1 h, especially when muscle glycogen is low (11,14, 17,18,50,60). As a result, fatigue can be delayed by carbohydrate ingestion during exercise of duration longer than 1 h which normally causes fatigue without carbohydrate ingestion (11). To maintain blood glucose levels during continuous moderate-to-high intensity exercise, carbohydrates should be ingested throughout exercise at a rate of 30–60 g · h^{-1}. These amounts of carbohydrates can be obtained while also replacing relatively large amounts of fluid if the concentration of carbohydrates is kept below 10% (g · 100 ml^{-1} of fluid). For example, if the desired volume of ingestion is 600–1200 ml · h^{-1}, then the carbohydrate requirements can be met by drinking fluids with concentrations in the range of 4%–8% (19). With this procedure, both fluid and carbohydrate requirements can be met simultaneously during prolonged exercise. Solutions containing carbohydrate concentrations >0% will cause a net movement of fluid into the intestinal lumen because of their high osmolality, when such solutions are ingested during exercise. This can result in an effective loss of water from the vascular compartment and can exacerbate the effects of dehydration (43).

Few investigators have examined the benefits of adding carbohydrates to water during exercise events lasting less than 1 h. Although preliminary data suggest a potential benefit for performance (4,7,48), the mechanism is unclear. It would be premature to recommend drinking something other than water during exercise lasting less than 1 h. Generally, the inclusion of glucose, sucrose, and other complex carbohydrates in fluid replacement solutions have equal effectiveness in increasing exogenous carbohydrate oxidation, delaying fatigue, and improving performance (11,16,79,90). However, fructose should not be the predominant carbohydrate because it is converted slowly to blood glucose—not readily oxidized (41,42)—which does not improve performance (8). Furthermore, fructose may cause gastrointestinal distress (59).

Fluid Replacement and Exercise Performance

Although the impact of fluid deficits on cardiovascular function and thermoregulation is evident, the extent to which exercise performance is altered by fluid replacement remains unclear. Although some data indicate that drinking improves the ability to perform short duration athletic events (1 h) in moderate climates (7), other data suggest that this may not be the case (40). It is likely that the effect of fluid replacement on performance may be most noticeable during exercise of duration greater than 1 h and/or at extreme ambient environments.

The addition of a small amount of sodium to rehydration fluids has little impact on time to exhaustion during mild prolonged (>4 h) exercise in the heat (73), ability to complete 6 h of moderate exercise (5), or capacity to perform during simulated time trials (20,74). A sodium deficit, in combination with ingestion and retention of a large volume of fluid with little or no electrolytes, has led to low plasma sodium levels in a very few marathon or ultra-marathon athletes (3,67). Hyponatremia (blood sodium concentration between 117 and 128 mmol $\cdot$ l^{-1}) has been observed in ultra-endurance athletes at the end of competition and is associated with disorientation, confusion, and in most cases, grand mal seizures (67,69). One major rationale for inclusion of sodium in rehydration drinks is to avoid hyponatremia. To prevent development of this rare condition during prolonged (>4 h) exercise, electrolytes should be present in the fluid or food during and after exercise.

Maintenance of blood glucose concentrations is necessary for optimal exercise performance. To maintain blood glucose concentration during fatiguing exercise greater than 1 h (above 65% VO_{2max}), carbohydrate ingestion is necessary (11,49). Late in prolonged exercise, ingested carbohydrates become the main source of carbohydrate energy and can delay the onset of fatigue (17,19,21,22,51,58). Data from field studies designed to test these concepts during athletic competition have not always demonstrated delayed onset of fatigue (46,47,91), but the inability to control critical factors (such as environmental conditions, state of training, drinking volumes) make confirmation difficult. Inclusion of carbohydrates in a rehydration solution becomes more important for optimal performance as the duration of intense exercise exceeds 1 h.

Conclusion

The primary objective for replacing body fluid loss during exercise is to maintain normal hydration. One should consume adequate fluids during the 24-h period before an event and drink about 500 ml (about 17 ounces) of fluid about 2 h before exercise to promote adequate hydration and allow time for excretion of excess ingested water. To minimize risk of thermal injury and impairment of exercise performance during exercise, fluid replacement should attempt to equal fluid loss. At equal exercise intensity, the requirement for fluid replacement becomes greater with increased sweating during environmental thermal stress. During exercise lasting longer than 1 h, a) carbohydrates should be added to the fluid replacement solution to maintain blood glucose concentration and delay the onset of fatigue, and b) electrolytes (primarily NaCl) should be added to the fluid replacement solution to enhance palatability and reduce the probability for development of hyponatremia. During exercise, fluid and carbohydrate requirements can be met simultaneously by ingesting 600–1200 ml $\cdot$ h^{-1} of solutions containing 4%–8% carbohydrate. During exercise greater than 1 h, approximately 0.5–0.7 g of sodium per liter of water would be appropriate to replace that lost from sweating.

Acknowledgment

This pronouncement was reviewed for the American College of Sports Medicine by members-at-large, the Pronouncement Committee, and by: David L. Costill, Ph.D., FACSM, John E. Greenleaf, Ph.D., FACSM, Scott J. Montain, Ph.D., and Timothy D. Noakes, M.D., FACSM.

Heat and Cold Illnesses During Distance Running

American College of Sports Medicine Position Stand
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Summary

Many recreational and elite runners participate in distance races each year. When these events are conducted in hot or cold conditions, the risk of environmental illness increases. However, exertional hyperthemia, hypothermia, dehydration, and other related problems may be minimized with pre-event education and preparation. This position stand provides recommendations for the medical director and other race officials in the following areas: scheduling; organizing personnel, facilities, supplies, equipment, and communications providing competitor education; measuring environmental stress; providing fluids; and avoiding potential legal liabilities. This document also describes the predisposing conditions, recognition, and treatment of the four most common environmental illnesses: heat exhaustion, heatstroke, hypothermia, and frostbite. The objectives of this position stand are: 1) To educate distance running event officials and participants about the most common forms of environmental illness including predisposing conditions, warning signs, susceptibility, and incidence reduction. 2) To advise race officials of their legal responsibilities and potential liability with regard to event safety and injury prevention. 3) To recommend that race officials consult local weather archives and plan events at times likely to be of low environmental stress to minimize detrimental effects on participants. 4) To encourage race officials to warm participants about environmental stress on race day and its implications for heat and cold illness. 5) To inform race officials of preventive actions that may reduce debilitation and environmental illness. 6) To describe the personnel, equipment, and supplies necessary to reduce and treat cases of collapse and environmental illness.

Introduction

This document replaces the position stand titled *The Prevention of Thermal Injuries During Distance Running* (4). It considers problems that may affect the extensive community of recreational joggers and elite athletes who participate in distance running events. It has been expanded to include heat exhaustion, heatstroke, hypothermia, and frostbite–the most common environmental illnesses during races.

Because physiological responses to exercise in stressful environments may vary among participants, and because the health status of participants varies from day to day, compliance with these recommendations will not guarantee protection from environmentally induced illnesses. Nevertheless, these recommendations should minimize the risk of exertional hyperthermia, hypothermia, dehydration, and resulting problems in distance running and other forms of continuous athletic activity such as bicycle, soccer, and triathlon competition.

Managing a large road race is a complex task that requires financial resources, a communication network, trained volunteers, and teamwork. Environmental extremes impose additional burdens on the organizational and medical systems. Therefore, it is the position of the American College of Sports Medicine that the following RECOMMENDATIONS be employed by race managers and medical directors of community events that involve prolonged or intense exercise in mild and stressful environments.

1. Race Organization

a. Distance races should be scheduled to avoid extremely hot and humid and very cold months. The local weather history should be consulted when scheduling an event. Organizers should be cautious of unseasonably hot or cold days in early spring or late fall because entrants may not be sufficiently acclimatized. The wind chill index should be used to reschedule races on cold, windy days because flesh may freeze rapidly and cold injuries may result.

b. Summer events should be scheduled in the early morning or the evening to minimize solar radiation and air temperature. Winter events should be scheduled at midday to minimize the risk of cold injury.

c. The heat stress index should be measured at the site of the race because meteorological data from a distant weather station may vary considerably from local conditions (66). The wet bulb globe temperature (WBGT) index is widely used in athletic and industrial settings [see Appendix I;(87)]. If the WBGT index is above 28 °C (82 °F), or if the ambient dry bulb temperature is below -20 °C (-4 °F), consideration should be given to canceling the race or rescheduling it until less stressful conditions prevail. If the WBGT index is below 28 °'C, participants should be alerted to the risk of heat illness by using signs posted at the start of the race and at key positions along the race course [see Appendix I;(61)]. Also, race organizers should monitor changes in weather conditions. WBGT monitors can be purchased commercially, or Figure I may be used to approximate the risk of racing in hot environments based on air temperature and relative humidity. These two measures are available from local meteorological stations and media weather reports, or can be measured with a sling psychrometer.

d. An adequate supply of fluid must be available before the start of the race, along the race course, and at the end of the event. Runners should be encouraged to replace their sweat losses or consume 150-300 ml (5.3-10.5 oz) every 15 minutes (3). Sweat loss can be derived by calculating the difference between pre and postexercise body weight.

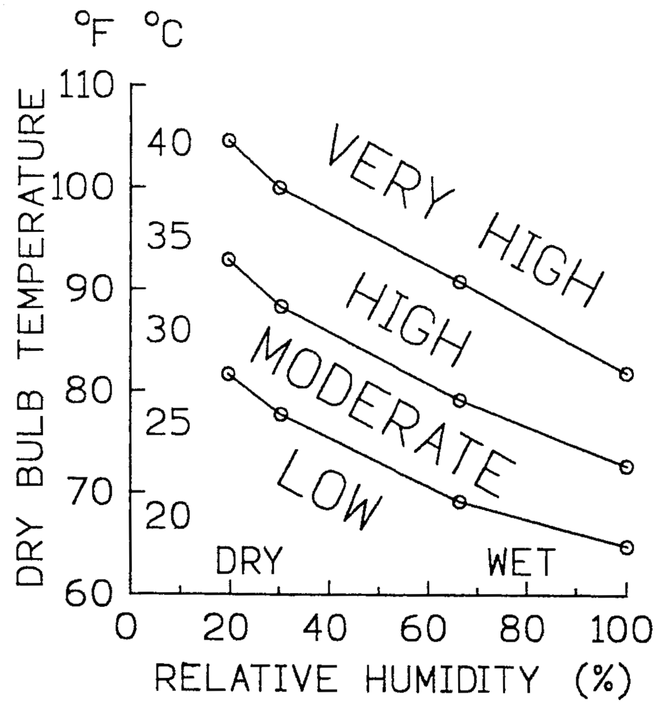

Figure 1 Risk of heat exhaustion or heatstroke while racing in hot environments. Figure drawn from data presented in American College of Sports Medicine Position stand: the prevention of thermal injuries during distance running. *Med. Sci. Sports Exerc.* 19:529-533, 1987.

e. Cool or cold (ice) water immersion is the most effective means of cooling a collapsed hyperthermic runner (25, 48, 49, 59, 88). Wetting runners externally by spraying or sponging during exercise in a hot environment is pleasurable but does not fully attenuate the rise in body core temperature (14, 88). Wetting the skin can result in effective cooling once exercise ceases.

f. Race officials should be aware of the warning signs of an impending collapse in both hot and cold environments and should warn runners to slow down or stop if they appear to be in difficulty.

g. Adequate traffic and crowd control must be maintained along the course at all times.

h. Radio communication or cellular telephones should connect various points on the course with an information processing center to coordinate emergency responses.

2. Medical Director

A sports medicine physician should work closely with the race director to enhance the safety and provide adequate medical care for all participants. The medical director should understand exercise physiology, interpretation of meteorological data, heat and cold illness prevention strategies, potential liability, and the treatment of medical problems associated with endurance events conducted in stressful environments.

3. Medical Support

a. Medical organization and responsibility: The medical director should alert local hospitals and ambulance services and make prior arrangements to care for casualties, including those with heat or cold injury. Medical personnel should have the authority to evaluate, examine, and stop runners who display signs of impending illness or collapse. Runners should be advised of this procedure prior to the event.

b. Medical facilities: Medical support staff and facilities must be available at the race site. The facilities should be staffed with personnel capable of instituting immediate and appropriate resuscitation measures. The equipment necessary to institute both cooling therapy (ice packs, child's wading pools filled with tap water or ice water, fans) and warming therapy (heaters, blankets, hot beverages) may be necessary at the same event. For example, medical personnel treated 12 cases of hyperthermia and 13 cases of hypothermia at an endurance triathlon involving 2300 competitors: air temperature was 85°F, water temperature was 58°F (92).

4. Competitor Education

The physical training and knowledge of competitive runners and joggers has increased greatly, but race organizers must not assume that all participants are well prepared or informed about safety. Distributing this position stand before registration, publicizing the event in the media, and conducting clinics or seminars before events are valuable educational procedures.

a. All participants should be advised that the following conditions may exacerbate heat illness: obesity (13, 39, 89), low degree of physical fitness (30, 63, 79, 83), dehydration (23, 34, 69, 83, 84, 95), lack of heat acclimatization (31, 51, 89), a previous history of heat stroke (82, 89), sleep deprivation (5), certain medications, including diuretics and antidepressants (31), and sweat gland dysfunction or sunburn (31). Illness 1 week prior to an event should preclude participation (32, 96), especially those involving fever, respiratory tract infections, or diarrhea (41, 46).

b. Prepubescent children sweat less than adults and have lower heat tolerance (11, 12).

c. Adequate training and fitness are important for full enjoyment of the event and will reduce the risk of heat illness and hypothermia (33, 64, 67, 85).

d. Prior training in the heat will promote heat acclimatization (6) and thereby reduce the risk of heat illness, especially if the training environment is warmer than that expected during a race (5, 51). Artificial heat acclimatization can be induced in cold conditions (6).

e. Adequate fluid consumption before and during the race can reduce the risk of heat illness, including disorientation and irrational behavior, particularly in longer events such as a marathon (23, 34, 95).

f. Excessive consumption of pure water or dilute fluid (i.e., up to 10 liters per 4 hours) during prolonged endurance events may lead to a harmful dilutional hyponatremia (60), which may involve disorientation, confusion, and seizure or coma. The possibility of hyponatremia may be the best rationale for inclusion of sodium chloride in fluid replacement beverages (3).

g. Participants should be advised of the early symptoms of heat illness, which may include clumsiness, stumbling, headache, nausea, dizziness, apathy, confusion, and impairment of consciousness (41,86).

h. Participants should be advised of the early symptoms of hypothemia (slurred speech, ataxia, stumbling gait) and frostbite (numbness, burning, pain, paresthesia) on exposed skin (36). Wet clothing, especially cotton, increases heat loss and the risk of hypothermia (68).

i. Participants should be advised to choose a comfortable running speed and not to run faster than environmental conditions or their cardiorespiratory fitness warrant (43, 71, 91).

j. It is helpful if novice runners exercise with a partner, each being responsible for the other's well-being (71).

5. Responsibilities and Potential Liability

The sponsors and directors of an endurance event are reasonably safe from liability due to injury if they avoid gross negligence and willful misconduct, carefully inform the participants of hazards, and have them sign waivers before the race (78). However, a waiver signed by a participant does not totally absolve race organizers of moral and/or legal responsibility. It is recommended that race sponsors and directors: 1) minimize hazards and make safety the first concern; 2) describe inherent hazards (i.e., potential course hazards, traffic control, weather conditions) in the race application; 3) require all entrants to sign a waiver; 4) retain waivers and records for 3 yrs; 5) warn runners of the predisposing factors and symptoms of environmental illness; 6) provide all advertised support services; 7) legally incorporate the race or organizations involved; and 8) purchase liability insurance (18, 78, 80).

Race directors should investigate local laws regarding Good Samaritan action. In some states physicians who do not accept remuneration may be classified as Good Samaritans. Race liability insurance may not cover physicians (78), therefore the malpractice insurance policy of each participating physician should be evaluated to determine if it covers services rendered at the race.

Medical and race directors should postpone, reschedule, or cancel a race if environmental conditions warrant, even though runners and trained volunteers arrive at the site and financial sponsorship has been provided. Runners may not have adequate experience to make the decision not to compete; their safety must be considered. Downgrading the race to a "fun run" does not absolve race supervisors from their responsibility or decrease the risk to participants (15, 66).

Background For This Position Stand

Dehydration is common during prolonged endurance events in both cold and hot environmental conditions because the average participant loses 0.5-1.5 quarts (0.47-1.42 liters) of sweat, and fluid replacement is usually insufficient (12, 42, 69). Runners may experience hyperthermia [body core temperature above 39°C (102.2°F)] or hypothermia [body core temperature below 35°C (95°F)], depending on the environmental conditions, caloric intake, fluid consumption, and clothing worn. Hyperthermia is a potential problem in warm and hot weather races when the body's rate of heat production is greater than its heat dissipation (2). Indeed, on extremely hot days, it is possible that up to 50% of the participants may require treatment for heat-related illnesses such as heat exhaustion and heatstroke (1, 66). Hypothermia is more likely to occur in cold or cool-windy conditions. Scanty clothing may provide inadequate protection from such environments, particularly near the end of a long race when running speed and heat production are reduced. Frostbite can occur in low air temperature and especially when combined with high wind speed. The race and medical directors should anticipate the above medical problems and be capable of responding to a large number of patients with adequate facilities, supplies, and support staff. The four most common heat and cold illnesses during distance running are heat exhaustion, heatstroke, hypothermia, and frostbite.

1. Heat Exhaustion

Body sweat loss can be significant in summer endurance races and may result in a body water deficit of 6-10% of body weight (41, 95). Such dehydration will reduce the ability to exercise in the heat because decreases in circulating blood volume, blood pressure, sweat production, and skin blood flow all inhibit heat loss (41, 81) and predispose the runner to heat exhaustion or the more dangerous hyperthermia and exertional heatstroke (41, 66).

Heat exhaustion, typically the most common heat illness among athletes, is defined as the inability to continue exercise in the heat (7). It represents a failure of the cardiovascular responses to workload, high external temperature, and dehydration (16, 41, 42). Heat exhaustion has no known chronic, harmful effects. Symptoms may include headache, extreme weakness, dizziness, vertigo, "heat sensations" on the head or neck, heat cramps, chills, "goose flesh" ("goose bumps"), vomiting, nausea, and irritability (41, 42). Hyperventilation, muscular incoordination, agitation, impaired judgment, and confusion also may be seen. Heat syncope (fainting) may or may not accompany heat exhaustion (41). The onset of heat exhaustion symptoms is usually sudden and the duration of collapse brief. During the acute stage of heat exhaustion, the patient looks ashen-gray, the blood pressure is low, and the pulse rate is elevated. Hyperthermia may add to the symptoms of heat exhaustion, even on relatively cool days (20, 22, 30, 37, 38, 43, 62, 90).

Although it is improbable that all heat exhaustion cases can be avoided, the most susceptible individuals are those who either exert themselves at or near their maximal capacities, are dehydrated, not physically fit, and not acclimatized to exercise in the heat. It is imperative that runners be adequately rested, fed, hydrated, and acclimatized (7); they should drink ample fluids before, during, and after exercise (3). Also, repeated bouts of exercise in the heat (heat acclimatization) reduce the incidence of both heat exhaustion and heat syncope. Heat acclimatization can best be accomplished by gradually increasing the duration and intensity of exercise training during the initial 10-14 d of heat exposure (6).

Oral rehydration is preferred for heat exhaustion patients who are conscious, coherent, and without vomiting or diarrhea. Intravenous (IV) fluid administration facilitates rapid recovery (42, 57). Although a variety of IV solutions have been used at races (42), a 5% dextrose sugar in either 0.45% saline (NACI) or 0.9% NaCl are the most common (1). Runners may require up to 4 1 of IV fluid if severely dehydrated (57).

2. Exertional Heatstroke

Heat production, mainly from muscles, during intense exercise is 15-20 times greater than at rest, and is sufficient to raise body core temperature by 1°C (1.8°F) each 5 minutes without thermoregulatory (heat loss) adjustments (56). When the rate of heat production exceeds that of heat loss for a sufficient period of time, severe hyperthermia occurs.

Heatstroke is the most serious of the syndromes associated with excess body heat. It is defined as a condition in which body temperature is elevated to a level that causes damage to the body's tissues, giving rise to a characteristic clinical and pathological syndrome affecting multiple organs (32, 83). After races, adult core (rectal) temperatures above 40.6°C (105.1°F) have been reported in conscious runners (24, 52, 69, 74, 77), and 42-43°C (107.6-109.4°F) in collapsed runners (72-74, 86, 90). Sweating is usually present in runners who experience exertional heatstroke (87).

Strenuous physical exercise in a hot environment has been notorious as the cause of heatstroke, but heatstroke also has been observed in cool-to-moderate [13-28°C (55-82°F)] environments (5, 32, 74), suggesting variations in individual susceptibility (5, 31, 32). Skin disease, sunburn, dehydration, alcohol or drug use/abuse, obesity, sleep loss, poor physical fitness, lack of heat acclimatization, advanced age, and a previous heat injury all have been theoretically linked to increased risk of heatstroke (5, 31, 51, 84). The risk of heatstroke is reduced if runners are well-hydrated, well-fed, rested, and acclimatized. Runners should not exercise if they have a concurrent illness, respiratory infection, diarrhea, vomiting, or fever (5, 7, 46). For example, a study of 179 heat casualties at a 14-km race showed that 23% reported a recent gastrointestinal or respiratory illness (70), whereas a study of 10 military heatstroke patients reported that three had a fever or disease and six recalled at least one warning sign of impending illness at the time of their heatstroke (5).

Appropriate fluid ingestion before and during prolonged running can minimize dehydration and reduce the rate of increase in body core temperature (24, 34). However, excessive hyperthermia may occur in the absence of significant dehydration, especially in races of less than 10 km, because the fast pace generates greater metabolic heat (90).

The mortality rate and organ damage due to heatstroke are proportional to the length of time between core temperature elevation and initiation of cooling therapy (5, 26). Therefore, prompt recognition and cooling are essential (1, 5, 22, 42, 48, 51, 62, 74, 83). A measurement of deep body temperature is vital to the diagnosis, and a rectal temperature should be measured in any casualty suspected of having heat illness or hypothermia. Ear (tympanic), oral, or axillary measurements are spuriously affected by peripheral (skin) and environmental temperatures and should not be used after exercise (8, 75, 76). When cooling is initiated rapidly, most heatstroke patients recover fully with normal psychological status (79), muscle energy metabolism (65), heat acclimatization, temperature regulation, electrolyte balance, sweat gland function, and blood constituents (5).

Many whole-body cooling techniques have been used to treat exertional heatstroke, including water immersion, application of wet towels or sheets, warm air spray, helicopter downdraft, and ice packs to the neck, underarm, and groin areas. There is disagreement as to which modality provides the most efficient cooling (7, 47, 97), because several methods have been used successfully. However, the fastest whole-body cooling rates (25, 48, 49, 59, 88) and the lowest mortality rates (25) have been observed during cool and cold water immersion. Whichever modality is utilized it should be simple and safe, provide great cooling power, and should not restrict other forms of therapy (i.e., cardiopulmonary resuscitation, defibrillation, IV cannulation). The advantages and disadvantages of various cooling techniques have been discussed (47, 75, 97).

Heatstroke is regarded as a medical emergency that might be fatal if not immediately diagnosed and properly treated. Early diagnosis is of utmost importance and time-consuming investigation should be postponed until body temperature is corrected and the patient is evacuated to a nearby medical facility that is aware of such conditions.

3. Hypothermia

Hypothermia [body core temperature below 36°C (97 °F)] occurs when heat loss is greater than metabolic heat production (94). Early signs and symptoms of hypothermia include shivering, euphoria, confusion, and behavior similar to intoxication. Lethargy, muscular weakness, disorientation, hallucinations, depression, or combative behavior may occur as core temperature continues to fall. If body core temperature falls below 31.1°C

(88°F), shivering may stop and the patient will become progressively delirious, uncoordinated, and eventually comatose if treatment is not provided (10).

During cool or cold weather marathons, the most common illnesses are hypothermia, exhaustion, and dehydration. The most common medical complaints are weakness, shivering, lethargy, slurred speech, dizziness, diarrhea, and thirst (1, 45). Runner complaints of feeling hot or cold do not always agree with changes in rectal temperature (74). Dehydration is common in cool weather (1, 45). Runners should attempt to replace fluids at a rate that matches their sweat and urine losses. Cases of hypothermia also occur in spring and fall because weather conditions change rapidly and runners wear inappropriate clothing that becomes sweat-soaked during training or competition (19).

Hypothermia may occur during races, for example when distance runners complete the second half of the event more slowly than the first half (54). Evaporative and radiative cooling increase because wet skin (from sweat, rain, or snow) and clothing are exposed to higher wind speed at a time when metabolic heat production decreases. Hypothermia also occurs after a race, when the temperature gradient between the body surface and the environment is high. Subfreezing ambient temperatures need not be present and hypothermia may develop even when the air temperature is 10-18°C (50-65°F) (19, 36, 74). A WBGT meter can be used to evaluate the risk of hypothermia (see Appendix 1). Cold wind increases heat loss in proportion to wind speed; i.e., wind chill factor. The relative degree of danger can be assessed (Fig. 2) (55). Wind speed can be estimated; if you feel the wind in your face the speed is at least 16 km per hour^{-1} (kph) [10 miles per hour^{-1} (mph)]; if small tree branches move or if snow and dust are raised, approximately 32 kph (20 mph); if large tree branches move, 48 kph (30 mph); if an entire tree bends, about 64 kph (40 mph) (9).

To reduce heat loss, runners should protect themselves from moisture, wind, and cold air by wearing several layers of light, loose clothing that insulate the skin with trapped air (17). An outer garment that is windproof, allows moisture to escape, and provides rain protection is useful. Lightweight nylon parkas may not offer thermal insulation but offer significant protection against severe wind chill, especially if a hood is provided. Wool and polyester fabrics retain some protective value when wet; cotton and goose down do not (10). Areas of the body that lose large amounts of heat (head, neck, legs, hands) should be covered (17).

Mild [34-36°C (93-97°F)] or moderate [30-34°C (86-93°F)] hypothermia should be treated before it progresses. Wet clothing should be replaced with dry material (sweatsuit, blanket) that is insulated from the ground and wind. Warm fluids should be consumed if patients are conscious, able to talk, and thinking clearly. Patients with moderate and severe [<30°C (86°F)] hypothermia should be insulated in a blanket and evacuated to a hospital immediately (19, 58). Although severe hypothermia should be treated in the field (27), it is widely recognized that life-threatening ventricular fibrillation is common in this state and may be initiated

Wind Chill Chart

AIR TEMPER-ATURE	ESTIMATED WIND SPEED IN MPH (KPH) 0 (0)	10 (16)	20 (32)	0 (48)	
30F (-1.l C)	30 (1.1)	16 (-8.9)	4 (-15.6)	-2 (-18.9)	LITTLE RISK
20 F (-6.7 C)	20 (-6-7)	4 (-15.6)	-10 (-23-3)	-18 (-27.8)	
10F (12.2 C)	10 (-12.2)	-9 (-22.8)	-25 (-31.7)	-33 (-36.1)	INCREASED RISK
0 F (-17.8 C)	0 (-17.8)	-24 (-31.1)	-39 (-39.4)	-48 (-44.4)	
-10 F (-23.3 C)	-10 (-23.3)	-33 (-36.1)	-53 (-47.2)	-63 (-52.8)	
-20 F (-28.9 C)	-20 (-28.9)	-46 (-43.3)	-67 (-55)	-79 (-61.7)	GREAT RISK

Figure 2 The risk of freezing exposed flesh in cold environments.
Reprinted from Milesko-Pytel, D. Helping the frostbitten patient. *Patient Care* 17:90-115, 1983.

by physical manipulation, chest compression, or intubation (10, 27, 58, 93). However, with conclusive evidence of cardiac standstill and breathlessness, emergency procedures (i.e., Basic Life Support, Advanced Cardiac Life Support) should be initiated. Life-support procedures (27) and commonly observed laboratory (i.e., electrolyte, acid-base) values (10, 58) have been described by others.

4. Frostbite

Frostbite involves crystallization of fluids in the skin or subcutaneous tissue after exposure to subfreezing temperatures [< -0.6°C (31°F)]. With low skin temperature and dehydration, cutaneous blood vessels constrict and circulation is attenuated because the viscosity of blood increases (55). Frostbite may occur within seconds or hours of exposure, depending upon air temperature, wind speed, and body insulation. Frostbitten skin can appear white, yellow-white, or purple, and is hard, cold, and insensitive to touch (55). Rewarming results in intense pain, skin reddening, and swelling. Blister formation is common and loss of extremities (fingers, toes, ears, hands, feet) is possible (36, 55). The degree of tissue damage depends on duration and severity of the freezing and effectiveness of treatment.

No data have been published regarding the incidence of frostbite among athletes during training or competition. Since winter running races are rarely postponed when environmental conditions are harsh, and frostbite is the most common cold injury in military settings (35), it is imperative that runners be aware of the dangers. Crosscountry ski races are postponed if the temperature at the coldest point of the course is less than -20 °C (-4 °F), due to the severe wind chill generated at race pace.

Runners risk frozen flesh within minutes if the air temperature and wind speed combine to present a severe wind chill. Because runners prefer to have unrestricted movement during races, and because they know that exercise results in body heating, they may not wear sufficient clothing. Runners can avoid frostbite and hypothermia in cold and windy conditions by protecting themselves by dressing adequately: wet skin or clothing will increase the risk of frostbite (21, 29).

When tissue freezes [skin temperature -2 ° -O °C, (28-32 °F)], water is drawn out of the cells and ice crystals cause mechanical destruction of skin and subcutaneous tissue (36). However, initial ice crystal formation is not as damaging to tissues as partial rethawing and refreezing (40). Therefore, the decision to treat severe frostbite in the field (versus transport to a hospital) should consider the possibility of refreezing. If there is no likelihood of refreezing, the tissue should be rapidly rewarmed (36, 40) in circulating warm water (40-43.3 °C, 104-110 °F), insulated, and the patient transported to a medical facility. Research on animals suggests that topical aloe vera and systemic ibuprofen may reduce tissue damage and speed rehabilitation in humans (9). Other aspects of hospital treatment protocols are detailed elsewhere (9, 36, 40).

Race Organization

The following suggestions constitute the ideal race medical team. They are offered for consideration, but are not intended as absolute requirements. Staff and equipment needs are unique to each race and may be revised after 1-2 yr, in light of the distinctive features of each race. Depending on the weather conditions, 2-12% of all entrants will typically enter a medical aid station (1, 45, 50, 74).

1. Medical Personnel

a. Provide medical assistance if the race is 10 km (6.2 miles) or longer.

b. Provide the following medical personnel per 1,000 runners: 1-2 physicians, 4-6 podiatrists, 1-4 emergency medical technicians, 2-4 nurses, 3-6 physical therapists, 3-6 athletic trainers, and 1-3 assistants. Approximately 75% of these personnel should be stationed at the finish area. Recruit one nurse (per 1,000 runners) trained in IV therapy.

c. Recruit emergency personnel from existing organizations (police, fire-rescue, emergency medical service).

d. One physician and 10-15 medical assistants serve as the triage team in the finish chute. Runners unable to walk are transported to the medical tent via wheelchair, litter, or two-person carry.

e. Consider one or two physicians and two to four nurses trained in the rehabilitative medical care of wheelchair athletes.

f. Medical volunteers should attend a briefing prior to the event to meet their supervisor and receive identification tags, weather forecast, instructions, and schedules. Supervisors from the following groups should be introduced: medical director; podiatry, nursing, physical therapy, athletic training, medical records, triage, wheelchair athlete care, and medical security (optional: chiropractic, massage therapy). Medical volunteers should be distinguished from other race volunteers; luminous/distinctive vests, coats, or hats work well.

2. Medical Aid Stations

a. Provide a primary medical aid station (250-1,500 ft^2 (23-139 m^2) for each 1,000 runners; see Table 1) at the finish area, with no public access. Place security guards at all entrances with instructions regarding who can enter.

b. Position secondary medical aid stations along the route at 2- to 3-km (1.2- to 1.9-mile) intervals for races over 10 km, and at the halfway point for shorter races (see Table 1). Some race directors have successfully secured equipment and medical volunteers from military reserve or national guard medical units, the American Red Cross, and the National Ski Patrol.

c. Station one ambulance per 3,000 runners at the finish area and one or more mobile emergency response vehicles on the course. Staff each vehicle with a nurse and radio person or cellular telephone. Stock each vehicle with a medical kit, automatic defibrillator, IV apparatus. blankets, towels, crushed ice, blood pressure cuffs, rehydration fluid, and cups.

d. Signs should be posted at the starting line and at each medical aid station to announce the risk of heat illness or cold injury (see Appendix 1).

e. A medical record card should be completed for each runner who receives treatment (1,74). This card provides details that can be used to plan the medical coverage of future events.

f. Provide personal protective equipment (gloves, gowns, face shields, eye protection) and hand washing facilities.

g. Provide portable latrines and containers for patients with vomiting and diarrhea.

h. Initial medical assessment must include rectal (not oral, aural, or axillary temperature; see ref. 8, 76), central nervous system function, and cardiovascular function. Rehydration and cooling or warming are the cornerstones of treatment (32, 41, 42, 50, 74, 94).

Medical aid stations

Item	Secondary Aid Station	Primary Aid Station
Stretchers (at 10 km and beyond)	2-5	4-10
Cots	10	30
Wheelchairs	0	1
Wool blankets (at 10 km and beyond)	6-10	12-20
Bath towels	5-10	10-20
High and low temperature rectal thermometers (37-43˚C; 99-110˚F) and (22-37˚C; 77-99˚F)[d]	5	10
Elastic bandages (2, 4, and 6 inch)	3 each	6 each
Gauze pads (4 x 4 inch)	1/2 case	1 case
Adhesive tape (1.5 inch)	1/2 case	1 case
Skin disinfectant	1 l	2 l
Surgical soap	1/2 case	1case
Band-aids	110	220
Moleskin	1/2 case	1 case
Petroleum jelly, ointments	1/2 case	1 case
Disposable latex gloves	80 pairs	175 pairs
Stethoscopes	1	2
Blood pressure cuffs	1	2
Intravenous (IV) stations[d]	1	2
IV fluid (D5:1/2 NS or D5:NS; 0.5 or 1l)[d]	15[e]	30[e]
Sharps and biohazard disposal containers[d]	1	2
Alcohol wipes	50	100
Small instrument kits	1	1
Athletic trainer's kit	1	1
Podiatrist's kit	1-2	2-4
Inflatable arm and leg splints	2 each	2 each
Tables for medical supplies	1	2
Hose with spray nozzle, running water[e]	1	2
Wading pool for water immersion[d]	1	2
Fans for cooling	1	2-4
Oxygen tanks with regulators and masks	0	2
Crushed ice in plastic bags	7 kg	14 kg
Rehydration fluids	50 l	100 l[e]
Cups (≥0.3l, 10 oz)	1250	2250
Eye drops	1	1
Urine dipsticksd	10	20
Glucose blood monitoring kits[d]	1	2
Inhalation therapy for asthmatics[d]	1	1
EMS ambulance or ACLS station	1	1
Injectable drugs[d]		
Oral drugs[d]		

Table 1 Suggested equipment and supplies per 1,000 runners[a].

[a] Revised from Adner, M. M., J. J. Scarlet, J. Casey, W. Robison, and 8, H. Jones. The Boston Marathon medical care team: ten years of experience. *Physician Sportsmed.* 16:99-106, 1988; Bodishbaugh, R. G. Boston marathoners get red carpet treatment in the medical tent. *Physician Sportsmed.* 16:139-143, 1988; and Noble, H. B. and D. Bachman. Medical aspects of distance race planning. *Physician Sportsmed.* 7:78-84, 1979.
[b] Increase supplies and equipment if the race course is out and back.
[c] At finish area.
[d] Supervised by a physician.
[e] Depends on environmental conditions.

3. Universal Precautions

All medical personnel may encounter blood-borne pathogens or other potentially infectious materials, and should observe the following precautions (53, 63):

a. Receive immunization against the hepatitis B virus prior to the event.

b. Recognize that blood and infectious body fluids may be encountered from needle sticks, cuts, abrasions, blisters, and clothing.

c. Reduce the likelihood of exposure by planning tasks carefully (i.e., prohibiting recapping of needles by a two-handed technique, minimizing splashing and spraying).

d. Wear personal protective equipment such as gloves, gowns, face shields and eye protection. Remove this equipment and dispose/decontaminate it prior to leaving the work area.

e. Wash hands after removing gloves or other personal protective equipment.

f. Dispose of protective coverings, needles, scalpels, and other sharp objects in approved, labeled biohazard containers.

g. Do not eat, drink, smoke, handle contact lenses, or any cosmetics/lip balm in the medical treatment area.

h. Decontaminate work surfaces, bins, pails, and cans [1/10 solution of household bleach (sodium hypochlorite) in water] after completion of procedures.

4. Fluid Stations

a. At the start and finish areas provide 0.34-0.45 1 (12-16 oz) of fluid per runner. At each fluid station on the race course (2-3 km apart), provide 0.28-0.34 1 (10-12 oz) of fluid per runner. Provide both water and a carbohydrate-electrolyte beverage in equal volumes.

b. In cool or cold weather [≤10˚C (50˚F)], an equivalent amount of warm fluid should be available.

c. Number of cups (>0.3 1, 10 oz) per fluid station on the course = number of entrants + 25% additional for spillage and double use. Double this total if the course is out and back.

d. Number of cups at start and finish area = (2 $\times$ number of entrants) + 25% additional.

e. Cups should be filled prior to the race and placed on tables to allow easy access. Runners drink larger volumes if volunteers hand them cups filled with fluid.

5. Communications/Surveillance

a. Provide two-way radio or telephone communication between the medical director, medical aid stations, mobile vans, and pick-up vehicles.

b. Arrange for radio-equipped vehicles to drive the race course (ahead and behind participants) and provide communication with the director and his/her staff. These vehicles should be stationed at regular intervals along the course to search the course for competitors who require emergency care and encourage compromised runners to stop.

c. Place radio-equipped observers along the course.

d. Notify local hospitals, police, and fire-rescue departments of the time of the event, number of participants, location of aid stations, extent of medical coverage, and the race course.

e. Use the emergency response system (telephone number 911) in urban areas.

6. Instructions to Runners

a. Advise each race participant to print name, address, telephone number, and medical problems on the back of the race number (pinned to the body). This permits emergency personnel to quickly identify unconscious runners. Inform emergency personnel that this information exists.

b. Inform race participants of potential medical problems at pre-race conferences and at the starting line. Signed registration forms should clearly state the types of heat or cold injuries that may arise from participation in this event.

c. Provide pre-event recommendations regarding training, fluid consumption, clothing selection, self-care, heat acclimatization, and signs or symptoms of heat/cold illness (88).

d. The race director should announce the following information to all participants by loudspeaker immediately prior to the race:

- Current and predicted maximum (or minimum) temperature, humidity, wind speed, and cloud cover;
- The WBGT category and the risks for hyperthermia or hypothermia (see Appendix 1);
- Location of aid stations, types of assistance, and fluid availability;
- Signs and symptoms of heat or cold illness;
- Recommended clothing;
- The need for fluid replacement before, during, and after the race;
- The policy of race monitors to stop runners who are ill;
- A request that runners seek help for impaired competitors who appear ill, who are not coherent, who run in the wrong direction, or who exhibit upper-body swaying and poor competitive posture;

- A warning to novice runners entering their first race that they should run at a comfortable pac and run with a partner;
- Warnings to runners who are taking medications or have chronic illnesses (asthma, hypertension, diabetes, cardiovascular problems).

This position stand replaces the 1987 ACSM position paper, "The Prevention of Thermal Injuries During Distance Running." This pronouncement was reviewed for the American College of Sports Medicine by members-at-large, the Pronouncements Committee, and by: Arthur E. Crago, M.D., Stafford W. Dobbin, M.D., Mary L. O'Toole, Ph.D., FACSM, LTC Katy L. Reynolds, M.D., John W. Robertson, M.D., FACSM.

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Appendix 1: Measurement of Environmental Stress

Ambient temperature is only one component of environmental heat or cold stress; others are humidity, wind speed, and radiant heat. The most widely used heat stress index is the wet bulb globe temperature (WBGT) index (96):

$$WBGT = (0.7\ T^{wb}) + (0.2\ T^{g}) + (0.\ 1\ T^{db})$$

where T^{wb} is the wet bulb temperature, T^{g} is the black globe temperature, and T^{db} is the shaded dry bulb temperature (28). T^{db} refers to air temperature measured with a standard dry bulb thermometer not in direct sunlight. T^{wb} is measured with a water-saturated cloth wick over a dry bulb thermometer (not immersed in water). T^{g} is measured by inserting a dry bulb thermometer into a standard black metal globe. Both T^{wb} and ^{T} are measured in direct sunlight.

A portable monitor that gives the WBGT index in degrees Celsius or degrees Fahrenheit has proven useful during races and in military training (28, 44, 87, 96). The measurement of air temperature alone is inadequate. The importance of humidity in total heat stress can be readily appreciated because T^{wb} accounts for 70% of the index whereas T^{db} accounts for only 10%.

The risk of heat illness (while wearing shorts, socks, shoes, and a t-shirt) due to environmental stress should be communicated to runners in four categories (see Fig. 1):

- Very high risk: WBGT above 28°C (82°F); high risk: WBGT 23-28°C (73-82°F);
- Moderate risk: WBGT 18-23°C (65-73°F);
- Low risk: WBGT below 18°C (65°F).

Large signs should be displayed, at the start of the race and at key points along the race course, to describe the risk of heat exhaustion and heatstroke (Fig. 1). When the WBGT index is above 28°C (82°F), the risk of heat exhaustion or heatstroke is very high; it is recommended that the race be postponed until less stressful conditions prevail, rescheduled, or canceled. High risk [WBGT index = 23-28°C (73-82°F)] indicates that runners should be aware that heat exhaustion or heatstroke may be experienced by any participant; anyone who is particularly sensitive to heat or humidity probably should not run. Moderate risk [WBGT index = 18-23°C (65-73°F)] reminds runners that heat and humidity will increase during the course of the race if conducted during the morning or early afternoon. Low risk [WBGT index below 18°C (65°F)] does not guarantee that heat exhaustion (even heatstroke, see ref. 5, 32) will not occur; it only indicates that the risk is low.

The risk of hypothermia (while wearing shorts, socks, shoes, and a t-shirt) also should be communicated to runners. A WBGT index below 10°C (50°F) indicates that hypothermia may occur in slow runners who run long distances, especially in wet and windy conditions. Core body temperatures as low as 92°F have been observed in 65°F conditions (74).

Playing Hot Quiz Questions and Answers

Quiz for your athletes to begin the video, activities, and discussion session. (All questions can be answered “true” or “false.”)

1. It’s a good idea to drink as much water as possible immediately after a long game or exercise session in the heat, especially if you have to play again soon (i.e., one to several hours later).

   Answer: **False.** Drinking water after competition is, of course, very helpful and necessary. But, you can drink too much water too fast! This can lead to feeling sick or possibly having very severe problems. Rehydrating after sweating a lot is important; however, it is also important to replace other nutrients such as electrolytes (primarily sodium and chloride) and carbohydrates.

2. Eating a banana or an orange is an effective way to prevent or resolve muscle cramping.

   Answer: **False.** Muscle cramping during competition in the heat, when you have been sweating considerably, is often due to the excessive loss of water and salt (sodium and chloride—not potassium) from sweating. Athletes who sweat a lot and are prone to cramping in the heat may benefit from increasing their salt intake before and after competition, when sweat losses are expected to be high.

3. If you eat well before you compete, water is all you will need to consume during a long match, game, or run.

   Answer: **False.** During any activity that lasts more than an hour, if the intensity is high enough, you will probably need to ingest some carbohydrates (e.g., sport drinks or certain snacks) to maintain your best performance. Even if you ate well earlier, this rule holds true—especially in the heat. Some athletes may need to consume some salt as well.

4. It’s better to sweat less during exercise in the heat.

   Answer: **False.** Although sweating extensively causes you to lose a lot of water, which can hurt your performance and increase your risk for heat illness, sweating is a good thing! Sweating cools your body. Sweating is a very high priority during exercise in the heat—for your safety and performance. The important thing is that if you tend to sweat a lot, make sure that you are well hydrated when you begin exercise and that you drink enough as often as you can during your activity.

5. The video *Playing Hot* will give you a lot of important information that will help you compete safely and closer to your best in the heat.

   True! *Enjoy the video!*

Fluid Pyramid

Use this handy chart to learn how much water you should be drinking daily, and during exercise.

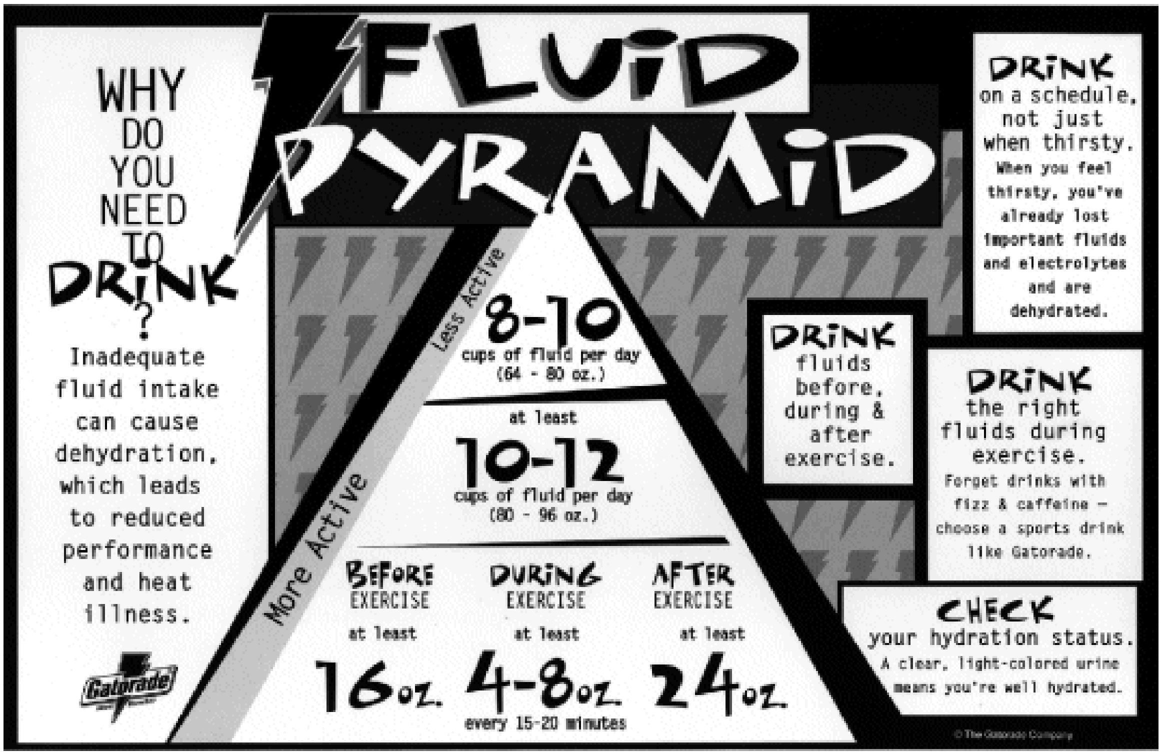

Figure 1 Fluid Pyramid.
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Heat-Related Disorders

Exposure to the combination of external heat stress and the inability to dissipate metabolically generated heat can lead to three heat-related disorders (see figure 2):

- Heat cramps
- Heat exhaustion
- Heat stroke

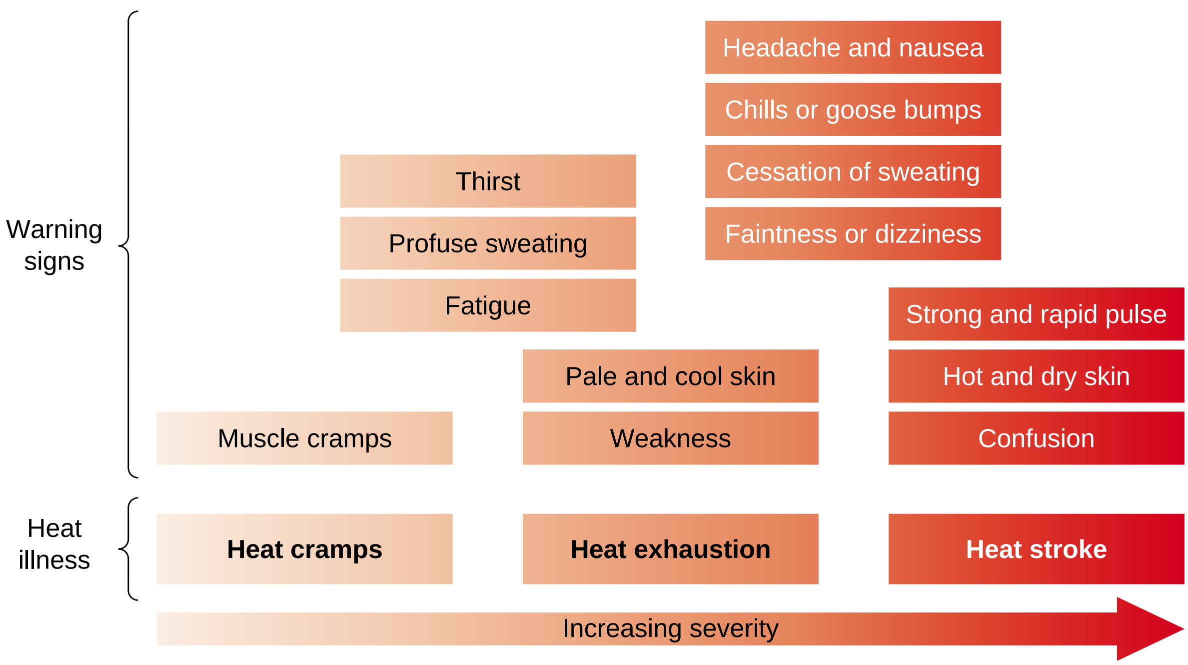

Figure 2 The warning signs of heat cramps, heat exhaustion, and heat stroke. ©PepsiCo 1995. Reprinted with permission.

Heat Cramps

Heat cramps, the least serious of the three heat disorders, is characterized by severe cramping of the skeletal muscles. It involves primarily the muscles that are most heavily used during exercise. This disorder is probably brought on by the mineral losses and dehydration that accompany high rates of sweating, but a cause-and-effect relationship has not been fully established. Heat cramps are treated by moving the stricken individual to a cooler location and administering fluids or a saline solution.

Heat Exhaustion

Heat exhaustion is typically accompanied by such symptoms as extreme fatigue, breathlessness, dizziness, vomiting, fainting, cold and clammy or hot and dry skin, hypotention (low blood pressure), and a weak, rapid pulse. It is caused by the cardiovascular system's inability to adequately meet the body's needs. Recall that during exercise in heat, your active muscles and your skin, through which excess heat is lost, compete for a share of your total blood volume. Heat exhaustion results when these simultaneous demands are not met. Heat exhaustion typically occurs when your blood volume decreases, by either excessive fluid loss or mineral loss from sweating.

With heat exhaustion, the thermoregulatory mechanisms are functioning but cannot dissipate heat quickly enough because there is insufficient blood volume to allow adequate distribution to the skin. Although the condition often occurs during mild to moderate exercise in the heat, it is not generally accompanied by a high rectal temperature. Some people who collapse from heat stress exhibit symptoms of heat exhaustion but have internal temperatures below 39 °C (102.2 °F). People who are poorly conditioned or unacclimatized to the heat are more susceptible to heat exhaustion.

Treatment for victims of heat exhaustion involves rest in a cooler environment with their feet elevated to avoid shock. If the person is conscious, administration of salt water is usually recommended. If the person is unconscious, medically supervised intravenous administration of saline solution is recommended. If allowed to progress, heat exhaustion can deteriorate to heat stroke.

Heat Stroke

Heat stroke is a life-threatening heat disorder that requires immediate medical attention. It is characterized by

- a rise in internal body temperature to a value exceeding 40 °C (104 °F),
- cessation of sweating,
- hot and dry skin,
- rapid pulse and respiration,
- usually hypertension (high blood pressure),
- confusion, and
- unconsciousness.

If left untreated, heat stroke progresses to coma, and death quickly follows. Treatment involves rapidly cooling the person's body in a bath of cold water or ice or wrapping the body in wet sheet and fanning the victim.

Heat stroke is caused by failure of the body's thermoregulatory mechanisms. Body heat production during exercise depend on exercise intensity and body weight, so heavier athletes run a higher risk of overheating than lighter athletes when exercising at the same rate and when both are about equally acclimatized to the heat.

For the athlete, heat stroke is a problem associated not only with extreme conditions. Studies have reported rectal temperatures above 40.5 ˚C (104.9 ˚F) in marathon runners who successfully completed race conducted under relatively moderate thermal conditions (e.g., 21.1 ˚C [70 ˚F] and 30% relative humidity). Even in shorter events, the body's core temperature can reach lift-threatening levels. As early as 1949, Robinson observed rectal temperatures of 41 ˚C (105.8 ˚F) in runners competing in events lasting only about 14 minutes, such as the 5-km race. Following a 10-km race conducted with an air temperature of 29.5 ˚C (85.1 ˚F), 80% relative humidity, and bright sun, one runner who collapsed had a rectal temperature of 43 ˚C (109.4 ˚F)! Without proper medical attention, such fevers can result in permanent central nervous system damage or death. Fortunately, this runner was rapidly cooled with ice and recovered without complication.

When exercising in the heat, if you suddenly feel chilled and goose bumps form on your skin, stop exercising, get into a cool environment, and drink plenty of cool fluids. The body's thermoregulatory system has become confused and think that the body temperature needs to be increased even more! Left untreated, this condition can lead to heat stroke and death.

Prevention of Hyperthermia

We can do little about environmental conditions. Thus, in threatening conditions, athletes must decrease their effort in order to reduce their heat production and their risk of developing hyperthermia (high body temperature). All athletes, coaches, and sports organizers should be able to recognize the symptoms of hyperthermia. Fortunately, our subjective sensations are well correlated with our body temperatures, as indicated on table 2 below. Although there is generally little concern when rectal temperature remains below 40 ˚C (104 ˚F) during prolonged exercise, athletes who experience throbbing pressure in their heads and chills should realize that they are rapidly approaching a dangerous situation that could prove fatal if they continue to exercise.

Subjective Symptoms Associated with Overheating

Rectal Temperature	Symptoms
40 ˚C – 40.5 ˚C (104 ˚F – 105 ˚F)	Cold sensation over stomach and back, with piloerection (goose bumps)
40.5 ˚C – 41.1 ˚C (105 ˚F – 106 ˚F)	Muscular weakness, disorientation, and loss of postural equilibrium
41.1 ˚C – 41.7 ˚C (106 ˚F – 107 ˚F)	Diminished sweating, loss of consciousness and hypothalamic control
≥42.2 ˚C (≥108 ˚F)	Death

To prevent heat disorders, several precautions should be taken. Competition and practice should not be held outdoors when the WBGT (see page 59) is over 28 ˚C (82.4 ˚F). As mentioned earlier, because WBGT reflects the humidity as well as the absolute temperature, it reflects the true physiological heat stress more accurately than does standard air temperature. Scheduling practices and contest either in the early morning or at night avoids the severe heat stress of midday. Fluids should be readily available, and athletes should be required to drink as much as they can, stopping every 10 to 20 minutes for a fluid break in warm temperatures.

Clothing is another important consideration. Obviously, the more clothing that is worn, the less body area exposed to the environment to allow heat exchange. The foolish practice of exercising in a rubberized suit to promote weight loss is an excellent illustration of how a dangerous microenvironment (the isolated environment inside the suit) can be created in which temperature and humidity can reach a sufficiently high level to block all heat loss from the body. This can rapidly lead to heat exhaustion or heat stroke. Football uniforms are another example. Areas that are covered by sweat-soaked clothing and padding are exposed to 100% humidity and higher temperatures, reducing the gradient between body surface and the environment.

Athletes should wear as little clothing as possible, when heat stress is a potential limitation to thermoregulation. The athlete should always underdress because the metabolic heat load will soon make extra clothing an unnecessary burden. When clothing is needed or required, it should be loosely woven to allow the skin to unload as much heat as possible and light colored to reflect heat back to the environment.

The American College of Sports Medicine (ACSM) has provided guidelines to help distance runners prevent heat-related injuries. A modified list of these recommendations appears in table 3 below.

Table 3 Guidelines for Distance Runners Competing Under Conditions of Heat Stress

1. Distance races should be scheduled to avoid extremely hot and humid conditions. If the WBGT index is above 28 ˚C (82 ˚F), canceling the race should be considered.
2. Summer events should be scheduled in the early morning or evening to minimize solar radiation and unusually high air temperature.
3. An adequate supply of fluid must be available before the start of the race, along the racecourse, and at the end of the event. Runners should be encouraged to replace their sweat losses or consume 150 to 300 ml (5.3 – 10.5 oz) every 15 minutes during the race.
4. Cool or cold (ice) water immersion is the most effective means of cooling a collapsed hyperthermic runner.

(continued)

Guidelines for Distance Runners
Competing Under Conditions of Heat Stress, *continued*

5. Runners should be aware of the early symptoms of hyperthermia, including
   - dizziness,
   - chilling,
   - headache or throbbing pressure in the temporal region, and
   - loss of coordination.
6. Race officials should be aware of the warning signs of an impending collapse in hot environments and should warn runners to slow down or stop if they appear to be in difficulty.
7. Organization personnel should reserve the right to stop runners who exhibit clear signs of heat stroke or heat exhaustion.

Note: These recommendations are based on the position stands published by the American College of Sports Medicine in 1987 and 1995.

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Keeping Your Players Hydrated

You may think that you've heard enough about the importance of drinking plenty of fluids and the benefits of staying well hydrated. After all, your players seem to drink a lot of water during exercise and most tend to avoid severe problems such as cramping or overheating. Yet many well-trained and informed tennis players continue to have hydration problems. The symptoms of inadequate or inappropriate hydration management range from simply feeling a little "off" and not quite playing at one's best to suffering painful heat cramps or heat exhaustion. These symptoms are commonly observed at many tennis tournaments, especially when it's hot.

The three primary nutritional factors related to keeping your players hydrated are **water**, **electrolytes**, and **carbohydrates**. These are also the nutrients that have the most immediate effect on performance—positive or negative, depending on management of their intake.

Water

Facts:

- Many players *begin* exercising while dehydrated.
- On-court sweat losses can be extensive—1 to 2.5 liters (~35-88 ounces) *per hour* is typical.
- *Any* water deficit can have a negative effect on a player's performance and well-being. The effects of a progressive water deficit due to inadequate fluid intake and/or excessive sweat losses include the following:

    - Increased cardiovascular strain—your heart has to work harder.
    - Decreased capacity for temperature regulation—you heat up more.
    - Decreased strength, endurance, and mental capacity—your intensity is lower, you tend to lose control, and you make inappropriate shot selections.
    - Increased rate of carbohydrate metabolism—you fatigue faster.
- Many players do not adequately *rehydrate* after play.

What you can do:

- Drink plenty of fluids (water, juice, milk, sport drinks) throughout the day.
- Don't forget to drink regularly during all practice and warm-up sessions.
- Drink another 12 to 16 ounces about one hour before you play.
- Drink at each changeover—typically, older adolescents and adults can comfortably drink up to 48 ounces or so per hour. This rate of fluid intake can prevent large fluid deficits from developing for most players.
- After play, drink about 150 percent of any fluid deficit that still remains. For example, if your weight is down 1 pound at the end of play, you will need to drink another 24 ounces.

Electrolytes

Facts:

- Players lose far more sodium and chloride (salt) from sweating than any other electrolyte.
- Sodium and chloride losses are greater with higher sweating rates.
- Players who are accustomed (acclimatized) to the heat tend to lose less sodium and chloride than players who are not acclimatized to the heat.
- Sodium deficits can lead to incomplete rehydration and muscle cramps.
- If players don't replace the salt they lose, they can't completely rehydrate.
- Excessive water consumption, combined with a large sweat-induced sodium deficit, can lead to severe hyponatremia (low blood sodium)—a very dangerous situation. Even mild hyponatremia can cause fatigue, apathy, nausea, or a headache.

What you can do:

- When you play in a hot environment (or any time you sweat a lot), add some salt to your diet, or eat certain high-salt foods, before and after you play. Salt contains 590 milligrams of sodium per 1/4 teaspoon (or 1.5 grams). Good food sources of sodium and chloride include:
  - salted pretzels,
  - many types of soups,
  - cheese,
  - salted sport drinks (or Pedialyte),
  - tomato sauce (pizza!), and
  - tomato juice.

Carbohydrates

Facts:

- Adequate carbohydrate intake is crucial to optimal tennis performance.
- Consuming carbohydrates before and after exercise can help restore some of your body water reserves.
- Playing tennis in the heat causes the body to use carbohydrates fast. So, even if you eat well before playing, after 60 to 90 minutes of intense singles play you'll probably need some supplemental carbohydrate to continue playing your best.
- Ingesting too many carbohydrates or too much of an inappropriate carbohydrate (e.g., fructose) can delay carbohydrate and fluid absorption and may cause gastrointestinal distress.

What you can do:

- Generally, 7 to 10 grams of carbohydrate per kilogram of body weight (~500 to 700 grams per day for a 155-pound player) is recommended for periods of intense training or competition.
- During exercise, 30 to 60 grams of carbohydrate per hour is most effective. Choose a sport drink whose *primary* carbohydrate is sucrose, glucose, or a glucose polymer (e.g., maltodextrin).

Adequate and well-timed water, electrolyte, and carbohydrate intake should be a priority for any athlete expecting to play well and safely. Yet athletes often overlook or underestimate the importance of these nutrients.

Adapted from Keeping Your Players Hydrated: What Are the Key Points? By Michael Bergeron, MD. From *High-Performance Coaching*, the USTA newsletter for tennis coaches, vol. 2, no. 2/2000. Used with permission of the USA Tennis Coaching Education Department.

Playing Hot:

Heat Illness in Sport

Playing Hot: Heat Illness in Sports
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Section One

OVERVIEW AND GOALS

Overview

This video and curriculum offer an introduction to preventing heat illness in youngsters while they participate in sport and physical activities. These materials emphasize the importance of proper hydration during physical activity, as well as alert you to the dangers that affect athletes when playing all types of sports in all kinds of weather.

Sponsored by an educational and research grant from Carl Lindner Sr., this video features an interview with Craig Lindner Jr., a collegiate tennis player who was in a coma after succumbing to heatstroke.

When the simple guidelines from this video are implemented, your athletes and students can play safely and perform at their best—in all kinds of weather.

The CD-ROM is divided into six sections. Section one contains an overview of the package. Section two instructs you, the coach or teacher, on using the package. Section three presents the key points on the videotape. Section four consists of handouts that can be photocopied and distributed to athletes and students. Section five provides further information for you to read and review before the start of the session. Section six is a resource section that includes citations of books, articles, Web sites, and other related information. These references are included to help you understand the information and important issues that are presented in the *Playing Hot* video so that you are prepared to answer questions and manage your athletes during competitions and practices in the heat.

Goals

The video and CD-ROM have two main goals:

1. To familiarize athletic directors, coaches, and physical education teachers with the research concerning proper hydration and sport participation.
2. To provide simple and clear information about proper hydration to athletes and students.

Section Two

HOW TO CONDUCT A SHORT SESSION WITH VIDEO, ACTIVITIES, AND DISCUSSION

The *Playing Hot* package was developed so that it can be used to educate athletes and students about heat-related illness during sport participation. The package can be used as a practice session before play or in a physical education health classroom.

The Resources

The *Playing Hot* package consists of an 18-minute videotape and a CD-ROM. The videotape is meant to raise awareness of heat-related illnesses that often (though not exclusively) occur in hot and humid environments. You should view the video and read the summary and handouts before showing them to students. These will provide additional facts to answer questions that arise during the class or practice session.

Options for Using the Resources

The video and accompanying handouts are *primarily* geared toward training and competing outdoors in the heat. However, most of the information presented is appropriate and useful for athletes training and competing indoors as well.

1. Have your athletes sit comfortably in a quiet area.
2. Give the short quiz orally. Your athletes can respond immediately to each question or write down the true-false answers so that all the responses can be discussed at once. Do not be particularly concerned about correct answers. The intent is to set the tone for discussion and to spark interest in watching the video. Briefly answer each question and indicate to your athletes that the video will discuss each of these points.
3. Show the video.
4. Review the key points of the video (some or all of the key points from the video summary) and answer questions.
5. Distribute and discuss the Fluid Pyramid and the Heat Index Chart, which are included in the handouts.

6. Ask your athletes to provide five tips that they can follow to prevent heat illness and optimize performance in the heat.
7. On another occasion, conduct the Body Weight, Fluid Intake, and Sweat Loss Activity (handout and directions included) with all or a selected group of your athletes.

Section Three

PLAYING HOT—KEY POINTS

Exercising in a hot environment is a challenge for any athlete. The video highlights some of the major concerns about training and competing in the heat. By watching this video and doing the activities, your athletes can reduce their risk of heat illness and increase their potential for optimal performance.

- Hot weather affects all athletes. A hot environment can make you feel uncomfortable and keep you from playing your best, and it can also be a serious threat to your health and well-being. Hot temperature combined with high humidity can increase the risk of heat illness.
- Exercise releases heat in your body, which causes your body temperature to rise. In a hot environment, this rise in core body temperature can be dramatic—especially with long-duration, high-intensity exercise.
- As core body temperature rises, performance tends to decrease due to physiological changes that reduce your capacity and desire to continue.
- Sweating is the body's primary way to get rid of heat during exercise. However, if you exercise when both the temperature and humidity are high, sweating is not very effective in removing heat. Heat and humidity combine to make the environment feel more stressful to the body and increase the risk for heat illness.
- Hydration (fluid intake and balance) is the *primary* concern for all athletes during exercise in the heat.
- Fluid losses via sweating can be extensive—1 to 2.5 liters *per hour* is common in many athletes. Some athletes sweat even more!
- Sweating can lead to significant dehydration if an athlete does not compensate by drinking enough. Dehydration leads to poorer performance and an increased risk for heat illness (heat cramps, heat exhaustion, or heat stroke).
- It is difficult—at times impossible—to match fluid intake with extensive sweating rates. Athletes should be well hydrated as they begin exercising and they should drink as much and as often as they can and are comfortable with during exercise, *especially* if they expect to sweat a lot.
- Extensive sweat loss can occur indoors as well.
- Electrolytes are also lost from sweating—primarily sodium and chloride, which together form salt.

- Sodium losses can be extensive—from 100 to more than 2,000 milligrams per liter of sweat. Some athletes with high sweating rates have been known to lose up to 5,000 milligrams of sodium each hour! Chloride losses are generally slightly less than sodium losses.
- A sodium deficit can make it difficult to rehydrate completely and may lead to heat cramps. Heat cramps can occur even when an athlete drinks a lot of water.
- Athletes who generally have high sodium and chloride losses through sweat may have to supplement their diet with salt or salty foods during competitions or while training in the heat. Tomato juice, pretzels, and salted sport drinks are some foods that can help prevent a severe progressive sodium deficit.
- Weighing yourself before and after exercise is a good way to determine your postexercise fluid deficit.
- To completely rehydrate, you need to drink about 150 percent of your postexercise fluid deficit. For example, if you weigh 1 pound less at the end of exercise, you need to drink 1.5 pounds or 24 ounces of fluid.
- You should drink fluids regularly throughout the day. These fluids can include water, milk, juice, and sport drinks. Too much caffeine can cause excessive urination and may cause dehydration before competition. Alcohol is not a good choice either.
- Drink fluids during exercise even if you don't feel thirsty. Thirst is not a good indicator of hydration status. If you feel thirsty while exercising, then you're probably already dehydrated.
- Sport drinks can be better than water alone, because they provide fluid, electrolytes (e.g., sodium and chloride), and carbohydrates.
- Immediately after exercise, it is important to replace water, carbohydrates, and salt before competing or exercising again.
- Adjusting (acclimatizing) to the heat helps an athlete tolerate excessive heat and can help to reduce the risk of heat injury.

Playing Hot Quiz Questions

All questions can be answered “true” or “false”

1. It’s a good idea to drink as much water as possible immediately after a long game or exercise session in the heat, especially if you have to play again soon (i.e., one to several hours later).

2. Eating a banana or an orange is an effective way to prevent or resolve muscle cramping.

3. If you eat well before you compete, water is all you will need to consume during a long match, game, or run.

4. It’s better to sweat less during exercise in the heat.

5. The video *Playing Hot* will give you a lot of important information that will help you compete safely and closer to your best in the heat.

Playing Hot Quiz Questions and Answers

Quiz for your athletes to begin the video, activities, and discussion session. (All questions can be answered "true" or "false.")

1. It's a good idea to drink as much water as possible immediately after a long game or exercise session in the heat, especially if you have to play again soon (i.e., one to several hours later).

   Answer: **False.** Drinking water after competition is, of course, very helpful and necessary. But, you can drink too much water too fast! This can lead to feeling sick or possibly having very severe problems. Rehydrating after sweating a lot is important; however, it is also important to replace other nutrients such as electrolytes (primarily sodium and chloride) and carbohydrates.

2. Eating a banana or an orange is an effective way to prevent or resolve muscle cramping.

   Answer: **False.** Muscle cramping during competition in the heat, when you have been sweating considerably, is often due to the excessive loss of water and salt (sodium and chloride—not potassium) from sweating. Athletes who sweat a lot and are prone to cramping in the heat may benefit from increasing their salt intake before and after competition, when sweat losses are expected to be high.

3. If you eat well before you compete, water is all you will need to consume during a long match, game, or run.

   Answer: **False.** During any activity that lasts more than an hour, if the intensity is high enough, you will probably need to ingest some carbohydrates (e.g., sport drinks or certain snacks) to maintain your best performance. Even if you ate well earlier, this rule holds true—especially in the heat. Some athletes may need to consume some salt as well.

4. It's better to sweat less during exercise in the heat.

   Answer: **False.** Although sweating extensively causes you to lose a lot of water, which can hurt your performance and increase your risk for heat illness, sweating is a good thing! Sweating cools your body. Sweating is a very high priority during exercise in the heat—for your safety and performance. The important thing is that if you tend to sweat a lot, make sure that you are well hydrated when you begin exercise and that you drink enough as often as you can during your activity.

5. The video *Playing Hot* will give you a lot of important information that will help you compete safely and closer to your best in the heat.

   True! *Enjoy the video!*

Fluid Pyramid

Use this handy chart to learn how much water you should be drinking daily, and during exercise.

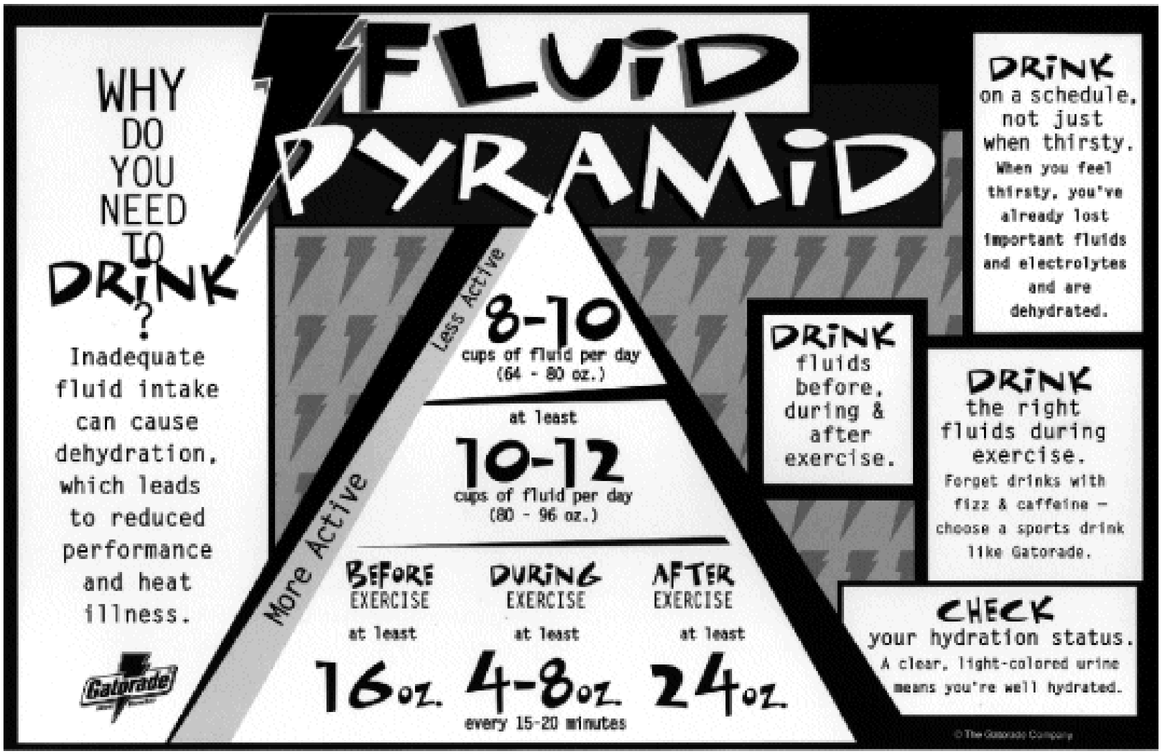

Figure 1 Fluid Pyramid.
From "Fluids 2000: Dehydration and Heat Illness." © 2000 Gatorade Sport Science Institute. Reprinted with permission. Visit the GSSI Web page at www.gssiweb.com

Heat Index Chart

This Heat Index Chart provides general guidelines for assessing the potential severity of heat stress. Individual reactions to heat will vary. Remember that heat illness can occur at lower temperatures than indicated on the chart. In addition, studies indicate that susceptibility to heat illness tends to increase with age.

How to Use the Heat Index Chart

1. Across the top of the chart, locate the environmental temperature (i.e., the air temperature).
2. Down the left side of the chart, locate the relative humidity.
3. Follow across and down to find the apparent temperature. Apparent temperature is the combined index of heat and humidity. It is the body's sensation of heat (the opposite of the wind chill factor).

Table 1 Heat Index

Relative Humidity	ENVIRONMENTAL TEMPERATURE (° F) 70°	75°	80°	85°	90°	95°	100°	105°	110°	115°	120°
	Apparent Temperature*										
0%	64°	69°	73°	78°	83°	87°	91°	95°	99°	103°	107°
10%	65°	70°	75°	80°	85°	90°	95°	100°	105°	111°	116°
20%	66°	72°	77°	82°	87°	93°	99°	105°	112°	120°	130°
30%	67°	73°	78°	84°	90°	96°	104°	113°	123°	135°	148°
40%	68°	74°	79°	86°	93°	101°	110°	123°	137°	151°	
50%	69°	75°	81°	88°	96°	107°	120°	135°	150°		
60%	70°	76°	82°	90°	100°	114°	132°	149°			
70%	70°	77°	85°	93°	106°	124°	144°				
80%	71°	78°	86°	97°	113°	136°					
90%	71°	79°	88°	102°	122°						
100%	72°	80°	91°	108°							

* Combined index of heat and humidity: what it feels like to the body. Source: National Oceanic and Atmospheric Administration.

Note: Exposure to full sunshine can increase heat index values by up to 15° F.

Table 2 Heat Stress Risk

Apparent Temperature	Heat Stress Risk With Physical Activity and/or Prolonged Exposure
90° - 105°	Heat cramps or heat exhaustion possible
105° - 130°	Heat cramps or heat exhaustion likely; heatstroke possible
130° and up	Heatstroke highly likely

From “Fluids 2000: Dehydration and Heat Illness.” © 2000 Gatorade Sports Science Institute. Reprinted with permission. Featured on Gatorade Sports Science Institute (GSSI) Web site (www.gssiweb.com).

Note: This Heat Index Chart is designed to provide general guidelines for assessing the potential severity of heat stress. Individual reactions to heat will vary. Remember that heat illness can occur at lower temperatures than indicated on the chart. In addition, studies indicate that susceptibility to heat disorders tends to increase with age.

Heat-Related Disorders

Exposure to the combination of external heat stress and the inability to dissipate metabolically generated heat can lead to three heat-related disorders (see figure 2):

- Heat cramps
- Heat exhaustion
- Heat stroke

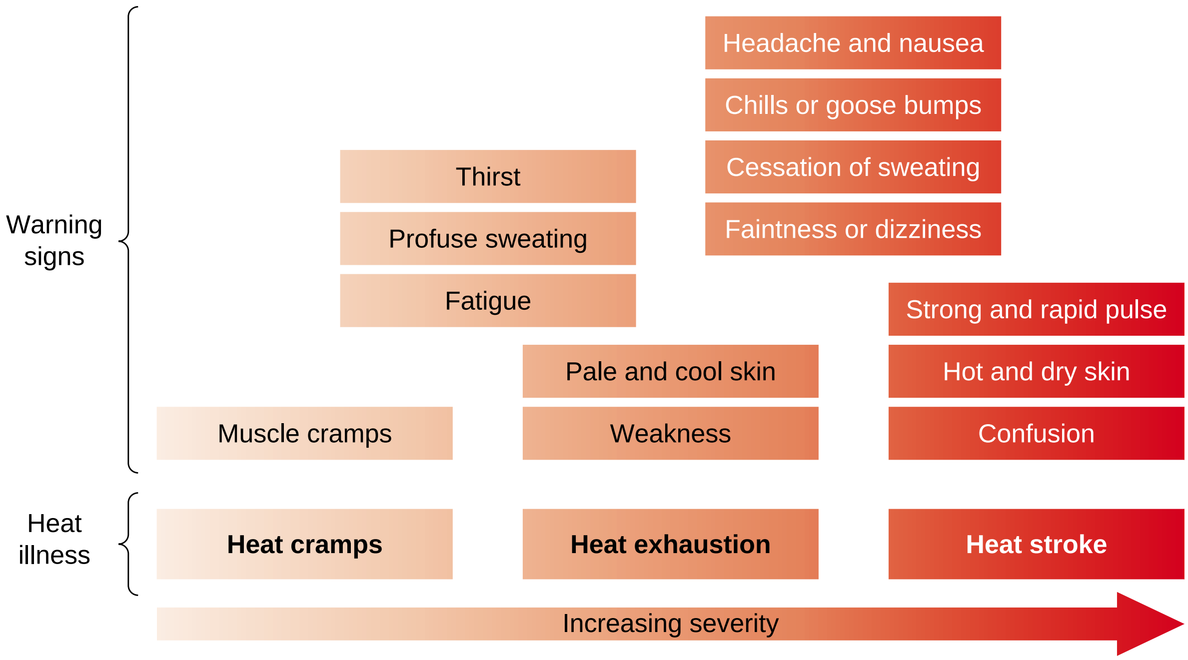

Figure 2 The warning signs of heat cramps, heat exhaustion, and heat stroke. ©PepsiCo 1995. Reprinted with permission.

Heat Cramps

Heat cramps, the least serious of the three heat disorders, is characterized by severe cramping of the skeletal muscles. It involves primarily the muscles that are most heavily used during exercise. This disorder is probably brought on by the mineral losses and dehydration that accompany high rates of sweating, but a cause-and-effect relationship has not been fully established. Heat cramps are treated by moving the stricken individual to a cooler location and administering fluids or a saline solution.

Heat Exhaustion

Heat exhaustion is typically accompanied by such symptoms as extreme fatigue, breathlessness, dizziness, vomiting, fainting, cold and clammy or hot and dry skin, hypotention (low blood pressure), and a weak, rapid pulse. It is caused by the cardiovascular system's inability to adequately meet the body's needs. Recall that during exercise in heat, your active muscles and your skin, through which excess heat is lost, compete for a share of your total blood volume. Heat exhaustion results when these simultaneous demands are not met. Heat exhaustion typically occurs when your blood volume decreases, by either excessive fluid loss or mineral loss from sweating.

With heat exhaustion, the thermoregulatory mechanisms are functioning but cannot dissipate heat quickly enough because there is insufficient blood volume to allow adequate distribution to the skin. Although the condition often occurs during mild to moderate exercise in the heat, it is not generally accompanied by a high rectal temperature. Some people who collapse from heat stress exhibit symptoms of heat exhaustion but have internal temperatures below 39 °C (102.2 °F). People who are poorly conditioned or unacclimatized to the heat are more susceptible to heat exhaustion.

Treatment for victims of heat exhaustion involves rest in a cooler environment with their feet elevated to avoid shock. If the person is conscious, administration of salt water is usually recommended. If the person is unconscious, medically supervised intravenous administration of saline solution is recommended. If allowed to progress, heat exhaustion can deteriorate to heat stroke.

Heat Stroke

Heat stroke is a life-threatening heat disorder that requires immediate medical attention. It is characterized by

- a rise in internal body temperature to a value exceeding 40 °C (104 °F),
- cessation of sweating,
- hot and dry skin,
- rapid pulse and respiration,
- usually hypertension (high blood pressure),
- confusion, and
- unconsciousness.

If left untreated, heat stroke progresses to coma, and death quickly follows. Treatment involves rapidly cooling the person's body in a bath of cold water or ice or wrapping the body in wet sheet and fanning the victim.

Heat stroke is caused by failure of the body's thermoregulatory mechanisms. Body heat production during exercise depend on exercise intensity and body weight, so heavier athletes run a higher risk of overheating than lighter athletes when exercising at the same rate and when both are about equally acclimatized to the heat.

For the athlete, heat stroke is a problem associated not only with extreme conditions. Studies have reported rectal temperatures above 40.5 ˚C (104.9 ˚F) in marathon runners who successfully completed race conducted under relatively moderate thermal conditions (e.g., 21.1 ˚C [70 ˚F] and 30% relative humidity). Even in shorter events, the body's core temperature can reach lift-threatening levels. As early as 1949, Robinson observed rectal temperatures of 41 ˚C (105.8 ˚F) in runners competing in events lasting only about 14 minutes, such as the 5-km race. Following a 10-km race conducted with an air temperature of 29.5 ˚C (85.1 ˚F), 80% relative humidity, and bright sun, one runner who collapsed had a rectal temperature of 43 ˚C (109.4 ˚F)! Without proper medical attention, such fevers can result in permanent central nervous system damage or death. Fortunately, this runner was rapidly cooled with ice and recovered without complication.

When exercising in the heat, if you suddenly feel chilled and goose bumps form on your skin, stop exercising, get into a cool environment, and drink plenty of cool fluids. The body's thermoregulatory system has become confused and think that the body temperature needs to be increased even more! Left untreated, this condition can lead to heat stroke and death.

Prevention of Hyperthermia

We can do little about environmental conditions. Thus, in threatening conditions, athletes must decrease their effort in order to reduce their heat production and their risk of developing hyperthermia (high body temperature). All athletes, coaches, and sports organizers should be able to recognize the symptoms of hyperthermia. Fortunately, our subjective sensations are well correlated with our body temperatures, as indicated on table 2 below. Although there is generally little concern when rectal temperature remains below 40 ˚C (104 ˚F) during prolonged exercise, athletes who experience throbbing pressure in their heads and chills should realize that they are rapidly approaching a dangerous situation that could prove fatal if they continue to exercise.

Subjective Symptoms Associated with Overheating

Rectal Temperature	Symptoms
40 ˚C – 40.5 ˚C (104 ˚F – 105 ˚F)	Cold sensation over stomach and back, with piloerection (goose bumps)
40.5 ˚C – 41.1 ˚C (105 ˚F – 106 ˚F)	Muscular weakness, disorientation, and loss of postural equilibrium
41.1 ˚C – 41.7 ˚C (106 ˚F – 107 ˚F)	Diminished sweating, loss of consciousness and hypothalamic control
≥42.2 ˚C (≥108 ˚F)	Death

To prevent heat disorders, several precautions should be taken. Competition and practice should not be held outdoors when the WBGT (see page 59) is over 28 ˚C (82.4 ˚F). As mentioned earlier, because WBGT reflects the humidity as well as the absolute temperature, it reflects the true physiological heat stress more accurately than does standard air temperature. Scheduling practices and contest either in the early morning or at night avoids the severe heat stress of midday. Fluids should be readily available, and athletes should be required to drink as much as they can, stopping every 10 to 20 minutes for a fluid break in warm temperatures.

Clothing is another important consideration. Obviously, the more clothing that is worn, the less body area exposed to the environment to allow heat exchange. The foolish practice of exercising in a rubberized suit to promote weight loss is an excellent illustration of how a dangerous microenvironment (the isolated environment inside the suit) can be created in which temperature and humidity can reach a sufficiently high level to block all heat loss from the body. This can rapidly lead to heat exhaustion or heat stroke. Football uniforms are another example. Areas that are covered by sweat-soaked clothing and padding are exposed to 100% humidity and higher temperatures, reducing the gradient between body surface and the environment.

Athletes should wear as little clothing as possible, when heat stress is a potential limitation to thermoregulation. The athlete should always underdress because the metabolic heat load will soon make extra clothing an unnecessary burden. When clothing is needed or required, it should be loosely woven to allow the skin to unload as much heat as possible and light colored to reflect heat back to the environment.

The American College of Sports Medicine (ACSM) has provided guidelines to help distance runners prevent heat-related injuries. A modified list of these recommendations appears in table 3 below.

Table 3 Guidelines for Distance Runners Competing Under Conditions of Heat Stress

1. Distance races should be scheduled to avoid extremely hot and humid conditions. If the WBGT index is above 28 ˚C (82 ˚F), canceling the race should be considered.
2. Summer events should be scheduled in the early morning or evening to minimize solar radiation and unusually high air temperature.
3. An adequate supply of fluid must be available before the start of the race, along the racecourse, and at the end of the event. Runners should be encouraged to replace their sweat losses or consume 150 to 300 ml (5.3 – 10.5 oz) every 15 minutes during the race.
4. Cool or cold (ice) water immersion is the most effective means of cooling a collapsed hyperthermic runner.

(continued)

Guidelines for Distance Runners
Competing Under Conditions of Heat Stress, *continued*

5. Runners should be aware of the early symptoms of hyperthermia, including
   - dizziness,
   - chilling,
   - headache or throbbing pressure in the temporal region, and
   - loss of coordination.
6. Race officials should be aware of the warning signs of an impending collapse in hot environments and should warn runners to slow down or stop if they appear to be in difficulty.
7. Organization personnel should reserve the right to stop runners who exhibit clear signs of heat stroke or heat exhaustion.

Note: These recommendations are based on the position stands published by the American College of Sports Medicine in 1987 and 1995.

Adapted, with permission, from *Physiology of Sport and Exercise,* pp. 326–328. © 1994, 1999 by Jack H. Wilmore and David L. Costill.

Keeping Your Players Hydrated

You may think that you've heard enough about the importance of drinking plenty of fluids and the benefits of staying well hydrated. After all, your players seem to drink a lot of water during exercise and most tend to avoid severe problems such as cramping or overheating. Yet many well-trained and informed tennis players continue to have hydration problems. The symptoms of inadequate or inappropriate hydration management range from simply feeling a little "off" and not quite playing at one's best to suffering painful heat cramps or heat exhaustion. These symptoms are commonly observed at many tennis tournaments, especially when it's hot.

The three primary nutritional factors related to keeping your players hydrated are **water**, **electrolytes**, and **carbohydrates**. These are also the nutrients that have the most immediate effect on performance—positive or negative, depending on management of their intake.

Water

Facts:

- Many players *begin* exercising while dehydrated.
- On-court sweat losses can be extensive—1 to 2.5 liters (~35-88 ounces) *per hour* is typical.
- *Any* water deficit can have a negative effect on a player's performance and well-being. The effects of a progressive water deficit due to inadequate fluid intake and/or excessive sweat losses include the following:

    - Increased cardiovascular strain—your heart has to work harder.
    - Decreased capacity for temperature regulation—you heat up more.
    - Decreased strength, endurance, and mental capacity—your intensity is lower, you tend to lose control, and you make inappropriate shot selections.
    - Increased rate of carbohydrate metabolism—you fatigue faster.
- Many players do not adequately *rehydrate* after play.

What you can do:

- Drink plenty of fluids (water, juice, milk, sport drinks) throughout the day.
- Don't forget to drink regularly during all practice and warm-up sessions.
- Drink another 12 to 16 ounces about one hour before you play.
- Drink at each changeover—typically, older adolescents and adults can comfortably drink up to 48 ounces or so per hour. This rate of fluid intake can prevent large fluid deficits from developing for most players.
- After play, drink about 150 percent of any fluid deficit that still remains. For example, if your weight is down 1 pound at the end of play, you will need to drink another 24 ounces.

Electrolytes

Facts:

- Players lose far more sodium and chloride (salt) from sweating than any other electrolyte.
- Sodium and chloride losses are greater with higher sweating rates.
- Players who are accustomed (acclimatized) to the heat tend to lose less sodium and chloride than players who are not acclimatized to the heat.
- Sodium deficits can lead to incomplete rehydration and muscle cramps.
- If players don't replace the salt they lose, they can't completely rehydrate.
- Excessive water consumption, combined with a large sweat-induced sodium deficit, can lead to severe hyponatremia (low blood sodium)—a very dangerous situation. Even mild hyponatremia can cause fatigue, apathy, nausea, or a headache.

What you can do:

- When you play in a hot environment (or any time you sweat a lot), add some salt to your diet, or eat certain high-salt foods, before and after you play. Salt contains 590 milligrams of sodium per 1/4 teaspoon (or 1.5 grams). Good food sources of sodium and chloride include:
  - salted pretzels,
  - many types of soups,
  - cheese,
  - salted sport drinks (or Pedialyte),
  - tomato sauce (pizza!), and
  - tomato juice.

Carbohydrates

Facts:

- Adequate carbohydrate intake is crucial to optimal tennis performance.
- Consuming carbohydrates before and after exercise can help restore some of your body water reserves.
- Playing tennis in the heat causes the body to use carbohydrates fast. So, even if you eat well before playing, after 60 to 90 minutes of intense singles play you'll probably need some supplemental carbohydrate to continue playing your best.
- Ingesting too many carbohydrates or too much of an inappropriate carbohydrate (e.g., fructose) can delay carbohydrate and fluid absorption and may cause gastrointestinal distress.

What you can do:

- Generally, 7 to 10 grams of carbohydrate per kilogram of body weight (~500 to 700 grams per day for a 155-pound player) is recommended for periods of intense training or competition.
- During exercise, 30 to 60 grams of carbohydrate per hour is most effective. Choose a sport drink whose *primary* carbohydrate is sucrose, glucose, or a glucose polymer (e.g., maltodextrin).

Adequate and well-timed water, electrolyte, and carbohydrate intake should be a priority for any athlete expecting to play well and safely. Yet athletes often overlook or underestimate the importance of these nutrients.

Adapted from Keeping Your Players Hydrated: What Are the Key Points? By Michael Bergeron, MD. From *High-Performance Coaching*, the USTA newsletter for tennis coaches, vol. 2, no. 2/2000. Used with permission of the USA Tennis Coaching Education Department.

Body Weight, Fluid Intake, and Sweat Loss Activity

The following calculations will help you find out how much fluid you lose during a training session or competition. By doing this activity, you will be able to find out how well you managed fluid intake during exercise. Your coach will help you fill in the blanks and interpret the results. You will need an accurate scale to do this activity.

Body Weight (BW)

Pre BW: ____________________ pounds

Post BW: ____________________ pounds

Total BW change (post BW – pre BW = total BW change):
____________________ pounds

% BW deficit (total BW change ÷ pre BW x 100):
____________________ percent

The change in body weight is calculated from the preplay and postplay body weight measurements. (It's best to weigh yourself both times in the same *dry* clothes, such as shorts and a T-shirt.) Any loss in body weight must be compensated for by your cardiovascular system. Notably, a decrease in body weight of even just 1 percent can have a dramatic negative effect on performance, especially in the heat.

If you weighed less at the end of play (post BW) than you did at the beginning of play (pre BW), this means that the change in body weight (total BW change) was *negative* and you had a body weight *deficit.* It also means that you did not drink enough during exercise. To find out how much more you should have drunk to avoid losing any weight, do the following:

Multiply the number of pounds lost times 16 ounces. That will give you the number of *additional* ounces that you should have drunk to avoid losing weight during exercise.

For example, with a total BW change of –1.7 pounds, 1.7 x 16 = 27.2 ounces (drop the negative sign).

In this case, you should have drunk 27.2 *more* ounces of water to avoid losing any body weight during exercise.

If you weighed the same or gained weight by the end of play (meaning post BW is greater than pre BW), the total BW change will be *0* or *positive* and you will *not* have a body weight deficit. This means that you drank as much as or more than you sweated.

Fluid Intake

Preplay water container(s) weight (WCW):

____________________ pounds

Postplay WCW:

____________________ pounds

Total WCW change (post WCW – pre WCW):

____________________ pounds

Total fluid consumed:

____________________ ounces

This difference shows how much you drank. First you calculate the amount you drank in pounds by using the scale to weigh your water container(s) before and after play. To convert pounds to ounces, simply multiply the total WCW change by 16 ounces. (You can avoid this calculation if you know exactly how many ounces you drank.)

For example, with a WCW change of –1.0 pounds, 1.0 x 16 = 16 ounces (eliminate the negative sign). In this case, you drank 16 ounces during play.

Sweat Loss

A. Total BW change (post BW – pre BW = total BW change):

____________________ pounds

B. Convert to ounces (total BW change x 16):

____________________ ounces

C. Total fluid consumed:

____________________ ounces (from fluid intake calculation above)

If the result in “B” is *negative*, then take away the negative sign and add the amount of total BW change (in ounces) to the total fluid consumed (in ounces).

Total sweat loss (in ounces) = B + C (______________ + _____________)

If the result in “B” is *positive*, then subtract the amount of total BW change from the total fluid consumed.

Total sweat loss (in ounces) = C– B (______________ – _____________)

If the result in “B” equals zero, then your total sweat loss equals your total fluid consumed—great job!

Section Five
ARTICLES

Hydration and Physical Activity: Scientific Concepts and Practical Applications

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Introduction

Generally, research that is conducted under controlled laboratory conditions does not have an immediate impact on sports practitioners-coaches, trainers, athletes, etc., who rightly feel that the non-controlled, spontaneous, and somewhat unpredictable aspect of sport warrants field testing under less-controlled conditions. Of course, the most complete answer to a problem can be developed when the theoretical tenets of basic science can be melded with the more practical aspects of applied science.

The issue of hydration and physical performance has been studied for many years by both basic and applied scientists. In this issue of the GSSI Roundtable, we discuss a number of topics pertaining to dehydration and exercise with Gary Mack, Ph.D., a basic scientist, and Michael Bergeron, Ph.D., who has focused much of his research on the effects of dehydration in tennis players. Their responses to our questions follows.

What type of studies have you conducted regarding the effects of dehydration on physical performance?

Mack: Our studies have focused on two aspects of dehydration. First, we have examined the detrimental influence of dehydration on the body's ability to dissipate heat during a thermal load. These studies have focused on identifying the physiological mechanism by which hypovolemia and hyperosmolality, produced during dehydration, impose limitations in heat transfer from the body core to the skin, and a reduction in heat loss from the skin to the environment. Our studies have also characterized baroreflex modulation of skin blood flow and sweating in response to alterations in central blood volume, and the inhibition of thermal sweating by increases in plasma osmolality. Second, we have examined the phenomenon referred to as "involuntary dehydration." In these studies we have examined the mechanisms that contribute to a delay in complete restitution of body fluids following a reduction in total body water. Our efforts have been directed to understanding the factors that contribute to this phenomenon so that we can improve rehydration practices.

Bergeron: Most of my recent studies have been more applied in nature. Our work has been directed toward examining fluid balance in tennis. Many of the tennis players that I have worked with have experienced significant performance decrements when they haven't managed fluid balance well, and more than a few have suffered problems such as heat cramps and heat exhaustion during competition. However, with a sport such as tennis it is somewhat difficult to identify reliable and measurable outcome-related performance variables. Thus, much of my work in this area has been descriptive in nature, in an attempt to determine the extent and rate of fluid loss that players routinely encounter during competition. As a next step, we are developing projects to examine the effects of dehydration on a variety of tennis-specific psychomotor skills.

Dr. Mack, what are the physiological consequences of dehydration on one's ability to perform physical activity?

Mack: Fluid deficits imposed voluntarily (i.e., by fluid restriction) or by previous thermal and/or exercise stress will impair subsequent work performance. Water losses due to sweating can often exceed 30 g/min. (1.8 kg/h). The consequences of a progressive loss of body water are a decrease in blood volume (hypovolemia) and an increase in the concentration of electrolytes in the body fluids (hypertonicity). Both of these conditions can impair the body's ability to dissipate heat generated during exercise. The greater level of dehydration, the greater the degree of impairment.

Numerous studies have clearly demonstrated that cardiovascular strain is greater and body core temperature rises faster when a person exercises in a dehydrated condition, regardless of the environmental conditions. Of course, the decrement in performance is exaggerated when exercise is performed in a hot environment. Furthermore, the combined effects of dehydration and exercise in the heat can lead to heat-related disorders ranging from simple heat cramps to life-threatening heat stroke.

Dr. Bergeron, you have focused the majority of your research on tennis players. What is the profile of the athletes who have served as subjects in your studies?

Bergeron: Most of the players I have worked with were regionally or nationally ranked juniors, Division I collegiate players, or touring professionals. As a result of their regular training and competition schedules, which typically includes at least 2-3 hours a day on the court, these athletes generally have a high degree of cardiorespiratory fitness, a relatively low amount of body fat, and a unique blend of on-court endurance, speed, agility, and power. They usually train and compete year-round, and often play tennis in places in which they have very little time to adequately acclimatize to new environmental conditions. Their matches generally last from less than one hour to sometimes more than four hours. During tournaments, these players often play multiple, long matches on successive days. Clearly, their schedules can be grueling.

What type of sweat and electrolyte losses have you documented in the players you have studied?

Bergeron: Most of the sweat losses that we have calculated were incurred during matches in fairly hot and humid conditions. The ambient temperature was generally 90°F (32°C) or more and the relative humidity was around 60%. In general, during singles play the boys and girls (12-16 yrs.) and young women (18-22 yrs.) had sweating rates of 0.7-1.4 liters per hour; young men (18-30 yrs.) sweated at a rate of 1.2 to 2.5 liters per hour. Although the highest sweat rates that I have measured in a male and female were 3.4 liters and 2.5 liters per hour, respectively.

In heat-acclimatized young adult tennis players the sweat concentration of sodium has generally been a little above 20 mmol per liter, and sweat potassium losses have approximated 5 mmol per liter. However, in heat-acclimatized boys, the sweat sodium loss tends to be somewhat higher (approximately 40 mmol per liter). Even with a high degree of mineral conservation the on-court hourly loss of sodium for many of these players can easily exceed 1 gram. As we have observed with some players, the combination of very high sweat rates (2.5-3.4 liters per hour) coupled with moderate sweat sodium concentrations (35 to just over 60 mmol/L) can yield rather impressive on-court sweat sodium losses of 2,000 to almost 5,000 mg. per hour of play. Considering that tennis players routinely play multiple or long matches on successive days during tournaments, it is not surprising that many tournament players often begin matches in a dehydrated and sodium-deficient condition.

Dr. Mack, are these values out of line with those that you see in a laboratory setting?

Mack: Answering this question is not as clear-cut as it may seem. Several factors influence whole body sweat rate and the determination of sweat electrolyte composition. First, sweating and sweat composition is not uniform over the entire body. Second, sweat composition is dependent on the local sweat rate. Finally, progressive dehydration associated with prolonged exercise in the heat may modify regional sweat rates and thereby sweat composition. Thus, determination of an average sweat composition during exercise performed in the laboratory or field is not a simple measurement.

In our laboratory we sample sweat from five different skin sites and then use an equation which incorporates factors that account for the regional differences in sweat rate and adjusts for the relative contribution of each region to the total surface area of the body. Using this technique we have determined the average electrolyte composition of sweat in active college aged students under standard exercise protocols. Whole-body sweat rates of ~0.8 L/hr. induced with mild (40% $\dot{V}O_2$ max.) cycle ergometry in the heat (36°C; 30% RH) produces sweat with an average sodium concentration of 68 mmol/L and a potassium concentration of 4.7 mmol/L. However, these values may vary considerably with a range of 30 to 110 mmol Na/L and 2.5 to 9.3 mmol K/L. During prolonged exercise (up to six hours) in the heat, when sweat rates are maintained by simultaneous fluid replacement, individuals may lose in excess of 5 g of sodium (the equivalent of 12.5 g of table salt). At higher sweat rates (1.4 L/hr.) induced by intense treadmill exercise (70% $\dot{V}O_2$ max) we have measured an average whole body sodium concentration of 74 mmol/L (range of 40 to 104 mmol/L). Lower values of sweat sodium concentration, such as those in the tennis players described by Dr. Bergeron, are a function of the athletes' high level of fitness and degree of heat acclimatization.

Dr. Mack, the importance of sodium for rehydration purposes has been outlined in numerous articles. However, is there a downside to giving a healthy athlete "carte blanche" access to sodium?

Mack: During recovery from dehydration, electrolyte replacement ensures complete restoration of the extracellular fluid and a more complete restitution of water balance. The normal range of daily U.S. intake of sodium chloride is 2-9 grams (35-156 mmol sodium), and potassium is 2-4 grams (50-100 mmol). Electrolyte losses in these ranges are generally replenished within 24 hours following exercise if adequate fluid is consumed. In the absence of meals, more complete rehydration can be accomplished with fluids containing sodium than with plain water. The ideal salt concentration in the ingested fluid has not been determined. However, a consensus report sponsored by the National Academy of Sciences recommends that the solution should provide approximately 20-30 mmols of sodium per liter, 2 to 5 mmols of potassium per liter, and chloride as the only anion.

I don't think there is a documented downside to ad libitum sodium intake in healthy adults. Sodium intake must vary in proportion to the deficit in total body sodium content. Normal healthy adults have several sophisticated regulatory systems that act to regulate sodium intake and retention. In healthy individuals, when all these mechanisms are working properly, sodium balance is achieved without the need to restrict sodium intake.

Dr. Bergeron, are there other nutritional issues besides hydration status that you see in the athletes you work with?

Bergeron: It's clear that any time there is extensive and repetitive sweating, there is potential for developing a sodium deficit. This condition is often exacerbated when a susceptible athlete limits his or her salt intake. We are now in the process of looking more closely at other potential mineral imbalances that might develop in athletes during long periods of extensive sweating.

A tennis player's blood glucose level and carbohydrate stores are also a concern. Therefore, we always stress a high-carbohydrate diet, and we encourage players to consume a carbohydrate-electrolyte drink during and after matches, particularly if they are going to play again soon.

I also find that the daily caloric intake of many athletes is often inadequate. Unfortunately, the high dietary bulk associated with a high-calorie, high-carbohydrate diet is unappealing to some athletes. In these cases, high-carbohydrate, high-calorie drinks or snacks can be beneficial.

Do you see any carryover from your studies to other groups of athletes? To the "average" person who trains and competes in the heat?

Bergeron: Many of the college athletes that I have worked with, including swimmers, basketball players, and soccer players, tend to function in a chronically dehydrated condition, as evidenced by their high urine specific gravities or their inability to urinate prior to practices or games. I don't think that the typical athlete or the average recreational exerciser appreciates the extent of fluid and electrolyte losses that readily and routinely occur during most forms of physical activity. Generally, athletes should be able to urinate before and after they train or compete. If they are unable to do so, they likely have not consumed enough fluid. For those people who lose considerable sodium from extensive sweating, consuming more sodium-rich foods or adding salt to foods and fluids may be appropriate.

Mack: As I stated earlier, our studies have demonstrated that complete restoration of the extracellular fluid compartment (and blood volume) cannot be attained without replacement of the lost sodium. Furthermore, during prolonged exercise, a combination of sodium loss and the ingestion of large quantities of fluids with little or no electrolytes can lead to low plasma sodium. In ultra-endurance events, hyponatremia (blood sodium concentrations of less than 130 mmol/L) has been observed at the end of competition and is associated with problems of disorientation, confusion and, in some cases, grand-mal seizures. To prevent the development of hyponatremia or related conditions, sufficient electrolytes should be provided in fluid replacement beverages. This would certainly constitute a practical application of our research.

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Fluid Replacement: The American College Of Sports Medicine Position Stand

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Key Points

1. Recent scientific research has underscored the physiological and performance benefits of remaining well hydrated before, during, and following physical activity.
2. Maintaining hydration takes a concerted effort on the part of the athlete to modify drinking behavior throughout the training day.
3. The amount of fluid voluntarily ingested during physical activity is affected by the palatability of the beverage, the composition of the beverage, and by ease of use. These factors must be considered when planning a fluid-replacement regimen for athletes.
4. The goal for fluid intake during exercise should be to fully replace sweat losses. The physiological and performance benefits of doing so are well documented.
5. Rapid and complete rehydration following exercise requires the ingestion of sodium chloride to replace that which was lost in sweat and the consumption of a volume of fluid that is greater than that which was lost as sweat.

Introduction

In a book titled *Physiology of Man in the Desert,* E.F. Adolph and associates expertly described the negative impact of dehydration upon physiological function, physical performance, and health (Adolph et al., 1947). Their exhaustive research demonstrated that preventing dehydration by regular ingestion of fluids was indispensable in ensuring the physical and mental well-being of their subjects. Unfortunately, more than two decades passed before the value of regular fluid replacement during physical activity was widely recognized and practiced in the athletic setting. During this time, dozens of athletes and military recruits died from hyperthermia complicated by dehydration (Baumann, 1995). Although athletes and others continue to fall prey to exertional heat stroke, the frequency of deaths has been drastically reduced over the years (Bauman, 1995), in large part because the necessity of adequate fluid replacement has become well recognized.

Although information on fluid intake during physical activity eventually found its way into textbooks, classrooms, and onto the practice field, most of these recommendations were fairly general in nature. For example, documents published by the American College of Sports Medicine (1987), the United States military (Marriott & Rosemont, 1991), and the National Institute of Occupational Safety and Health (1986) included information on fluid replacement from which some general guidelines could be drawn. In the case of the American College of Sports Medicine (ACSM), recommendations for fluid replacement were included in a position stand entitled The Prevention of Thermal Injuries During Distance Running (ACSM, 1987). The ACSM article emphasized the need for regular fluid intake during races of 10 km and longer, and encouraged runners to ingest 100–200 ml (3–6 oz) at every aid station. The public health value of this recommendation was significant because it helped assure that race organizers included fluid stations in their events and that participants were given the opportunity to drink. However, depending upon the speed of the runner, the distance between aid stations, and the volume of fluid ingested at each station, the resulting fluid intake could vary widely, replacing a very large or very small portion of sweat loss.

This uncertainty has been addressed in the most recent position stand published the American College of Sports Medicine. The ACSM position stand on Exercise and Fluid Replacement (ACSM, 1996) provides clear and practical guidelines regarding fluid, carbohydrate, and electrolyte replenishment for athletes. In preparing the recommendations, a panel of experts in fluid homeostasis and related fields completed a comprehensive review of the scientific literature, making certain that each practical recommendation was well substantiated by research. As a result, the ACSM position stand will benefit the lay and scientific communities for years to come.

The ACSM Recommendations

The ACSM position stand contains a summary of practical recommendations supported by four pages of scientific review complemented by 92 references. The document begins by stating that, "It is the position of the American College of Sports Medicine that adequate fluid replacement helps maintain hydration and, therefore, promotes the health, safety, and optimal physical performance of individuals participating in regular physical activity."

The purpose of this Sports Science Exchange is to further underscore the scientific and practical relevance of the ACSM recommendations so that coaches, athletic trainers, physicians, dietitians, and athletes gain an increased appreciation of the value of remaining well hydrated during physical activity. The recommendations found in the ACSM position stand are highlighted below and are supplemented with scientific and practical information related to their content.

Fluid Ingestion Before Exercise

"It is recommended that individuals consume a nutritionally balanced diet and drink adequate fluids during the 24-h period before an event, especially during the period that includes the meal prior to exercise, to promote proper hydration before exercise or competition."

The physiological and performance benefits of entering training and competition well hydrated and with large stores of muscle and liver glycogen are widely accepted from a scientific standpoint. In terms of fluid balance, it is clear that athletes who enter competition in a dehydrated state are at a competitive disadvantage (Sawka, 1992). For example, in a study by Armstrong et al. (1985), subjects performed a 5,000-meter (~ 19 min) and 10,000-meter (~ 40 min) run in either a normally hydrated or dehydrated condition. When dehydrated by ~2% of body weight (by a diuretic given prior to exercise), their running speeds decreased significantly (by 6%–7%) in both events. To make matters worse, exercise in the heat exacerbates the performance-impairing effects of dehydration (Sawka et al., 1984).

Getting athletes to actually modify their drinking behavior during the training day is arguably a much larger challenge than convincing them about the scientific value of doing so. Dr. Ron Maughan, a sports scientist at the University of Aberdeen and an adviser to the 1996 British Olympic Team, indicated that the British athletes had to be schooled in mealtime drinking behavior during their training camps in Tallahassee, Florida. Unaccustomed to the decorum of buffet-line eating at an American university, the British athletes politely took just one beverage as they passed through the line while their American counterparts loaded up with three or four drinks. The British athletes were losing an important opportunity to rehydrate after hot-weather training. With a little prodding and some reminders, they became more aggressive mealtime drinkers. (R.J. Maughan, personal communication).

"It is recommended that individuals drink about 500 ml (about 17 ounces) of fluid about 2 h before exercise to promote adequate hydration and allow time for excretion of excess ingested water."

Laboratory subjects who ingest fluid in the hour before exercise exhibit lower core temperatures and heart rates during exercise than when no fluid is ingested (Greenleaf & Castle, 1971; Moroff & Bass, 1965). These physiological responses are undoubtedly beneficial as they reduce the strain on the body and lower the perception of exertion at a given workload (Montain & Coyle, 1992). When athletes live and train in warm environments, the value of adequate fluid intake prior to exercise cannot be overemphasized. This is apparent in the results of a study conducted on soccer players in Puerto Rico (Rico-Sanz et al., 1996). The athletes were studied during two weeks of training. When the players were allowed to drink fluids throughout the day as they wished (average intake = 2.7 L/d), their total body water at the end of one week was about 1.1 L lower than when they were mandated to drink 4.6 L of fluid per day. In other words, voluntary fluid consumption was insufficient to meet the players' daily fluid requirements, causing them to enter training and competition already dehydrated.

From a practical standpoint, the frequency of urination and the color and volume of urine can be monitored as a means of helping athletes assess their hydration status. Infrequent urination with a darkly colored urine of relatively small volume can be an indication of dehydration, a signal that the athlete should continue drinking before beginning exercise. Monitoring urine output is a common recommendation in occupational settings such as the mining industry in which the workers are constantly exposed to conditions of high heat and humidity.

Fluid Ingestion During Exercise

"During exercise, athletes should start drinking early and at regular intervals in an attempt to consume fluids at a rate sufficient to replace all the water lost through sweating, or consume the maximal amount that can be tolerated."

This is perhaps the most-significant recommendation in the position stand because it clearly identifies that the ideal goal of fluid intake during exercise is to prevent any amount of dehydration, and yet it recognizes that an optimal intake may be difficult under some circumstances. The value of maintaining full hydration is well illustrated by the studies of Montain and Coyle (1992) and Walsh et al. (1994). These researchers demonstrated that cardiovascular, thermoregulatory, and performance responses are optimized by replacing at least 80% of sweat loss during exercise. Montain and Coyle showed that larger volumes of fluid intake during exercise were associated with greater cardiac output, greater skin blood flow, lower core temperature, and a reduced rating of perceived exertion. The data of Walsh et al. reaffirmed that even low amounts of dehydration (1.8% of body weight, in this case) can impair exercise performance.

The dramatic impairment in physiological and performance response that occurs with dehydration is more easily understood when the limitations of the cardiovascular system are considered. In his text on Human Circulation: Regulation During Physical Stress, cardiovascular physiologist L.B. Rowell wrote that, "Perhaps the greatest stress ever imposed on the human cardiovascular system (except for severe hemorrhage) is the combination of exercise and hyperthermia. Together these stresses can present life-threatening challenges, especially in highly motivated athletes who drive themselves to extremes in hot environments. A long history of heat fatalities gives stark testimony to the gravity of the problem and the failure of various organizations to recognize and deal with it effectively." (Rowell, 1986). Rowell's statement is a dramatic but accurate way of explaining that both exercise and hemorrhage require the body to cope with progressively diminishing blood volume and blood pressure. Although the physiological challenge to the body occurs much more quickly and with decidedly deadlier potential in the case of hemorrhage, the slower progression of events that occurs as a result of sweat loss is no less challenging from a physiological standpoint.

It is recommended that ingested fluids be cooler than ambient temperature [between 15°and 22°C (59° and 72°F)] and flavored to enhance palatability and promote fluid replacement. Fluids should be readily available and served in containers that allow adequate volumes to be ingested with ease and with minimal interruption of exercise."

It is certainly no surprise that humans are inclined to drink more of beverages that are flavored and sweetened (Greenleaf, 1991) but the practical ramifications of this common-sense knowledge are important in the exercise setting. Any step that can be taken to increase voluntary fluid intake will help decrease the extent of dehydration and reduce the risk of health problems associated with dehydration and heat stress. In addition to having palatable beverages available for athletes to drink, a number of other practical steps should be taken. These include educating coaches, trainers, parents, and athletes about the benefits of proper hydration, making certain that fluids are easily available at all times, encouraging athletes to follow an organized regimen for fluid replacement, and weighing athletes before and after practice as a way to assess the effectiveness of their fluid intake (Broad, 1996).

The composition of beverages can also have a substantial effect on voluntary fluid intake, as illustrated by the research of Wilk and Bar-Or (1996). Young boys were studied during 3 h of intermittent exercise in the heat, during which time the subjects could drink ad libitum. The boys completed this protocol on three occasions; the beverages tested included water, a sports drink, and a flavored, artificially sweetened replica of the sports drink. The results showed that the boys ingested almost twice as much sports drink as they did water. Consumption of the placebo fell in between. Not only did flavoring and sweetness increase voluntary fluid intake, but the presence of sodium chloride in the sports drink further increased consumption (i.e., the subjects drank more sports drink than placebo).

The human thirst mechanism is sensitive to changes in plasma sodium concentration (and plasma osmolality) and to changes in blood volume (Hubbard et al., 1990). The increase in sodium concentration and the decrease in blood volume that accompany exercise result in an increased perception of thirst. Drinking plain water quickly removes the osmotic drive to drink and reduces the volume-dependent drive, causing the satiation of thirst. The resulting decrease in fluid intake occurs prematurely, occurring before adequate fluid has been ingested. The presence of low levels of sodium chloride in a beverage help maintain the osmotic drive for drinking, and assure greater fluid intake (Nose et al. 1988), a physiological certainty well understood by bartenders who make certain that their customers have easy access to salty snack foods.

"Addition of proper amounts of carbohydrates and/or electrolytes to a fluid replacement solution is recommended for exercise events of duration greater than 1 h since it does not significantly impair water delivery to the body and may enhance performance."

The ergogenic effect of carbohydrate feeding during exercise has been extensively confirmed by research, much of which has been conducted using exercise bouts lasting from one to four-or-more hours (Coggan & Coyle, 1991). Ingestion of carbohydrate solutions containing combinations of sucrose, glucose, fructose, and maltodextrins results in improved exercise performance provided that at least 45 g of carbohydrate are ingested each hour (Coggan & Coyle, 1991). It should be noted that some researchers (Murray et al., 1991) have reported performance improvements even when subjects have ingested as little as 20–25 g/h, although a higher rate of carbohydrate intake is more advisable. However, the maximal rate at which exogenous carbohydrate can be utilized appears to be in the range of 60-75 g/h (ie, 1.0–1.5 g/min). No additional performance benefit is realized when subjects are fed greater amounts of carbohydrate (Murray et al., 1991).

The specific mechanism(s) by which performance is improved by carbohydrate feeding is still a matter of scientific inquiry, but there is general agreement that the improvement in performance is linked to an increased reliance on carbohydrate as fuel for active muscles (Coggan & Coyle, 1991). During intense physical activity, the metabolic demand for carbohydrate is high; carbohydrate ingestion satisfies part of that demand, helping assure the maintenance of carbohydrate oxidation.

"During exercise lasting less than 1 h, there is little evidence of physiological or physical performance differences between consuming a carbohydrate-electrolyte drink and plain water."

During long-duration exercise (i.e., > 1 h), carbohydrate oxidation normally declines as muscle and liver glycogen stores fall to low levels. Considering these responses, it is not surprising that exercise scientists initially relied upon bouts of long-duration cycling or running to determine if carbohydrate feeding improved performance. Not until recently have scientists turned their attention to studying shorter-duration, intermittent exercise protocols lasting one h or less to determine if carbohydrate feeding elicits a similar ergogenic effect. At the time of the 1996 ACSM position stand, very few such studies had been published. Although much more research needs to be completed, the growing body of evidence (Ball et al., 1995; Below et al., 1995; Wagenmakers et al., 1996; Walsh et al., 1994) indicates that carbohydrate ingestion may indeed benefit performance during shorter duration exercise (i.e., 1 h or less) and during intermittent exercise such as high-intensity running (Nicholas et al., 1996), cycling (Jackson et al., 1995), and tennis play (Vergauwen et al., 1996).

An excellent comparison of the benefits of ingesting water or a sports drink during shorter-duration exercise was conducted by Below et al. (1994) who had subjects cycle for 50 min at 80%VO2max and then complete a "sprint to the finish" requiring 9-12 min. The subjects experienced a 6% improvement in performance when they consumed enough water to replace about 80% of their sweat loss (1330 ml) compared to when they ingested only 200 ml of water. However, when the subjects ingested 1330 ml of a sports drink, their performance improved by 12%, leading the authors to conclude that the benefits of hydration and carbohydrate feeding were additive.

The benefits of proper hydration and carbohydrate feeding that have been illustrated by numerous laboratory studies are often echoed by the experiences of the subjects in the studies. Dr. Edward Coyle of The University of Texas noted that the competitive cyclists who participate in his experiments "know that drinking is critical to surviving the Texas heat. What they usually don't appreciate is that being well hydrated can help them thrive rather than just survive. After they learn how to fully replace fluids in our studies, they are amazed at how much better they feel as far as being cooler, having a lower heart rate, and generating more power." (E.F. Coyle, personal communication)

"During intense exercise lasting longer than 1 h, it is recommended that carbohydrates be ingested at a rate of 30–60 grams per hour to maintain oxidation of carbohydrates and delay fatigue. This rate of carbohydrate intake can be achieved without compromising fluid delivery by drinking 600–1200 ml per hour of solutions containing 4%–8% carbohydrates (grams per 100 ml). The carbohydrates can be sugars (glucose or sucrose) or starch (e.g., maltodextrin)."

As previously indicated, ingesting carbohydrate at the rate of about 60 g/h during exercise is associated with improved physical performance. Considering that most sports drinks contain 6% to 7% carbohydrate (i.e., 60–70 g carbohydrate per liter), the consumption of one L (~ one qt) of sports drink per hour will provide the needed amount of carbohydrate. However, many athletes sweat at rates substantially greater than one L/h (Broad et al., 1996) and so should drink more than 1 L/h. Consuming carbohydrate in excess of 60 g/h will not be detrimental to gastrointestinal comfort, physiological function, or performance provided that the carbohydrate concentration of the ingested beverage is not too high. Beverages containing greater than 7% carbohydrate (i.e., > 17 g carbohydrate per 236 ml [8 oz]) are associated with slower rates of intestinal absorption (Shi et al., 1995), which increases the risk of gastrointestinal distress (Davis et al., 1988; Peters et al., 1995).

Sports drinks usually contain more than one type of carbohydrate, most often combinations of sucrose, glucose, fructose, and maltodextrin. Such combinations are acceptable from both a sensory and a physiological perspective. Beverages containing mostly or solely fructose are not optimal because fructose is absorbed slowly by the intestine (Shi et al., 1995) and requires conversion to glucose by the liver before it can be metabolized by skeletal muscle, making fructose an ineffective fuel for improving performance (Murray et al., 1989). Research subjects who have had the unpleasant experience of participating in studies requiring the ingestion of fructose-only beverages can attest to the gastrointestinal limitations of fructose as the sole source of carbohydrate because vomiting and diarrhea are two common side effects when large amounts of fructose are ingested.

"Inclusion of sodium (0.5–0.7 grams per liter of water) in the rehydration solution ingested during exercise lasting longer than 1 h is recommended since it may be advantageous in enhancing palatability, promoting fluid retention, and possibly preventing hyponatremia in certain individuals who drink excessive quantities of fluid. There is little physiological basis for the presence of sodium in an oral rehydration solution for enhancing intestinal water absorption as long as sodium is sufficiently available from the previous meal."

Sweat contains more sodium and chloride than other minerals and, although sweat electrolyte values are normally substantially lower than plasma values (plasma = 138–142 mmol/L; sweat = 25–75 mmol/L), athletes who exercise in excess of two h each day can lose considerable amounts of sodium chloride. Consider, for example, a football lineman during two-a-day summer practices in which a total of 5 L of sweat is lost. If each liter of sweat contained 50 mmol sodium, the total sodium loss would be 5,750 mg, the equivalent of over 14 g of NaCl.

Food intake is usually accompanied by sodium chloride intake, and most research indicates that sodium deficits are rare among athletes or military personnel (Armstrong et al., 1987). However, there are occasions when sodium losses can present problems, as illustrated by Bergeron (1996) in a case study of a nationally ranked tennis player who suffered from frequent heat cramps. This player had both a high sweat rate (2.5 L/h) and higher-than-normal sweat sodium concentration (90 mmol/h). The muscle cramps were eliminated when he increased his daily dietary intake of sodium chloride from 5–10 g/day to 15–20 g/day, and increased his fluid intake to assure adequate hydration.

The ACSM position stand also indicates that ingesting sodium chloride in a beverage consumed during exercise can help ensure adequate fluid intake (Wilk & Bar-Or, 1996) and stimulate more-complete rehydration following exercise (Maughan et al., 1996). Both of these responses underscore the important role that sodium plays in maintaining the osmotic drive to drink and in providing an osmotic stimulus to retain fluid in the extracellular space.

It is true that the sodium content of a fluid-replacement beverage does not directly affect the rate of fluid absorption, as demonstrated by recent research (Gisolfi et al., 1995). This is because the amount of sodium that can be provided to the intestine by a beverage is miniscule compared to the amount of sodium that can be provided from the bloodstream. Plasma sodium freely diffuses into the gut following fluid intake because the concentration gradient for sodium between plasma and the contents of the intestine strongly favors sodium influx. The sodium content of the previous meal or of pancreatic secretions is of little importance in the fluid absorption process. That said, sodium chloride remains a critical ingredient in a properly formulated sports drink because it improves beverage palatability, helps maintain the osmotic drive for thirst, reduces the contribution of plasma sodium required in the gut prior to absorption, helps maintain plasma volume during exercise, and serves as the primary osmotic impetus for restoring extracellular fluid volume following exercise (Maughan et al., 1996; Nose et al., 1988).

Fluid Ingestion Following Exercise

Fluid intake following physical activity can be a critical factor in helping athletes recovery quickly between bouts of training and competition. Many athletes train more than once each day, making rapid rehydration an important consideration, particularly during training in warm weather. The ACSM position stand did not elaborate on recommendations for fluid intake after exercise, but in a recent Sports Science Exchange article, Maughan et al. (1996) provided a comprehensive review of this topic. The authors concluded that ingesting plain water is ineffective at restoring rehydration because water absorption causes plasma osmolality to fall, suppressing thirst and increasing urine output. When sodium is provided in fluids or foods, the osmotic drive to drink is maintained (Gonzalez-Alonso et al., 1992; Nose et al., 1988), and urine production is decreased. There are many occasions during training and competition when it is either difficult or unwise to ingest food, making it all the more important that athletes have access to fluid containing sodium chloride and other electrolytes.

Maughan et al. (1996) also emphasized the importance of ingesting fluid in excess of the deficit in body weight to account for obligatory urine losses. In other words, the advice normally given athletes —"drink a pint of fluid for every pound of body weight deficit"—must be amended to "drink at least a pint of fluid for every pound of body weight deficit". More-precise recommendations for how much fluid athletes should ingest to assure rapid and complete rehydration will evolve from future research; existing data indicate that ingestion of 150% or more of weight loss may be required to achieve normal hydration within six h following exercise (Shirreffs et al., 1996).

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Heat and Cold Illnesses During Distance Running

American College of Sports Medicine Position Stand

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Summary

Many recreational and elite runners participate in distance races each year. When these events are conducted in hot or cold conditions, the risk of environmental illness increases. However, exertional hyperthemia, hypothermia, dehydration, and other related problems may be minimized with pre-event education and preparation. This position stand provides recommendations for the medical director and other race officials in the following areas: scheduling; organizing personnel, facilities, supplies, equipment, and communications providing competitor education; measuring environmental stress; providing fluids; and avoiding potential legal liabilities. This document also describes the predisposing conditions, recognition, and treatment of the four most common environmental illnesses: heat exhaustion, heatstroke, hypothermia, and frostbite. The objectives of this position stand are: 1) To educate distance running event officials and participants about the most common forms of environmental illness including predisposing conditions, warning signs, susceptibility, and incidence reduction. 2) To advise race officials of their legal responsibilities and potential liability with regard to event safety and injury prevention. 3) To recommend that race officials consult local weather archives and plan events at times likely to be of low environmental stress to minimize detrimental effects on participants. 4) To encourage race officials to warm participants about environmental stress on race day and its implications for heat and cold illness. 5) To inform race officials of preventive actions that may reduce debilitation and environmental illness. 6) To describe the personnel, equipment, and supplies necessary to reduce and treat cases of collapse and environmental illness.

Introduction

This document replaces the position stand titled *The Prevention of Thermal Injuries During Distance Running* (4). It considers problems that may affect the extensive community of recreational joggers and elite athletes who participate in distance running events. It has been expanded to include heat exhaustion, heatstroke, hypothermia, and frostbite–the most common environmental illnesses during races.

Because physiological responses to exercise in stressful environments may vary among participants, and because the health status of participants varies from day to day, compliance with these recommendations will not guarantee protection from environmentally induced illnesses. Nevertheless, these recommendations should minimize the risk of exertional hyperthermia, hypothermia, dehydration, and resulting problems in distance running and other forms of continuous athletic activity such as bicycle, soccer, and triathlon competition.

Managing a large road race is a complex task that requires financial resources, a communication network, trained volunteers, and teamwork. Environmental extremes impose additional burdens on the organizational and medical systems. Therefore, it is the position of the American College of Sports Medicine that the following RECOMMENDATIONS be employed by race managers and medical directors of community events that involve prolonged or intense exercise in mild and stressful environments.

1. Race Organization

a. Distance races should be scheduled to avoid extremely hot and humid and very cold months. The local weather history should be consulted when scheduling an event. Organizers should be cautious of unseasonably hot or cold days in early spring or late fall because entrants may not be sufficiently acclimatized. The wind chill index should be used to reschedule races on cold, windy days because flesh may freeze rapidly and cold injuries may result.

b. Summer events should be scheduled in the early morning or the evening to minimize solar radiation and air temperature. Winter events should be scheduled at midday to minimize the risk of cold injury.

c. The heat stress index should be measured at the site of the race because meteorological data from a distant weather station may vary considerably from local conditions (66). The wet bulb globe temperature (WBGT) index is widely used in athletic and industrial settings [see Appendix I;(87)]. If the WBGT index is above 28 °C (82 °F), or if the ambient dry bulb temperature is below -20 °C (-4 °F), consideration should be given to canceling the race or rescheduling it until less stressful conditions prevail. If the WBGT index is below 28 °'C, participants should be alerted to the risk of heat illness by using signs posted at the start of the race and at key positions along the race course [see Appendix I;(61)]. Also, race organizers should monitor changes in weather conditions. WBGT monitors can be purchased commercially, or Figure I may be used to approximate the risk of racing in hot environments based on air temperature and relative humidity. These two measures are available from local meteorological stations and media weather reports, or can be measured with a sling psychrometer.

d. An adequate supply of fluid must be available before the start of the race, along the race course, and at the end of the event. Runners should be encouraged to replace their sweat losses or consume 150-300 ml (5.3-10.5 oz) every 15 minutes (3). Sweat loss can be derived by calculating the difference between pre and postexercise body weight.

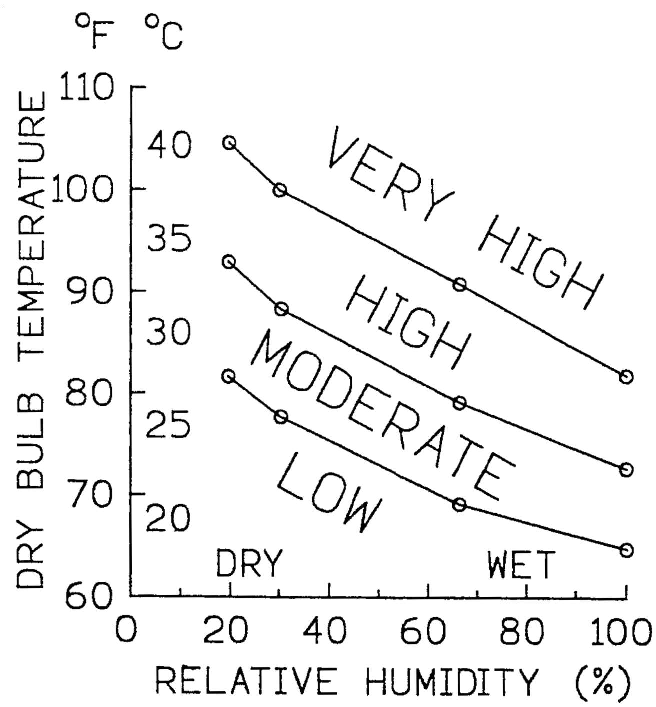

Figure 1 Risk of heat exhaustion or heatstroke while racing in hot environments. Figure drawn from data presented in American College of Sports Medicine Position stand: the prevention of thermal injuries during distance running. *Med. Sci. Sports Exerc.* 19:529-533, 1987.

e. Cool or cold (ice) water immersion is the most effective means of cooling a collapsed hyperthermic runner (25, 48, 49, 59, 88). Wetting runners externally by spraying or sponging during exercise in a hot environment is pleasurable but does not fully attenuate the rise in body core temperature (14, 88). Wetting the skin can result in effective cooling once exercise ceases.

f. Race officials should be aware of the warning signs of an impending collapse in both hot and cold environments and should warn runners to slow down or stop if they appear to be in difficulty.

g. Adequate traffic and crowd control must be maintained along the course at all times.

h. Radio communication or cellular telephones should connect various points on the course with an information processing center to coordinate emergency responses.

2. Medical Director

A sports medicine physician should work closely with the race director to enhance the safety and provide adequate medical care for all participants. The medical director should understand exercise physiology, interpretation of meteorological data, heat and cold illness prevention strategies, potential liability, and the treatment of medical problems associated with endurance events conducted in stressful environments.

3. Medical Support

a. Medical organization and responsibility: The medical director should alert local hospitals and ambulance services and make prior arrangements to care for casualties, including those with heat or cold injury. Medical personnel should have the authority to evaluate, examine, and stop runners who display signs of impending illness or collapse. Runners should be advised of this procedure prior to the event.

b. Medical facilities: Medical support staff and facilities must be available at the race site. The facilities should be staffed with personnel capable of instituting immediate and appropriate resuscitation measures. The equipment necessary to institute both cooling therapy (ice packs, child's wading pools filled with tap water or ice water, fans) and warming therapy (heaters, blankets, hot beverages) may be necessary at the same event. For example, medical personnel treated 12 cases of hyperthermia and 13 cases of hypothermia at an endurance triathlon involving 2300 competitors: air temperature was 85°F, water temperature was 58°F (92).

4. Competitor Education

The physical training and knowledge of competitive runners and joggers has increased greatly, but race organizers must not assume that all participants are well prepared or informed about safety. Distributing this position stand before registration, publicizing the event in the media, and conducting clinics or seminars before events are valuable educational procedures.

a. All participants should be advised that the following conditions may exacerbate heat illness: obesity (13, 39, 89), low degree of physical fitness (30, 63, 79, 83), dehydration (23, 34, 69, 83, 84, 95), lack of heat acclimatization (31, 51, 89), a previous history of heat stroke (82, 89), sleep deprivation (5), certain medications, including diuretics and antidepressants (31), and sweat gland dysfunction or sunburn (31). Illness 1 week prior to an event should preclude participation (32, 96), especially those involving fever, respiratory tract infections, or diarrhea (41, 46).

b. Prepubescent children sweat less than adults and have lower heat tolerance (11, 12).

c. Adequate training and fitness are important for full enjoyment of the event and will reduce the risk of heat illness and hypothermia (33, 64, 67, 85).

d. Prior training in the heat will promote heat acclimatization (6) and thereby reduce the risk of heat illness, especially if the training environment is warmer than that expected during a race (5, 51). Artificial heat acclimatization can be induced in cold conditions (6).

e. Adequate fluid consumption before and during the race can reduce the risk of heat illness, including disorientation and irrational behavior, particularly in longer events such as a marathon (23, 34, 95).

f. Excessive consumption of pure water or dilute fluid (i.e., up to 10 liters per 4 hours) during prolonged endurance events may lead to a harmful dilutional hyponatremia (60), which may involve disorientation, confusion, and seizure or coma. The possibility of hyponatremia may be the best rationale for inclusion of sodium chloride in fluid replacement beverages (3).

g. Participants should be advised of the early symptoms of heat illness, which may include clumsiness, stumbling, headache, nausea, dizziness, apathy, confusion, and impairment of consciousness (41,86).

h. Participants should be advised of the early symptoms of hypothemia (slurred speech, ataxia, stumbling gait) and frostbite (numbness, burning, pain, paresthesia) on exposed skin (36). Wet clothing, especially cotton, increases heat loss and the risk of hypothermia (68).

i. Participants should be advised to choose a comfortable running speed and not to run faster than environmental conditions or their cardiorespiratory fitness warrant (43, 71, 91).

j. It is helpful if novice runners exercise with a partner, each being responsible for the other's well-being (71).

5. Responsibilities and Potential Liability

The sponsors and directors of an endurance event are reasonably safe from liability due to injury if they avoid gross negligence and willful misconduct, carefully inform the participants of hazards, and have them sign waivers before the race (78). However, a waiver signed by a participant does not totally absolve race organizers of moral and/or legal responsibility. It is recommended that race sponsors and directors: 1) minimize hazards and make safety the first concern; 2) describe inherent hazards (i.e., potential course hazards, traffic control, weather conditions) in the race application; 3) require all entrants to sign a waiver; 4) retain waivers and records for 3 yrs; 5) warn runners of the predisposing factors and symptoms of environmental illness; 6) provide all advertised support services; 7) legally incorporate the race or organizations involved; and 8) purchase liability insurance (18, 78, 80).

Race directors should investigate local laws regarding Good Samaritan action. In some states physicians who do not accept remuneration may be classified as Good Samaritans. Race liability insurance may not cover physicians (78), therefore the malpractice insurance policy of each participating physician should be evaluated to determine if it covers services rendered at the race.

Medical and race directors should postpone, reschedule, or cancel a race if environmental conditions warrant, even though runners and trained volunteers arrive at the site and financial sponsorship has been provided. Runners may not have adequate experience to make the decision not to compete; their safety must be considered. Downgrading the race to a "fun run" does not absolve race supervisors from their responsibility or decrease the risk to participants (15, 66).

Background For This Position Stand

Dehydration is common during prolonged endurance events in both cold and hot environmental conditions because the average participant loses 0.5-1.5 quarts (0.47-1.42 liters) of sweat, and fluid replacement is usually insufficient (12, 42, 69). Runners may experience hyperthermia [body core temperature above 39°C (102.2°F)] or hypothermia [body core temperature below 35°C (95°F)], depending on the environmental conditions, caloric intake, fluid consumption, and clothing worn. Hyperthermia is a potential problem in warm and hot weather races when the body's rate of heat production is greater than its heat dissipation (2). Indeed, on extremely hot days, it is possible that up to 50% of the participants may require treatment for heat-related illnesses such as heat exhaustion and heatstroke (1, 66). Hypothermia is more likely to occur in cold or cool-windy conditions. Scanty clothing may provide inadequate protection from such environments, particularly near the end of a long race when running speed and heat production are reduced. Frostbite can occur in low air temperature and especially when combined with high wind speed. The race and medical directors should anticipate the above medical problems and be capable of responding to a large number of patients with adequate facilities, supplies, and support staff. The four most common heat and cold illnesses during distance running are heat exhaustion, heatstroke, hypothermia, and frostbite.

1. Heat Exhaustion

Body sweat loss can be significant in summer endurance races and may result in a body water deficit of 6-10% of body weight (41, 95). Such dehydration will reduce the ability to exercise in the heat because decreases in circulating blood volume, blood pressure, sweat production, and skin blood flow all inhibit heat loss (41, 81) and predispose the runner to heat exhaustion or the more dangerous hyperthermia and exertional heatstroke (41, 66).

Heat exhaustion, typically the most common heat illness among athletes, is defined as the inability to continue exercise in the heat (7). It represents a failure of the cardiovascular responses to workload, high external temperature, and dehydration (16, 41, 42). Heat exhaustion has no known chronic, harmful effects. Symptoms may include headache, extreme weakness, dizziness, vertigo, "heat sensations" on the head or neck, heat cramps, chills, "goose flesh" ("goose bumps"), vomiting, nausea, and irritability (41, 42). Hyperventilation, muscular incoordination, agitation, impaired judgment, and confusion also may be seen. Heat syncope (fainting) may or may not accompany heat exhaustion (41). The onset of heat exhaustion symptoms is usually sudden and the duration of collapse brief. During the acute stage of heat exhaustion, the patient looks ashen-gray, the blood pressure is low, and the pulse rate is elevated. Hyperthermia may add to the symptoms of heat exhaustion, even on relatively cool days (20, 22, 30, 37, 38, 43, 62, 90).

Although it is improbable that all heat exhaustion cases can be avoided, the most susceptible individuals are those who either exert themselves at or near their maximal capacities, are dehydrated, not physically fit, and not acclimatized to exercise in the heat. It is imperative that runners be adequately rested, fed, hydrated, and acclimatized (7); they should drink ample fluids before, during, and after exercise (3). Also, repeated bouts of exercise in the heat (heat acclimatization) reduce the incidence of both heat exhaustion and heat syncope. Heat acclimatization can best be accomplished by gradually increasing the duration and intensity of exercise training during the initial 10-14 d of heat exposure (6).

Oral rehydration is preferred for heat exhaustion patients who are conscious, coherent, and without vomiting or diarrhea. Intravenous (IV) fluid administration facilitates rapid recovery (42, 57). Although a variety of IV solutions have been used at races (42), a 5% dextrose sugar in either 0.45% saline (NACI) or 0.9% NaCl are the most common (1). Runners may require up to 4 1 of IV fluid if severely dehydrated (57).

2. Exertional Heatstroke

Heat production, mainly from muscles, during intense exercise is 15-20 times greater than at rest, and is sufficient to raise body core temperature by 1°C (1.8°F) each 5 minutes without thermoregulatory (heat loss) adjustments (56). When the rate of heat production exceeds that of heat loss for a sufficient period of time, severe hyperthermia occurs.

Heatstroke is the most serious of the syndromes associated with excess body heat. It is defined as a condition in which body temperature is elevated to a level that causes damage to the body's tissues, giving rise to a characteristic clinical and pathological syndrome affecting multiple organs (32, 83). After races, adult core (rectal) temperatures above 40.6°C (105.1°F) have been reported in conscious runners (24, 52, 69, 74, 77), and 42-43°C (107.6-109.4°F) in collapsed runners (72-74, 86, 90). Sweating is usually present in runners who experience exertional heatstroke (87).

Strenuous physical exercise in a hot environment has been notorious as the cause of heatstroke, but heatstroke also has been observed in cool-to-moderate [13-28°C (55-82°F)] environments (5, 32, 74), suggesting variations in individual susceptibility (5, 31, 32). Skin disease, sunburn, dehydration, alcohol or drug use/abuse, obesity, sleep loss, poor physical fitness, lack of heat acclimatization, advanced age, and a previous heat injury all have been theoretically linked to increased risk of heatstroke (5, 31, 51, 84). The risk of heatstroke is reduced if runners are well-hydrated, well-fed, rested, and acclimatized. Runners should not exercise if they have a concurrent illness, respiratory infection, diarrhea, vomiting, or fever (5, 7, 46). For example, a study of 179 heat casualties at a 14-km race showed that 23% reported a recent gastrointestinal or respiratory illness (70), whereas a study of 10 military heatstroke patients reported that three had a fever or disease and six recalled at least one warning sign of impending illness at the time of their heatstroke (5).

Appropriate fluid ingestion before and during prolonged running can minimize dehydration and reduce the rate of increase in body core temperature (24, 34). However, excessive hyperthermia may occur in the absence of significant dehydration, especially in races of less than 10 km, because the fast pace generates greater metabolic heat (90).

The mortality rate and organ damage due to heatstroke are proportional to the length of time between core temperature elevation and initiation of cooling therapy (5, 26). Therefore, prompt recognition and cooling are essential (1, 5, 22, 42, 48, 51, 62, 74, 83). A measurement of deep body temperature is vital to the diagnosis, and a rectal temperature should be measured in any casualty suspected of having heat illness or hypothermia. Ear (tympanic), oral, or axillary measurements are spuriously affected by peripheral (skin) and environmental temperatures and should not be used after exercise (8, 75, 76). When cooling is initiated rapidly, most heatstroke patients recover fully with normal psychological status (79), muscle energy metabolism (65), heat acclimatization, temperature regulation, electrolyte balance, sweat gland function, and blood constituents (5).

Many whole-body cooling techniques have been used to treat exertional heatstroke, including water immersion, application of wet towels or sheets, warm air spray, helicopter downdraft, and ice packs to the neck, underarm, and groin areas. There is disagreement as to which modality provides the most efficient cooling (7, 47, 97), because several methods have been used successfully. However, the fastest whole-body cooling rates (25, 48, 49, 59, 88) and the lowest mortality rates (25) have been observed during cool and cold water immersion. Whichever modality is utilized it should be simple and safe, provide great cooling power, and should not restrict other forms of therapy (i.e., cardiopulmonary resuscitation, defibrillation, IV cannulation). The advantages and disadvantages of various cooling techniques have been discussed (47, 75, 97).

Heatstroke is regarded as a medical emergency that might be fatal if not immediately diagnosed and properly treated. Early diagnosis is of utmost importance and time-consuming investigation should be postponed until body temperature is corrected and the patient is evacuated to a nearby medical facility that is aware of such conditions.

3. Hypothermia

Hypothermia [body core temperature below 36°C (97 °F)] occurs when heat loss is greater than metabolic heat production (94). Early signs and symptoms of hypothermia include shivering, euphoria, confusion, and behavior similar to intoxication. Lethargy, muscular weakness, disorientation, hallucinations, depression, or combative behavior may occur as core temperature continues to fall. If body core temperature falls below 31.1°C

(88°F), shivering may stop and the patient will become progressively delirious, uncoordinated, and eventually comatose if treatment is not provided (10).

During cool or cold weather marathons, the most common illnesses are hypothermia, exhaustion, and dehydration. The most common medical complaints are weakness, shivering, lethargy, slurred speech, dizziness, diarrhea, and thirst (1, 45). Runner complaints of feeling hot or cold do not always agree with changes in rectal temperature (74). Dehydration is common in cool weather (1, 45). Runners should attempt to replace fluids at a rate that matches their sweat and urine losses. Cases of hypothermia also occur in spring and fall because weather conditions change rapidly and runners wear inappropriate clothing that becomes sweat-soaked during training or competition (19).

Hypothermia may occur during races, for example when distance runners complete the second half of the event more slowly than the first half (54). Evaporative and radiative cooling increase because wet skin (from sweat, rain, or snow) and clothing are exposed to higher wind speed at a time when metabolic heat production decreases. Hypothermia also occurs after a race, when the temperature gradient between the body surface and the environment is high. Subfreezing ambient temperatures need not be present and hypothermia may develop even when the air temperature is 10-18°C (50-65°F) (19, 36, 74). A WBGT meter can be used to evaluate the risk of hypothermia (see Appendix 1). Cold wind increases heat loss in proportion to wind speed; i.e., wind chill factor. The relative degree of danger can be assessed (Fig. 2) (55). Wind speed can be estimated; if you feel the wind in your face the speed is at least 16 km per hour^{-1} (kph) [10 miles per hour^{-1} (mph)]; if small tree branches move or if snow and dust are raised, approximately 32 kph (20 mph); if large tree branches move, 48 kph (30 mph); if an entire tree bends, about 64 kph (40 mph) (9).

To reduce heat loss, runners should protect themselves from moisture, wind, and cold air by wearing several layers of light, loose clothing that insulate the skin with trapped air (17). An outer garment that is windproof, allows moisture to escape, and provides rain protection is useful. Lightweight nylon parkas may not offer thermal insulation but offer significant protection against severe wind chill, especially if a hood is provided. Wool and polyester fabrics retain some protective value when wet; cotton and goose down do not (10). Areas of the body that lose large amounts of heat (head, neck, legs, hands) should be covered (17).

Mild [34-36°C (93-97°F)] or moderate [30-34°C (86-93°F)] hypothermia should be treated before it progresses. Wet clothing should be replaced with dry material (sweatsuit, blanket) that is insulated from the ground and wind. Warm fluids should be consumed if patients are conscious, able to talk, and thinking clearly. Patients with moderate and severe [<30°C (86°F)] hypothermia should be insulated in a blanket and evacuated to a hospital immediately (19, 58). Although severe hypothermia should be treated in the field (27), it is widely recognized that life-threatening ventricular fibrillation is common in this state and may be initiated

Wind Chill Chart

AIR TEMPER-ATURE	ESTIMATED WIND SPEED IN MPH (KPH) 0 (0)	10 (16)	20 (32)	0 (48)	
30F (-1.l C)	30 (1.1)	16 (-8.9)	4 (-15.6)	-2 (-18.9)	LITTLE RISK
20 F (-6.7 C)	20 (-6-7)	4 (-15.6)	-10 (-23-3)	-18 (-27.8)	
10F (12.2 C)	10 (-12.2)	-9 (-22.8)	-25 (-31.7)	-33 (-36.1)	INCREASED RISK
0 F (-17.8 C)	0 (-17.8)	-24 (-31.1)	-39 (-39.4)	-48 (-44.4)	
-10 F (-23.3 C)	-10 (-23.3)	-33 (-36.1)	-53 (-47.2)	-63 (-52.8)	
-20 F (-28.9 C)	-20 (-28.9)	-46 (-43.3)	-67 (-55)	-79 (-61.7)	GREAT RISK

Figure 2 The risk of freezing exposed flesh in cold environments. Reprinted from Milesko-Pytel, D. Helping the frostbitten patient. *Patient Care* 17:90-115, 1983.

by physical manipulation, chest compression, or intubation (10, 27, 58, 93). However, with conclusive evidence of cardiac standstill and breathlessness, emergency procedures (i.e., Basic Life Support, Advanced Cardiac Life Support) should be initiated. Life-support procedures (27) and commonly observed laboratory (i.e., electrolyte, acid-base) values (10, 58) have been described by others.

4. Frostbite

Frostbite involves crystallization of fluids in the skin or subcutaneous tissue after exposure to subfreezing temperatures [< -0.6°C (31°F)]. With low skin temperature and dehydration, cutaneous blood vessels constrict and circulation is attenuated because the viscosity of blood increases (55). Frostbite may occur within seconds or hours of exposure, depending upon air temperature, wind speed, and body insulation. Frostbitten skin can appear white, yellow-white, or purple, and is hard, cold, and insensitive to touch (55). Rewarming results in intense pain, skin reddening, and swelling. Blister formation is common and loss of extremities (fingers, toes, ears, hands, feet) is possible (36, 55). The degree of tissue damage depends on duration and severity of the freezing and effectiveness of treatment.

No data have been published regarding the incidence of frostbite among athletes during training or competition. Since winter running races are rarely postponed when environmental conditions are harsh, and frostbite is the most common cold injury in military settings (35), it is imperative that runners be aware of the dangers. Crosscountry ski races are postponed if the temperature at the coldest point of the course is less than -20 °C (-4 °F), due to the severe wind chill generated at race pace.

Runners risk frozen flesh within minutes if the air temperature and wind speed combine to present a severe wind chill. Because runners prefer to have unrestricted movement during races, and because they know that exercise results in body heating, they may not wear sufficient clothing. Runners can avoid frostbite and hypothermia in cold and windy conditions by protecting themselves by dressing adequately: wet skin or clothing will increase the risk of frostbite (21, 29).

When tissue freezes [skin temperature -2 ° -O °C, (28-32 °F)], water is drawn out of the cells and ice crystals cause mechanical destruction of skin and subcutaneous tissue (36). However, initial ice crystal formation is not as damaging to tissues as partial rethawing and refreezing (40). Therefore, the decision to treat severe frostbite in the field (versus transport to a hospital) should consider the possibility of refreezing. If there is no likelihood of refreezing, the tissue should be rapidly rewarmed (36, 40) in circulating warm water (40-43.3 °C, 104-110 °F), insulated, and the patient transported to a medical facility. Research on animals suggests that topical aloe vera and systemic ibuprofen may reduce tissue damage and speed rehabilitation in humans (9). Other aspects of hospital treatment protocols are detailed elsewhere (9, 36, 40).

Race Organization

The following suggestions constitute the ideal race medical team. They are offered for consideration, but are not intended as absolute requirements. Staff and equipment needs are unique to each race and may be revised after 1-2 yr, in light of the distinctive features of each race. Depending on the weather conditions, 2-12% of all entrants will typically enter a medical aid station (1, 45, 50, 74).

1. Medical Personnel

a. Provide medical assistance if the race is 10 km (6.2 miles) or longer.

b. Provide the following medical personnel per 1,000 runners: 1-2 physicians, 4-6 podiatrists, 1-4 emergency medical technicians, 2-4 nurses, 3-6 physical therapists, 3-6 athletic trainers, and 1-3 assistants. Approximately 75% of these personnel should be stationed at the finish area. Recruit one nurse (per 1,000 runners) trained in IV therapy.

c. Recruit emergency personnel from existing organizations (police, fire-rescue, emergency medical service).

d. One physician and 10-15 medical assistants serve as the triage team in the finish chute. Runners unable to walk are transported to the medical tent via wheelchair, litter, or two-person carry.

e. Consider one or two physicians and two to four nurses trained in the rehabilitative medical care of wheelchair athletes.

f. Medical volunteers should attend a briefing prior to the event to meet their supervisor and receive identification tags, weather forecast, instructions, and schedules. Supervisors from the following groups should be introduced: medical director; podiatry, nursing, physical therapy, athletic training, medical records, triage, wheelchair athlete care, and medical security (optional: chiropractic, massage therapy). Medical volunteers should be distinguished from other race volunteers; luminous/distinctive vests, coats, or hats work well.

2. Medical Aid Stations

a. Provide a primary medical aid station (250-1,500 ft^2 (23-139 m^2) for each 1,000 runners; see Table 1) at the finish area, with no public access. Place security guards at all entrances with instructions regarding who can enter.

b. Position secondary medical aid stations along the route at 2- to 3-km (1.2- to 1.9-mile) intervals for races over 10 km, and at the halfway point for shorter races (see Table 1). Some race directors have successfully secured equipment and medical volunteers from military reserve or national guard medical units, the American Red Cross, and the National Ski Patrol.

c. Station one ambulance per 3,000 runners at the finish area and one or more mobile emergency response vehicles on the course. Staff each vehicle with a nurse and radio person or cellular telephone. Stock each vehicle with a medical kit, automatic defibrillator, IV apparatus. blankets, towels, crushed ice, blood pressure cuffs, rehydration fluid, and cups.

d. Signs should be posted at the starting line and at each medical aid station to announce the risk of heat illness or cold injury (see Appendix 1).

e. A medical record card should be completed for each runner who receives treatment (1,74). This card provides details that can be used to plan the medical coverage of future events.

f. Provide personal protective equipment (gloves, gowns, face shields, eye protection) and hand washing facilities.

g. Provide portable latrines and containers for patients with vomiting and diarrhea.

h. Initial medical assessment must include rectal (not oral, aural, or axillary temperature; see ref. 8, 76), central nervous system function, and cardiovascular function. Rehydration and cooling or warming are the cornerstones of treatment (32, 41, 42, 50, 74, 94).

Medical aid stations

Item	Secondary Aid Station	Primary Aid Station
Stretchers (at 10 km and beyond)	2-5	4-10
Cots	10	30
Wheelchairs	0	1
Wool blankets (at 10 km and beyond)	6-10	12-20
Bath towels	5-10	10-20
High and low temperature rectal thermometers (37-43˚C; 99-110˚F) and (22-37˚C; 77-99˚F)[d]	5	10
Elastic bandages (2, 4, and 6 inch)	3 each	6 each
Gauze pads (4 x 4 inch)	1/2 case	1 case
Adhesive tape (1.5 inch)	1/2 case	1 case
Skin disinfectant	1 l	2 l
Surgical soap	1/2 case	1case
Band-aids	110	220
Moleskin	1/2 case	1 case
Petroleum jelly, ointments	1/2 case	1 case
Disposable latex gloves	80 pairs	175 pairs
Stethoscopes	1	2
Blood pressure cuffs	1	2
Intravenous (IV) stations[d]	1	2
IV fluid (D5:1/2 NS or D5:NS; 0.5 or 1l)[d]	15[e]	30[e]
Sharps and biohazard disposal containers[d]	1	2
Alcohol wipes	50	100
Small instrument kits	1	1
Athletic trainer's kit	1	1
Podiatrist's kit	1-2	2-4
Inflatable arm and leg splints	2 each	2 each
Tables for medical supplies	1	2
Hose with spray nozzle, running water[e]	1	2
Wading pool for water immersion[d]	1	2
Fans for cooling	1	2-4
Oxygen tanks with regulators and masks	0	2
Crushed ice in plastic bags	7 kg	14 kg
Rehydration fluids	50 l	100 l[e]
Cups (≥0.3l, 10 oz)	1250	2250
Eye drops	1	1
Urine dipsticksd	10	20
Glucose blood monitoring kits[d]	1	2
Inhalation therapy for asthmatics[d]	1	1
EMS ambulance or ACLS station	1	1
Injectable drugs[d]		
Oral drugs[d]		

Table 1 Suggested equipment and supplies per 1,000 runners[a].

[a] Revised from Adner, M. M., J. J. Scarlet, J. Casey, W. Robison, and 8, H. Jones. The Boston Marathon medical care team: ten years of experience. *Physician Sportsmed.* 16:99-106, 1988; Bodishbaugh, R. G. Boston marathoners get red carpet treatment in the medical tent. *Physician Sportsmed.* 16:139-143, 1988; and Noble, H. B. and D. Bachman. Medical aspects of distance race planning. *Physician Sportsmed.* 7:78-84, 1979.
[b] Increase supplies and equipment if the race course is out and back.
[c] At finish area.
[d] Supervised by a physician.
[e] Depends on environmental conditions.

3. Universal Precautions

All medical personnel may encounter blood-borne pathogens or other potentially infectious materials, and should observe the following precautions (53, 63):

a. Receive immunization against the hepatitis B virus prior to the event.

b. Recognize that blood and infectious body fluids may be encountered from needle sticks, cuts, abrasions, blisters, and clothing.

c. Reduce the likelihood of exposure by planning tasks carefully (i.e., prohibiting recapping of needles by a two-handed technique, minimizing splashing and spraying).

d. Wear personal protective equipment such as gloves, gowns, face shields and eye protection. Remove this equipment and dispose/ decontaminate it prior to leaving the work area.

e. Wash hands after removing gloves or other personal protective equipment.

f. Dispose of protective coverings, needles, scalpels, and other sharp objects in approved, labeled biohazard containers.

g. Do not eat, drink, smoke, handle contact lenses, or any cosmetics/ lip balm in the medical treatment area.

h. Decontaminate work surfaces, bins, pails, and cans [1/10 solution of household bleach (sodium hypochlorite) in water] after completion of procedures.

4. Fluid Stations

a. At the start and finish areas provide 0.34-0.45 1 (12-16 oz) of fluid per runner. At each fluid station on the race course (2-3 km apart), provide 0.28-0.34 1 (10-12 oz) of fluid per runner. Provide both water and a carbohydrate-electrolyte beverage in equal volumes.

b. In cool or cold weather [≤10˚C (50˚F)], an equivalent amount of warm fluid should be available.

c. Number of cups (>0.3 1, 10 oz) per fluid station on the course = number of entrants + 25% additional for spillage and double use. Double this total if the course is out and back.

d. Number of cups at start and finish area = (2 × number of entrants) + 25% additional.

e. Cups should be filled prior to the race and placed on tables to allow easy access. Runners drink larger volumes if volunteers hand them cups filled with fluid.

5. Communications/Surveillance

a. Provide two-way radio or telephone communication between the medical director, medical aid stations, mobile vans, and pick-up vehicles.

b. Arrange for radio-equipped vehicles to drive the race course (ahead and behind participants) and provide communication with the director and his/her staff. These vehicles should be stationed at regular intervals along the course to search the course for competitors who require emergency care and encourage compromised runners to stop.

c. Place radio-equipped observers along the course.

d. Notify local hospitals, police, and fire-rescue departments of the time of the event, number of participants, location of aid stations, extent of medical coverage, and the race course.

e. Use the emergency response system (telephone number 911) in urban areas.

6. Instructions to Runners

a. Advise each race participant to print name, address, telephone number, and medical problems on the back of the race number (pinned to the body). This permits emergency personnel to quickly identify unconscious runners. Inform emergency personnel that this information exists.

b. Inform race participants of potential medical problems at pre-race conferences and at the starting line. Signed registration forms should clearly state the types of heat or cold injuries that may arise from participation in this event.

c. Provide pre-event recommendations regarding training, fluid consumption, clothing selection, self-care, heat acclimatization, and signs or symptoms of heat/cold illness (88).

d. The race director should announce the following information to all participants by loudspeaker immediately prior to the race:

- Current and predicted maximum (or minimum) temperature, humidity, wind speed, and cloud cover;
- The WBGT category and the risks for hyperthermia or hypothermia (see Appendix 1);
- Location of aid stations, types of assistance, and fluid availability;
- Signs and symptoms of heat or cold illness;
- Recommended clothing;
- The need for fluid replacement before, during, and after the race;
- The policy of race monitors to stop runners who are ill;
- A request that runners seek help for impaired competitors who appear ill, who are not coherent, who run in the wrong direction, or who exhibit upper-body swaying and poor competitive posture;

- A warning to novice runners entering their first race that they should run at a comfortable pac and run with a partner;
- Warnings to runners who are taking medications or have chronic illnesses (asthma, hypertension, diabetes, cardiovascular problems).

This position stand replaces the 1987 ACSM position paper, "The Prevention of Thermal Injuries During Distance Running." This pronouncement was reviewed for the American College of Sports Medicine by members-at-large, the Pronouncements Committee, and by: Arthur E. Crago, M.D., Stafford W. Dobbin, M.D., Mary L. O'Toole, Ph.D., FACSM, LTC Katy L. Reynolds, M.D., John W. Robertson, M.D., FACSM.

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Appendix 1: Measurement of Environmental Stress

Ambient temperature is only one component of environmental heat or cold stress; others are humidity, wind speed, and radiant heat. The most widely used heat stress index is the wet bulb globe temperature (WBGT) index (96):

$$WBGT = (0.7\ T^{wb}) + (0.2\ T^{g}) + (0.\ 1\ T^{db})$$

where T^{wb} is the wet bulb temperature, T^{g} is the black globe temperature, and T^{db} is the shaded dry bulb temperature (28). T^{db} refers to air temperature measured with a standard dry bulb thermometer not in direct sunlight. T^{wb} is measured with a water-saturated cloth wick over a dry bulb thermometer (not immersed in water). T^{g} is measured by inserting a dry bulb thermometer into a standard black metal globe. Both T^{wb} and ^{T} are measured in direct sunlight.

A portable monitor that gives the WBGT index in degrees Celsius or degrees Fahrenheit has proven useful during races and in military training (28, 44, 87, 96). The measurement of air temperature alone is inadequate. The importance of humidity in total heat stress can be readily appreciated because T^{wb} accounts for 70% of the index whereas T^{db} accounts for only 10%.

The risk of heat illness (while wearing shorts, socks, shoes, and a t-shirt) due to environmental stress should be communicated to runners in four categories (see Fig. 1):

- Very high risk: WBGT above 28°C (82°F); high risk: WBGT 23-28°C (73-82°F);
- Moderate risk: WBGT 18-23°C (65-73°F);
- Low risk: WBGT below 18°C (65°F).

Large signs should be displayed, at the start of the race and at key points along the race course, to describe the risk of heat exhaustion and heatstroke (Fig. 1). When the WBGT index is above 28°C (82°F), the risk of heat exhaustion or heatstroke is very high; it is recommended that the race be postponed until less stressful conditions prevail, rescheduled, or canceled. High risk [WBGT index = 23-28°C (73-82°F)] indicates that runners should be aware that heat exhaustion or heatstroke may be experienced by any participant; anyone who is particularly sensitive to heat or humidity probably should not run. Moderate risk [WBGT index = 18-23°C (65-73°F)] reminds runners that heat and humidity will increase during the course of the race if conducted during the morning or early afternoon. Low risk [WBGT index below 18°C (65°F)] does not guarantee that heat exhaustion (even heatstroke, see ref. 5, 32) will not occur; it only indicates that the risk is low.

The risk of hypothermia (while wearing shorts, socks, shoes, and a t-shirt) also should be communicated to runners. A WBGT index below 10°C (50°F) indicates that hypothermia may occur in slow runners who run long distances, especially in wet and windy conditions. Core body temperatures as low as 92°F have been observed in 65°F conditions (74).

Section Six

REFERENCES AND WEB SITES

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American College of Sport Medicine (ACSM)

www.acsm.org

American Sport Education Program

www.asep.com

Gatorade Sport Science Institute (GSSI)

www.gssiweb.com

Human Kinetics

www.humankinetics.com

National Athletic Trainers Association (NATA)

www.nata.org

National Strength and Conditioning Association (NSCA)

www.nsca-lift.org

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Heat Stroke

Heat stroke occurs when the body is unable to regulate its temperature. The body's temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down. Body temperature may rise to 106°F or higher within 10 to 15 minutes. Heat stroke can cause death or permanent disability if emergency treatment is not provided.

Recognizing Heat Stroke

Warning signs of heat stroke vary but may include the following:

- An extremely high body temperature (above 103°F, orally)
- Red, hot, and dry skin (no sweating)
- Rapid, strong pulse
- Throbbing headache
- Dizziness
- Nausea
- Confusion
- Unconsciousness

What to Do

If you see any of these signs, you may be dealing with a life-threatening emergency. Have someone call for immediate medical assistance while you begin cooling the victim. Do the following:

- Get the victim to a shady area.
- **Cool the victim rapidly using whatever methods you can.** For example, immerse the victim in a tub of cool water; place the person in a cool shower; spray the victim with cool water from a garden hose; sponge the person with cool water; or if the humidity is low, wrap the victim in a cool, wet sheet and fan him or her vigorously.
- Monitor body temperature, and continue cooling efforts until the body temperature drops to 101-102°F.
- If emergency medical personnel are delayed, call the hospital emergency room for further instructions.
- Do not give the victim alcohol to drink.

- Get medical assistance as soon as possible.

Sometimes a victim's muscles will begin to twitch uncontrollably as a result of heat stroke. If this happens, keep the victim from injuring himself, but do not place any object in the mouth and do not give fluids. If there is vomiting, make sure the airway remains open by turning the victim on his or her side.

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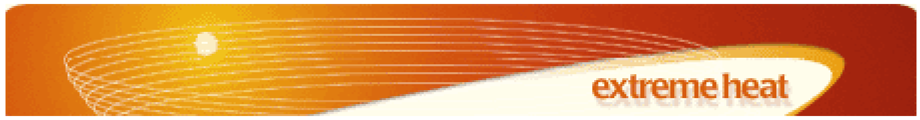

Heat Rash

Heat rash is a skin irritation caused by excessive sweating during hot, humid weather. It can occur at any age but is most common in young children.

Recognizing Heat Rash

Heat rash looks like a red cluster of pimples or small blisters. It is more likely to occur on the neck and upper chest, in the groin, under the breasts, and in elbow creases.

What to Do

The best treatment for heat rash is to provide a cooler, less humid environment. Keep the affected area dry. Dusting powder may be used to increase comfort, but avoid using ointments or creams -- they keep the skin warm and moist and may make the condition worse.

Treating heat rash is simple and usually does not require medical assistance. Other heat-related problems can be much more severe.

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Heat Cramps

Heat cramps usually affect people who sweat a lot during strenuous activity. This sweating depletes the body's salt and moisture. The low salt level in the muscles causes painful cramps. Heat cramps may also be a symptom of heat exhaustion.

Recognizing Heat Cramps

Heat cramps are muscle pains or spasms -- usually in the abdomen, arms, or legs -- that may occur in association with strenuous activity. If you have heart problems or are on a low-sodium diet, get medical attention for heat cramps.

What to Do

If medical attention is not necessary, take these steps:

- Stop all activity, and sit quietly in a cool place.
- Drink clear juice or a sports beverage.
- Do not return to strenuous activity for a few hours after the cramps subside, because further exertion may lead to heat exhaustion or heat stroke.
- Seek medical attention for heat cramps if they do not subside in 1 hour.

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Sunburn

Sunburn should be avoided because it damages the skin. Although the discomfort is usually minor and healing often occurs in about a week, a more severe sunburn may require medical attention.

Recognizing Sunburn

Symptoms of sunburn are well known: skin becomes red, painful, and abnormally warm after sun exposure.

What to Do

Consult a doctor if the sunburn affects an infant younger than 1 year of age or if these symptoms are present:

- Fever
- Fluid-filled blisters
- Severe pain

Also, remember these tips when treating sunburn:

- Avoid repeated sun exposure.
- Apply cold compresses or immerse the sunburned area in cool water.
- Apply moisturizing lotion to affected areas. Do not use salve, butter, or ointment.
- Do not break blisters.

Click here for more information about skin cancer prevention.

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Heat Exhaustion

Heat exhaustion is a milder form of heat-related illness that can develop after several days of exposure to high temperatures and inadequate or unbalanced replacement of fluids. Those most prone to heat exhaustion are elderly people, people with high blood pressure, and people working or exercising in a hot environment.

Recognizing Heat Exhaustion

Warning signs of heat exhaustion include the following:

- Heavy sweating
- Paleness
- Muscle cramps
- Tiredness
- Weakness
- Dizziness
- Headache
- Nausea or vomiting
- Fainting

The skin may be cool and moist. The victim's pulse rate will be fast and weak, and breathing will be fast and shallow. If heat exhaustion is untreated, it may progress to heat stroke. Seek medical attention immediately if any of the following occurs:

- Symptoms are severe.
- The victim has heart problems or high blood pressure.

Otherwise, help the victim to cool off, and seek medical attention if symptoms worsen or last longer than 1 hour.

What to Do

Cooling measures that may be effective include the following:

- Cool, nonalcoholic beverages, as directed by your physician
- Rest
- Cool shower, bath, or sponge bath

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Tips on Preventing and Managing Heat

The best defense is prevention. Here are some prevention tips:

- Drink more fluids (nonalcoholic), regardless of your activity level. Don't wait until you're thirsty to drink. Warning: If your doctor generally limits the amount of fluid you drink or has you on water pills, ask him how much you should drink while the weather is hot.
- Don't drink liquids that contain caffeine, alcohol, or large amounts of sugar–these actually cause you to lose more body fluid. Also, avoid very cold drinks, because they can cause stomach cramps.
- Stay indoors and, if at all possible, stay in an air-conditioned place. If your home does not have air conditioning, go to the shopping mall or public library–even a few hours spent in air conditioning can help your body stay cooler when you go back into the heat. Call your local health department to see if there are any heat-relief shelters in your area.
- Electric fans may provide comfort, but when the temperature is in the high 90s, fans will not prevent heat-related illness. Taking a cool shower or bath, or moving to an air-conditioned place is a much better way to cool off.
- Wear lightweight, light-colored, loose-fitting clothing.
- NEVER leave anyone in a closed, parked vehicle.
- Although any one at any time can suffer from heat-related illness, some people are at greater risk than others. Check regularly on:
  - Infants and young children
  - People aged 65 or older
  - People who have a mental illness
  - Those who are physically ill, especially with heart disease or high blood pressure
- Visit adults at risk at least twice a day and closely watch

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them for signs of heat exhaustion or heat stroke. Infants and young children, of course, need much more frequent watching.

If you must be out in the heat:

- Limit your outdoor activity to morning and evening hours.
- Cut down on exercise. If you must exercise, drink two to four glasses of cool, nonalcoholic fluids each hour. A sports beverage can replace the salt and minerals you lose in sweat. Warning: If you are on a low-salt diet, talk with your doctor before drinking a sports beverage. Remember the warning in the first "tip" (above), too.
- Try to rest often in shady areas.
- Protect yourself from the sun by wearing a wide-brimmed hat (also keeps you cooler) and sunglasses and by putting on sunscreen of SPF 15 or higher (the most effective products say "broad spectrum" or "UVA/UVB protection" on their labels).

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Outdoor Action Guide to Heat-Related Illnesses& Fluid Balance

by Rick Curtis

Heat injuries can be immediately life-threatening. Be aware of the temperature conditions and your hydration levels. The information provided here is designed for educational use only and is not a substitute for specific training or experience. Princeton University and the author assume no liability for any individual's use of or reliance upon any material contained or referenced herein. This article is prepared to provide basic information about heat related illnesses for the lay person. Medical research is always expanding our knowledge of the causes and treatment. It is your responsibility to learn the latest information. The material contained in this article may **not** be the most current.

Fluid Balance

All the body's fluids make up one large body fluid pool. Losses of fluid from any one source is reflected in the levels of all the body's other fluids: e.g. profuse sweating will ultimately result in decreased blood volume. If a patient loses enough fluid through any manner-bleeding, sweating, vomiting, or diarrhea-the end result is the same: dehydration and, potentially, volume shock. Adequate fluid is also critically important in hot environments to help our body thermoregulate (see Heat Illnesses page 00). Remember, dehydration can kill!

If someone is chronically losing fluid (from diarrhea or vomiting), then you have a real emergency on your hands. Treat the cause of the fluid lose as best you can (see Shock page 00, Bleeding page 00, Heat Illnesses page 00, Abdominal Infections page 00) and rehydrate the patient. **Be prepared to evacuate your patient.**

Dehydration is always easier to prevent than it is to treat. So it is important to ensure that all members of your group replace their regular fluid losses by drinking adequate amounts of water (see below). Your body absorbs fluids best when you drink frequently and in small amounts rather than drinking large amounts at one time. It also helps with fluid absorption if you drink while eating. A pinch of salt and sugar in the water will do if no food is available. Very dilute mixtures of sports drinks like Gatorade® (add just enough to taste) work well for this purpose.

Don't depend on feeling thirsty to tell you when to drink. Thirst is a late response of the body to fluid depletion. Once you feel thirsty, you are already low on fluids. The best indicator of proper fluid levels is urine output and color. You, and all the people in your group should strive to be "copious and clear." Ample urine that is light colored to clear shows that the body has plenty of fluid. Dark urine means that the body is low on water, and is trying to conserve its supply by hoarding fluid which means that urine becomes more concentrated (thereby darker).

Basic Fluid Recommendations

Season/Weather	Quarts/day	Explanation
Fall & Spring Backpacking***<B/**	2-3 quarts 1.8-2.8 liters	This is what an average person will need on a daily basis in general temperate conditions.
Hot Weather Backpacking*****	3-4 quarts 2.8-3.7 liters	In hot and humid weather you are losing additional fluid through sweating which must be replaced.
Winter Backpacking*****	3-4 quarts 2.8-3.7 liters	In the winter time you are losing moisture through evaporation to the dry air and especially through respiration. Dry air entering the lungs heats up and is exhaled saturated with moisture.
***All Seasons**	Add 1quart 1.8 liters	At high altitude the body looses more fluid. Increase your fluid intake if you are traveling at high altitudes (over 8,000 feet/2,438 meters)

Table 9.1

Fluids & Salts:

Another factor in overall fluid balance is the replacement of salts lost to sweat. In most cases the salts found in normal food consumption is adequate for salt replacement. In the event of severe dehydration, a solution of ½ teaspoon salt and ½ teaspoon of baking soda per quart/liter of water can be used to replace lost fluid and salt. Use lukewarm fluids. Discontinue the fluids if the person becomes nauseated or vomits. Restart fluids as soon as the person can tolerate it.

Thermoregulation

The body has a number of mechanisms to properly maintain its optimal core temperature of 98.6° F (37° C). Above 105° F (40° C) many body enzymes become denatured and chemical reactions cannot take place leading to death. Below 98.6° F (37° C) chemical reactions slow down with various complications which can lead to death. Understanding thermoregulation is important to understanding Heat Illnesses and Cold Injuries.

How Your Body Regulates Core Temperature:

- **Vasodilation** - increases surface blood flow which increases heat loss (when ambient temperature is less that body temperature).
- **Vasoconstriction** - decreases blood flow to periphery, decreases heat loss.
- **Sweating** - cools body through evaporative cooling
- **Shivering** - generates heat through increase in chemical reactions required for muscle activity. Visible shivering can maximally increase surface heat production by 500%. However, this is limited to a few hours because of depletion of muscle glucose and the onset of fatigue.

- **Increasing/Decreasing Activity** will cause corresponding increases in heat production and decreases in heat production.
- **Behavioral Responses** - putting on or taking off layers of clothing will result in thermoregulation

Cold Challenge

Whenever you go into an environment that is less than your body temperature, you are exposed to a Cold Challenge. As long as your levels of Heat Production and Heat Retention are greater than the Cold Challenge, then you will be thermoregulating properly. If the Cold Challenge is greater than your combined Heat Production and Heat Retention, then you susceptible to a cold illness such as hypothermia or frostbite (see Table 9.3).

Cold Challenge - (negative factors)

- Temperature
- Wet (rain, sweat, water)
- Wind (see Table 9.3 Wind Chill Table)

Heat Retention - (positive factors)

- Body Size/shape - your surface to volume ratio effects how quickly you lose heat.
- Insulation - type of clothing layers
- Body Fat - amount of body fat also effects how quickly you lose heat.
- Shell/Core Response - allows the body shell to act as a thermal barrier

Heat Production - (positive factors)

- Exercise
- Shivering

Heat Retention	+	Heat Production	<	Cold Challenge	=	Cold Injury
Body Size/shape Insulation Body Fat Body shunting blood to the core		Exercise Shivering		Temperature Wetness Wind		Hypothermia Frostbite

Table 9.2

Wind Chill

Wind Chill can have a major impact on heat loss through convection (see Chapter 2 - Equipment: Regulating Your Body Temperature). As air heated by your body is replaced with cooler air pushed by the wind, the amount of heat you can lose in a given period of time increases. This increase is comparable to the amount of heat you would lose at a colder temperature with no wind. The Wind Chill factor is a scale that shows the equivalent temperature given a particular wind speed.

Heat Challenge

In hot weather, especially with and humidity, you can lose a great deal of body fluid through exercise. This can lead to a variety of heat related illnesses including Heat Exhaustion and Heat Stroke. Heat Challenge is a combination of a number of external heat factors. Balanced against this Heat Challenge is your body's methods of Heat Loss (passive and active). When Heat Challenge is greater than Heat Loss, you are at risk for a heat-related injury (see Table 9.4). In order to reduce the risk you need to either decrease the Heat Challenge or increase your Heat Loss. Fluids are a central part of exercising in a Heat Challenge (see Fluids above).

Heat Challenge - (negative factors)

- Temperature
- Exercise
- Humidity (see Table 9.5 Heat Index Table)
- Body Wetness from sweating
- Wind (see Table 9.3 Wind Chill Table)

Passive Heat Loss - (positive factors)

- Body Size/shape - your surface to volume ratio effects how quickly you lose heat.
- Insulation - type of clothing layers
- Body Fat - amount of body fat also effects how quickly you lose heat.
- Shell/Core Response - allows the body shell to act as a thermal barrier
-

Active Heat Loss - (positive factors)

- Radiant Heat from the body.
- Sweating which causes heat loss through evaporation. Amount of sweating is limited by:
    - Fluid Levels
    - Level of Fitness

Passive Heat Loss	+	**Active Heat Loss**	<	**Heat Challenge**	=	**Heat Injury**
Body Size/shape Insulation Body Fat Body shunting blood to the core		Radiant Heat Sweating		Temperature Exercise Humidity Body Wetness Wind		Heat Syncope Heat Exhaustion Heat Stroke

Table 9.4

The Heat Index:

Ambient temperature is not the only factor that plays a role in creating the potential for heat injuries, humidity is also important. Since our bodies rely on the evaporation of sweat as a major method of cooling, high humidity reduces our ability to cool the body, increasing the risk of heat illnesses. The Heat Index shows the relative effects of temperature and humidity (see Table 9.5).

The Heat Index											
	Environmental Temperature Fº (Cº)										
	70º (21)	75º(24)	80º(27)	85º(29)	90º(32)	95º(35)	100º(38)	105º(41)	110º(43)	115º(46)	120º(49)
Relative Humidity	**Apparent Temperature Fº (Cº)**										
0%	64&ord	69&ord	73&ord	78&ord	83&ord	87&ord	91&ord	95&ord	99&ord	103&ord	107&ord

	m;(18)	m;(20)	m;(23)	m;(26)	m;(28)	m;(31)	m;(33)	m;(35)	m;(37)	m;(39)	m;(42)
10%	65&ord m;(18)	70&ord m;(21)	75&ord m;(24)	80&ord m;(27)	85&ord m;(29)	90&ord m;(33)	95&ord m;(35)	100&ord m;(38)	105&ord m;(41)	111&ord m;(44)	116&ord m;(47)
20%	66&ord m;(19)	72&ord m;(22)	77&ord m;(25)	82&ord m;(28)	87&ord m;(30)	93&ord m;(33)	99&ord m;(37)	105&ord m;(41)	112&ord m;(44)	120&ord m;(49)	130&ord m;(54)
30%	67&ord m;(19)	73&ord m;(23)	78&ord m;(26)	84&ord m;(29)	90&ord m;(33)	96&ord m;(36)	104&ord m;(40)	113&ord m;(45)	123&ord m;(51)	135&ord m;(57)	148&ord m;(64)
40%	68&ord m;(20)	74&ord m;(23)	79&ord m;(26)	86&ord m;(30)	93&ord m;(34)	101&ord m;(38)	110&ord m;(43)	123&ord m;(56)	137&ord m;(58)	151&ord m;(66)	
50%	69&ord m;(20)	75&ord m;(24)	81&ord m;(27)	88&ord m;(31)	96&ord m;(36)	107&ord m;(42)	120&ord m;(49)	135&ord m;(57)	150&ord m;(66)		
60%	70&ord m;(21)	76&ord m;(24)	82&ord m;(28)	90&ord m;(33)	100&ord m;(38)	114&ord m;(46)	132&ord m;(56)	149&ord m;(65)			
70%	70&ord m;(21)	77&ord m;(25)	85&ord m;(29)	93&ord m;(34)	106&ord m;(41)	124&ord m;(51)	144&ord m;(62)				
80%	71&ord m;(22)	78&ord m;(26)	86&ord m;(30)	97&ord m;(36)	113&ord m;(45)	136&ord m;(58)					
90%	71&ord m;(22)	79&ord m;(26)	88&ord m;(31)	102&ord m;(39)	122&ord m;(50)						
100%	72&ord m;(22)	80&ord m;(27)	91&ord m;(33)	108&ord m;(42)							

Apparent Temperature	**Heat-stress risk with physical activity and/or prolonged exposure.**
90º-104º (32-40)	Heat cramps or Heat Exhaustion possible
105º-130º (31-54)	Heat cramps or Heat Exhaustion likely. Heat Stroke possible.
130º and up (54 and up)	Heat Stroke very likely.

Caution: This chart provides guidelines for assessing the potential severity of heat stress. Individual reactions to heat will vary. Heat illnesses can occur at lower temperature than indicated on this chart. Exposure to full sunshine can increase values up to 15º F.

Table 9.5

Heat Illnesses

Heat illnesses are the result of elevated body temperatures due to an inability to dissipate the body's heat and/or a decreased fluid level. Always remember that mild heat illnesses have the potential of becoming severe life threatening emergencies if not treated properly (See Fluid Balance above).

Heat Cramps

Heat cramps are a form of muscle cramp brought on by exertion and insufficient salt.

Heat Cramps Treatment

Replace salt and fluid (see Fluid Balance) and stretch the muscle (See Chapter 6 - Wilderness Travel & Camping: Stretching). Kneading and pounding the muscle is less effective than stretching and probably contributes to residual soreness.

Heat Syncope

Heat Syncope (fainting) is a mild form of heat illness which results from physical exertion in a hot environment. In an effort to increase heat loss, the skin blood vessels dilate to such an extent that blood flow to the brain is reduced, resulting in symptoms of faintness, dizziness, headache, increased pulse rate, restlessness, nausea, vomiting, and possibly even a brief loss of consciousness. Inadequate fluid replacement which leads to dehydration contributes significantly to this problem.

Heat Syncope Treatment

Heat Syncope should be treated as fainting (See Fainting). The person should lie or sit down, preferably in the shade or in a cool environment. Elevate the feet and give fluids, particularly those containing salt (commercial "rehydration" mix or ½ teaspoon salt and ½ teaspoon baking soda per quart/0.9 liter) (see Fluid Balance page 00). **The patient should not engage in vigorous activity for at least the rest of that day.** Only after s/he has completely restored his/her body fluids and salt and has a normal urinary output should exercise in a hot environment be resumed (and then cautiously).

Heat Exhaustion

This occurs when fluid losses from sweating and respiration are greater than internal fluid reserves (volume depletion). Heat Exhaustion is really a form of volume shock. The lack of fluid causes the body to constrict blood vessels especially in the periphery (arms and legs). To understand Heat Exhaustion think of a car with a radiator leak pulling a trailer up a mountain pass. There is not enough fluid in the system to cool off the engine so the car overheats. Adding fluid solves the problem.

The signs and symptoms of Heat Exhaustion are:

- Sweating
- Skin - Pale, clammy (from peripheral vasoconstriction)
- Pulse - Increased
- Respirations - Increased
- Temperature - normal or slightly elevated
- Urine Output - Decreased
- Patient feels weak, dizzy, thirsty, "sick," anxious
- Nausea and vomiting (from decreased circulation in the stomach)

Heat Exhaustion Treatment

Victims of Heat Exhaustion must be properly re-hydrated and must be very careful about resuming physical activity (it is best to see a physician before doing so). Treatment is as described above for Heat Syncope, but the person should be **more** conservative about resuming physical activity to give the body a chance to recover. Have the person rest (lying down) in the shade. Replace fluid with a water/salt solution (commercial "rehydration" mix or ½ teaspoon salt and ½ teaspoon baking soda per quart/0.9 liter) (see Fluid Balance page 00). Drink slowly, drinking too much, too fast very often causes nausea and vomiting.

Evacuation usually is not necessary. Heat Exhaustion can become Heat Stroke if not properly treated (see Heat Stroke below). **A victim of Heat Exhaustion should have be closely monitored to make sure that their temperature does not go above 103° F (39° C) If it does so, treat the person for Heat Stroke as described below.**

<u>Heat Stroke - Hyperthermia</u>

Heat Stroke is one of the few life threatening medical emergencies. A victim can die within minutes if not properly treated. Heat Stroke is caused by an increase in the body's core temperature. Core temperatures over 105° (41° C) can lead to death. The rate of onset of Heat Stroke depends on the individual's fluid status. To understand Heat Stroke think of that same car pulling a trailer up a mountain pass on a hot day. This time the radiator has plenty of fluid, but the heat challenge of the engine combined with the external temperature is too much. The engine can't great rid of the heat fast enough and the engine overheats. There are two types of Heat Stroke-fluid depleted (slow onset) and fluid intact (fast onset).

- **<u>Fluid depleted</u>** - The person has Heat Exhaustion due to fluid loss from sweating and/or inadequate fluid replacement, but continues to function in a heat challenge situation. Ultimately, the lack of fluid has minimized the body's active heat loss capabilities to such an extent that the internal core temperature begins to rise. Example: a cyclist on a hot day with limited water.

- **<u>Fluid intact (fast onset)</u>** - The person is under an extreme heat challenge. The heat challenge overwhelms the body's active heat loss mechanisms even though the fluid level is sufficient. Example: a cyclist pushing hard on a 104° F day (40° C).

<u>Signs & Symptoms of Heat Stroke</u>

- **The key to identifying Heat Stroke is hot skin**. Some victims may have hot, dry skin, others may have hot, wet skin because they have just moved from Heat Exhaustion to Heat Stroke.

- Peripheral vasoconstriction (skin gets pale)

- Pulse Rate - increased

- Respiratory Rate - increased

- Urine Output - decreased

- Temperature - increased (may be over 105° F/41° C)

- Skin - may be wet or dry, flushed

- AVPU - Severe changes in mental status and motor/sensory changes, then the person may become comatose, possibility of seizures.

- Pupils - may be dilated and unresponsive to light

<u>Heat Stroke Treatment</u>

- **Efforts to reduce body temperature must begin immediately!** Move the patient (gently) to a cooler spot or shade the victim. Remove clothing. Pour water on the extremities and fan the person to increase air circulation and evaporation. Or cover the extremities with cool wet cloths and fan the patient. Immersion in cool **(not cold)** water is also useful. During cooling the extremities should be massaged vigorously to help propel the cooled blood back into the core.

- After the temperature has been reduce to 102° F (39° C), active cooling should be reduced to avoid hypothermia (shivering produces more heat). The patient must be monitored closely to make sure that temperature does not begin to go up again.

- Volume replacement - the victim will probably need fluid regardless of the type of onset.
- Basic life support, CPR if needed.
- Afterwards there can be serious medical problems. **Prepare to evacuate your patient.**
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IMMDA ADVISORY STATEMENT ON
GUIDELINES FOR FLUID REPLACEMENT DURING MARATHON RUNNING

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SUMMARY

During endurance exercise about 75% of the energy produced from metabolism is in the form of heat, which cannot accumulate. The remaining 25% of energy available can be used for movement. As running pace increases, the rate of heat production increases. Also, the larger one's body mass, the greater the heat production at a particular pace. Sweat evaporation provides the primary cooling mechanism for the body, and for this reason athletes are encouraged to drink fluids to ensure continued fluid availability for both evaporation and circulatory flow to the tissues. Elite level runners could be in danger of heat illness if they race too quickly in hot/humid conditions, and may collapse at the end of their event. Most marathon races, however, are scheduled at cooler times of the year or day, so that heat loss to the environment is adequate. Typically however, this post-race collapse is due simply to postural hypotension from decreased skeletal muscle massage of the venous return circulation to the heart upon stopping. Elite athletes manage adequate hydration by ingesting about 200 – 800 ml per hour, and such collapse is rare. Athletes "back in the pack," however, are moving at a much slower pace, with heat accumulation unlikely and drinking much easier to manage. They are often urged to drink "as much as possible," ostensibly to prevent dehydration from their hours out on the race course. Excessive drinking among these participants can lead to hyponatraemia severe enough to cause fatalities. Thus, a more reasonable approach is to urge these participants not to drink as much as possible but to drink *ad libitum* no more than 400 – 800 ml per hour.

HISTORICAL BACKGROUND: IMMDA AND AIMS

The International Marathon Medical Directors Association (IMMDA) was formed as the Consulting Medical Committee of the Association of International Marathons (AIMS). AIMS is a global organization of marathons and other road races, formed in May, 1982. The purpose of AIMS is to i) foster and promote marathon running throughout the world, ii) recognize and work with the International Association of Athletics Federations (IAAF) as the sport's world governing body on all matters relating to international marathons, and iii) exchange information, knowledge, and expertise among its member events. Starting with scarcely a dozen members, AIMS' current roster numbers approximately 150 events which are conducted on all 7 continents and which includes the world's largest and most prestigious marathons.

The purpose of IMMDA is to i) promote and study the health of long distance runners, ii) promote research into the cause and treatment of running injuries, iii) prevent the occurrence of injuries during mass participation runs, iv) offer guidelines for the provision of uniform marathon medical services throughout the world, and v) promote a close working relationship between race and medical directors in achieving the above four goals. This Advisory Statement on Guidelines for Fluid Replacement During Marathon Running continues a series of periodic informational and advisory pieces prepared occasionally by IMMDA to provide timely, needed, and practical information for the health and safety of runners participating in AIMS events in particular, but applicable to other distance running races as well.

THE CHANGING NATURE OF PARTICIPATION IN MARATHON RACES

During the 1970s a major development in the worldwide fitness movement saw the creation of so-called "Big City Marathons," in which thousands of fitness enthusiasts joined elite athletes in the grueling challenge of completing a 42.195 km (26.22 mi) trip on foot through city streets. The first of these occurred in 1976 when the New York City Marathon changed its course from several loops around its Central Park to become a tour of the town covering all 5 of its boroughs. Prior to the early 1970s, relatively few marathons were staged around the world on an annual basis, and they were small, with participation numbering from the dozens into the hundreds. The competitors entered were talented athletes, well-trained and dedicated, including some hoping to earn berths on national traveling teams to major regional or world competitions such as the Olympic, Pan American, and Commonwealth Games, European Championships, and the like. The Boston Marathon was the largest of these, and as shown in Table 1, so talented was the field that the race was finished by 3 ½ hours. Women seldom participated until the mid-1970's.

The 1976 New York City Marathon thus added the element of a giant physical fitness participation spectacle to what previously was a purely athletic event, and its popularity gave it steady growth. Table 1 shows the numbers of finishers sorted by 30-minute time groupings for the 1978 and 2001 editions of this race as a means for comparing its changing participatory dynamics over time. Notice first the enormous size that can be attained by today's marathons; the New York City Marathon is often among the one or two world's largest such events. Second, notice the longer time required by the bulk of the runners in 2001 to complete the distance as compared with that in 1978 - at least 60 minutes or more. Just the opposite might have been expected, i.e. the increasing popularity of marathon racing over the years ought to have produced faster times for participants rather than slower. Indeed, this has occurred among the several dozen invited elite-level runners up front, but it appears that the "back-in-the-pack" marathon runners are delivering slower performances. They either have less inherent talent, or are doing less training, or both. Study of the race demographics does show among today's participants a large percentage who are engaging in "running tourism" or who are "running for a charitable cause," and thus for whom simply finishing is satisfaction enough.

This increased event size has of necessity resulted in an enormous expansion of medical support services for participants, especially during and immediately following these races. Much of this medical support has consisted of fluids (water plus electrolyte and energy-containing beverages) at so-called "aid stations" along the course. This is because the current approach to drinking, especially during the race has become quite the opposite to that advocated in the 1960's and early 1970's. The current paradigm is that athletes should drink "as much as possible" during lengthy endurance exercise such as marathon running (3-6).

The purpose of this IMMDA Advisory Statement is to provide a caution against this paradigm, due to the recent realization that athletes – particularly the slower ones - can drink so much during prolonged exercise that potentially fatal consequences can result (7-14). The previously accepted guidelines for fluid replacement during more prolonged exercise thus require timely and meaningful revision. This Advisory Statement covers both social recreational running/racing as well as the more disciplined training done by elite-level athletes and also essentially sedentary people becoming military basic training recruits (12,13). Perusal of the several revisions of published guidelines by the American College of Sports Medicine (ACSM) for fluid replacement during exercise (3-6) indicates that they are more laboratory-evidence-based than clinical-evidence-based (15,16). Although they indeed promote the wise doctrine that athletes do need to drink generously during exercise, a substantial and increasing body of evidence shows that harm can occur (7-9) from excessive drinking by endurance fitness enthusiasts requiring 4 or more hours to complete events such as a marathon footrace. This Advisory Statement briefly reviews the literature on this topic, describing how the interpretation of experimental data by itself has failed to adequately explain physiological adjustments occurring in the body during exercise that causes heat gains and fluid losses.

LABORATORY VERSUS CLINICAL OBSERVATIONS REGARDING ENDURANCE EXERCISE PERFORMANCE

Laboratory Studies

The logic for suggesting that athletes should drink copious amounts of fluids during prolonged exercise such as marathon running likely stems from publication of laboratory research as early as 1969, which showed a relationship between the extent of dehydration that developed during exercise and the rise in rectal (core body) temperature (17-21). The sensible conclusion was that dehydration was the single greatest risk to the health of marathon runners because it would cause the body temperature to rise, leading to heat illness, including heatstroke (4-6,16-18). A related conclusion was that marathon runners who collapsed during or after races were suffering from dehydration-induced heat illness, the urgent treatment for which logically would include rapid intravenous fluid therapy (22). Further laboratory studies showed that the complete repletion of fluid losses during exercise maintained more normal cardiovascular function and lower rectal temperatures than did lesser levels of fluid replacement during exercise (20-21). Hence it was concluded that *complete* replacement of fluid losses during exercise was desirable. Thus, all athletes should be encouraged to drink "as much as possible" during long-lasting endurance exercise (4-6).

However, many of these studies lack practical relevance for advising such copious drinking because they were performed in laboratory temperature/humidity environmental conditions that exceeded the typically cool-to-temperate spring or fall season climate under which most of today's city marathons are conducted (18-21). During these seasons, days with excessive heat production, and with it, the risk of heat illness, are minimal. (Those races contested in regions where the climate is consistently tropical – notably Pacific Rim locations - are held very early in the morning.) Some experimental temperature conditions even exceeded the guidelines for safe exercise proposed by the ACSM in attempting to quantify the thermal challenge.

In addition, many of these studies were performed without adequate convective cooling (16) (facing wind speed), which is another important difference when exercise is performed in the laboratory as opposed to out-of-doors (28). Inadequate convective cooling might explain why the high incidence of dehydration and elevated body temperature, reported in laboratory studies performed under these very warm environmental conditions, has never been confirmed in out-of-doors competitive sport (26,27,29,30). Indeed, the logical conclusion from those studies is that when athlete subjects are allowed to choose their own pacing strategies as they do when participating in out-of-doors competitive sport, then their level of dehydration, as well as their drinking behavioral patterns, becomes a relatively unimportant determinant of the rectal temperature during exercise. A brief review of the physiological relationships between heat production and the development of heat injury is appropriate here.

Physiological Basis for Heat Stress and Heat Illness

The crucial factors that determine the risk of heatstroke are not the levels of dehydration reached during exercise but rather the rate at which the athlete produces heat and the capacity of the environment to absorb that heat. Perhaps the main reason why an incorrect doctrine (that dehydration *alone* causes heatstroke) has been allowed to achieve universal credence is because of the widespread ignorance of the multi-factorial aetiology of heatstroke and, especially, the relative importance of the different aetiological factors.

Several factors more important than dehydration combine their influence to determine when the rate of heat production exceeds the rate of heat loss. The rate of heat production is determined by the athlete's rate of energy expenditure (metabolic rate), which is a function of the athlete's mass and intensity of effort (running speed). Using this logic, the risk of heatstroke will likely be greater in athletes who run 10 km races (42) than when they run marathons, because 10 km race pace is faster than 42.195 km race pace. Heavier athletes will also be at greater risk than lighter athletes when both run at the same speed (41), since they generate more heat when running at the same speed, which cannot accumulate. *The reality is that heatstroke can only occur when the athlete's rate of heat production exceeds the rate at which the excess heat produced during exercise can be dissipated into the environment.*

The capacity of the environment to absorb the heat generated by the athlete during exercise is determined by the environmental temperature and humidity, and by the rate at which the surrounding air courses over the athlete's body, producing cooling by convective heat losses. Thus, in summary, the risk of developing heat stroke is increased:

i) when the exercise intensity is highest, for example in shorter distance races (such as 10 km) rather than in longer distance races including the marathon;

ii) in athletes with greater body mass, who thereby generate more heat than lighter athletes who are running at the same pace;

iii) when the environmental temperature, and most especially the humidity of the air, are increased; and

iv) when the potential for convective cooling is low as occurs under still wind conditions or in laboratory experiments in which there is inadequate convective cooling (16,28).

Practical Clinical Experience

Three compelling sets of clinical and field observations provide evidence against the recommended need for as much fluid replacement as possible during marathon competition. One set of data involves the marked rise in the number of athletes "back in the pack" suffering from fluid overload in marathon and ultramarathon races (Table 2). More than 70 cases of this condition have been described (7-9) since it was first recognized in 1985 (23). The majority of these cases have occurred in athletes in the United States and many of the victims report that they followed the prevailing advice of drinking "as much as possible" during exercise (9). During the same time period, it has been difficult to find any studies in which dehydration has been identified as the sole important causative factor for even a single case of exercise-related heatstroke.

Hence, it appears that the advice to drink copious amounts of fluid during prolonged exercise has generated an iatrogenic disease, the incidence of which has increased sharply in the past 15 years during the same period that this advice has been propagated with increasing enthusiasm. Furthermore, it appears that the medical risks associated with this novel iatrogenic condition exceed the risks associated with the condition for the prevention of which this (harmful) advice was originally formulated. This is particularly unfortunate since there is no credible evidence that high rates of fluid ingestion can influence the risk of heatstroke (22,24,25).

A second body of evidence mitigating against the need for drinking large volumes of fluids during marathon races comes from the observation that this behavior does not appear to have reduced the number of people seeking medical care after marathon and ultramarathon races. Some medical directors have found that advocating a *conservative* rather than an aggressive drinking policy is associated with fewer than expected admissions to the race day medical facilities, if for no other reason than because the incidence of water intoxication is substantially reduced (26,27).

A third set of observations combines physiologic estimates of dehydration with practical experience in working with elite athletes. It is well-known that the level of dehydration that develops during prolonged exercise like marathon running cannot be measured with certainty because it is not determined simply by the amount of weight loss during exercise. This is because the weight lost during exercise includes up to 1 kg of metabolic fuel that is irreversibly oxidized during exercise plus a variable amount of fluid that is stored with glycogen and released during exercise as the stored liver and muscle glycogen stores are oxidized. It has been calculated that an athlete who loses 2 kg of weight during a marathon race would, in fact, be dehydrated by only ~200 g (34) when allowance is made for the weight lost from those other sources.

Interestingly, the average weight loss during marathon races in which athletes drink *ad libitum* and not "as much as possible," is between 2-3 kg, suggesting that these athletes intuitively (and accurately) assess their needs for fluid replacement during exercise. This contrasts to the currently popular dogma which holds that thirst is an inadequate index of the fluid requirements during exercise, and thus athletes who drink only in response to their thirst will become sufficiently dehydrated during exercise that their performances will be impaired and their health placed at risk. Hence they are urged to override their natural inclination and rather to drink "as much as possible". This dogma may in fact not represent what competitive athletes ought to follow.

Athlete interview evidence suggests that world-class runners ingest minimal fluid volume during their competitive races, primarily because of the difficulty of such ingestion when racing at the high exercise intensities (~85% of maximum oxygen consumption) and fast running speeds necessary to achieve success in top-level races. As examples, for the men, a 2:06:00 marathon represents a pace of 2:59 per km (4:48 per mile) or a velocity of 20.1 km per hour (12.5 miles per hour). For the women, a 2:23:00 marathon represents a pace of 3:23 per km (5:27 per mile), or a velocity of 17.7 km/hr (11.0 miles per hour). Personal discussions with elite-level marathon runners suggest that they ingest about 200 ml per hour during marathon races. This value is similar to drinking amounts reported in the 1960's in slightly less talented athletes (17,35,36), but substantially less than the volume of 1.2 - 2 liters per hour that the ACSM guidelines recommend for elite athletes in competition. This practical information alone questions the dogma that only by drinking large volumes of fluids are athletes able to perform at a high level of competency.

Based upon the above review of literature, practical information available from competing athletes, and experience in clinical settings at finish lines of endurance races, several guidelines can be offered to assist medical personnel better manage their population of patients presenting with symptoms during or after their race.

GUIDELINE # 1*:* *Be very careful to make accurate diagnoses, so that the treatment plan can be optimally effective rather than inappropriate.*

Perspective: As an example, encouraging the slower runners/walkers in marathon races to drink "as much as possible" is the incorrect treatment for the wrong group of athletes, since it is precisely this group of athletes who are at essentially no risk of developing heatstroke due to their low rate of heat production during exercise. It is the elite athletes who experience the greatest risk of heatstroke due to their much larger *rate* of heat production. Even they tend not to develop heat stroke despite drinking very little during such races, because they vary their pace according to existing conditions, delivering extraordinarily quick performance times in cooler weather and slowing the pace appropriately during hot summertime competitions such as occurs with major world championships.

GUIDELINE # 2: *Considerable individual difference in responsiveness exists for tolerable fluid ingestion during exercise. The optimum rates of fluid ingestion during exercise depend on a number of individual and environmental factors. Hence it is neither correct nor safe to provide a blanket recommendation for all athletes during exercise.*

Perspective: Several factors determine the rate of sweat loss and hence the necessary rate of fluid ingestion during exercise. These have been mentioned already, and include i) the rate of energy expenditure (metabolic rate), which is a function of the athlete's size and running speed, and ii) the environmental conditions, particularly the humidity and the presence or absence of convective cooling (facing wind speed).

In general, it is found that the fastest running athletes lose between 1 –1.5 kg of mass per hour during competitive marathon running. However, for reasons described earlier, this does not mean that this is the rate at which fluid must be replaced. This is because a portion of that weight loss is from oxidized metabolic fuels and another portion is from the release of water stored with muscle glycogen. Furthermore, there is no evidence that, during competition, elite athletes can drink at rates that even approach these rates of weight loss.

GUIDELINE # 3: *A diagnosis of heat illness should be reserved only for those patients who have clear evidence of heatstroke, the diagnostic symptoms of which are described above, and* ***the successful treatment of which requires active whole body cooling.*** *If the rectal temperature is not elevated above 40 – 41 degrees C so that the patient recovers fully without the need for whole body cooling, then a diagnosis of "heat illness" cannot be sustained and an alternate diagnosis must be entertained (25,32,33).*

Perspective: Much of the confusion of the role of fluid balance in the prevention of heat illness indeed arises because of the adoption of incorrect diagnostic categories for the classification of "heat illnesses" (16,25,32). True heatstroke is diagnosed as a rectal temperature in excess of 40-41 degrees C in an athlete who shows an altered level of consciousness without other cause, and who recovers only after a period of active cooling; this appears to be an extremely uncommon complication of marathon running since there are so few documented case reports in the medical literature. Even the boldly titled review article, "Heatstroke and Hyperthermia in Marathon Runners," (36) presented at the New York Academy of Sciences Conference on the Marathon that preceded the first 5-boroughs New York City Marathon in 1976, described anecdotal evidence of only one well-known case of heatstroke in a world class marathon runner. It is for this reason that these well-remembered anecdotes – Jim Peters in the 1954 Empire Games Marathon (36); Alberto Salazar in the 1982 Boston Marathon; Gabrielle Andersen-Schiess in the 1984 Olympic Games Marathon - are frequently used to project the danger of heatstroke during marathon running and hence the need to drink adequately to prevent this condition in marathon races. In fact these anecdotes really only prove how extremely rare is this condition in modern marathon races run in reasonable environmental conditions.

Indeed the evidence from the 1996 Centennial Olympic Games held in "Hotlanta" was that "heat illness" was the most common diagnosis amongst spectators, accounting for 22% of medical visits, but was the least common diagnosis among the competitors, accounting for only 5% of medical consultations (37). Furthermore of 10,715 persons treated by physicians during those Games, not one was treated for heatstroke (37).

On the other hand, the number of athletes requiring medical care especially after marathon races has increased precipitously in the past 25 years, as evidenced by the growth in the provision of medical services at those races. However there is no evidence that the vast majority (> 99%) of the athletes treated in those medical facilities are suffering from heat-related illnesses since (i) they recover without active cooling and (ii) their rectal temperatures are not higher than are those of control runners who do not require medical care after those races (37-40).

As a result, the prevention of heatstroke in distance running requires that attention first be paid to those factors that really do contribute to the condition in a meaningful way.

The true incidence of the real heat illnesses in marathon runners is unknown but appears to be extremely low. There are no studies showing that dehydration or its prevention plays any role in the cause or prevention of the so-called "heat illnesses" that are frequently diagnosed, on questionable grounds, in athletes seeking medical care after endurance events (22,24,25). Rather it has been suggested that postural hypotension, reversible by nursing the collapsed athlete in the head-down position (25,31-33), is the most appropriate and only necessary form of treatment for these incorrectly diagnosed as cases of "heat illnesses".

GUIDELINE # 4: *Athletes who collapse and require medical attention **after** completing long distance running events are probably suffering more from the sudden onset of postural hypotension (31,32) than from dehydration.*

Perspective: A crucial recent finding was that the majority (~ 75%) of athletes seeking medical care at marathon or ultra marathon races collapse only **after** they cross the finishing line (32,40). It is difficult to believe that a condition insufficiently serious to prevent the athlete from finishing a marathon, for example, suddenly becomes life-threatening only **after** the athlete has completed the race, at the very time when the athlete's physiology is returning to a state of rest. Rather, the evidence is that athletes who collapse **before** the race finish are likely to be suffering from a serious medical condition for which they require urgent and expert medical care (32,40).

The hypotension is likely due to the persistence of a state of low peripheral vascular resistance into the recovery period, compounded by an absence of the rhythmic action of the skeletal muscles contracting in the legs (that earlier had been aiding blood return to the heart) as soon as the athlete completes the race and stops moving. Thus, there is a sudden fall in right atrial pressure which begins the moment the athlete stops exercising.

There is no published evidence that this postural hypotension is due to dehydration. Nor does logic suggest this as a likely explanation, since dehydration should cause collapse when the cardiovascular system is under the greatest stress, for example, **during** rather than immediately upon cessation of prolonged exercise. This has important implications for treatment of the common condition of post-exercise collapse in marathon runners.

Diagnosing this condition as a "heat illness" is intellectually risky not least because it leads to the false doctrine that "if only these athletes had drunk 'as much as possible' during the marathon, they would not have required medical care after the race". In addition, there is evidence that a sudden fall in right atrial pressure can produce a paradoxical and sudden increase in skeletal muscle vasodilation. This leads to a sudden fall in peripheral vascular resistance, thereby inducing fainting. This was first identified by Barcroft et al. (43) in research undertaken during the Second World War (1944).

The assumption that athletes collapse after exercise because they are suffering from a dehydration-related heat illness has led to the widespread use of intravenous fluids as the first line of treatment for this condition of exercise-associated collapse. There are no clinical trials to show that intravenous fluid therapy is either beneficial or even necessary for the optimum treatment of those athletes who collapse **after completing marathon races** and who seek medical care as a result.

If, however, the condition is really due to a sustained vasodilatation, perhaps in response to a dramatic reduction in right atrial pressure (43) that begins at the cessation of exercise, then the most appropriate treatment is to increase the right atrial pressure. The most effective method to achieve this to nurse the collapsed athlete in the head down position, according to the method depicted in Figure 1. Since adopting this technique in the two races under our jurisdiction in Cape Town, South Africa, we have not used a single intravenous drip in the past 2 years. These are very long races with large numbers of participants. The 56 km Two Oceans Marathon had a total of ~ 16,000 runners in the last 2 years, and the 224 km Cape Town Ironman Triathlon had ~ 1,000 finishers in the last 2 years (26,27). We found no evidence that the management of these athletes was compromised in any way as a result of the adoption of this novel treatment method.

GUIDELINE # 5: *Runners should aim to drink ad libitum between 400 – 800 ml per hour, with the higher rates for the faster, heavier runners competing in warm environmental conditions and the lower rates for the slower runners/walkers completing marathon races in cooler environmental conditions***.**

Perspective: Published evidence indicates that rates of fluid intake during running races vary from 400 – 800 ml per hour (1, 29). Among those who develop the hyponatraemia of exercise, the rates of fluid ingestion during exercise are very much higher and may be as high as 1.5 liters per hour (7-9,44).

One can observe consistently that athletes who run fast in the present-day marathons with temperate environmental conditions appear to cope quite adequately despite what appear to be quite low levels of fluid intake during those races. Thus there does not appear to be any reason why elite athletes should be encouraged to increase their rates of fluid intake during marathon racing by drinking "as much as possible" (26, 27). But perhaps the even more cardinal point is that athletes who run/walk marathon races in 4 or more hours will have lower rates of both heat production and fluid loss, and must therefore be advised **not** to drink more than a maximum of 800 ml per hour during such races. They must be warned that higher rates of fluid intake can be fatal if sustained for 4 or more hours.

Several recent studies show that drinking *ad libitum* is as effective a drinking strategy during exercise as is drinking at the much higher rates proposed in the ACSM guidelines (45-47). Accordingly perhaps the wisest advice that can be provided to athletes in marathon races is that they should drink *ad libitum* and aim for ingestion rates that never exceed about 800 ml per hour.

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The International Marathon Medical Directors Association (IMMDA) was formed as the Consulting Medical Committee of the Association of International Marathons (AIMS). AIMS is a global organization of marathons and other road races, formed in May, 1982. The purpose of AIMS is to i) foster and promote marathon running throughout the world, ii) recognize and work with the International Association of Athletics Federations (IAAF) as the sport's world governing body on all matters relating to international marathons, and iii) exchange information, knowledge, and expertise among its member events. AIMS' current roster numbers approximately 150 events which are conducted on all 7 continents and which includes the world's largest and most prestigious marathons.

The purpose of IMMDA is to i) promote and study the health of long distance runners, ii) promote research into the cause and treatment of running injuries, iii) prevent the occurrence of injuries during mass participation runs, iv) offer guidelines for the provision of uniform marathon medical services throughout the world, and v) promote a close working relationship between race and medical directors in achieving the above four goals.

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TABLE 1. Difference in Finish Time Distribution Among Marathons 'Then' and 'Now'

	Boston, 1975	New York City, 1978	New York City, 2001
Men's Winning Time	2:09:55	2:12:11	2:07:43
Total # Finishers	1,818	8,588	23,651
#, % under 3 hours	887, 48.8%	806, 9.4%	570, 2.4%
#, % 3 to 3 1/2 hours	931, 51.2%	1,810, 21.1%	1,996, 8.4%
#, % 3 1/2 to 4 hours		2,513, 29.3%	4,595, 19.4%
#, % 4 to 4 1/2 hours		1,807, 21.0%	5,770, 24.4%
#, % 4 1/2 to 5 hours		1,047, 12.2%	5,302, 22.4%
#, % 5 to 5 1/2 hours		437, 5.1%	2,818, 11.9%
#, % 5 1/2 to 6 hours		126, 1.5%	1,434, 6.1%
#, % 6 to 6 1/2 hours		35, 0.4%	609, 2.6%
#, % 6 1/2 to 7 hours		3, 0.03%	324, 1.4%
#, % 7 to 7 1/2 hours		4, 0.05%	137, 0.6%
#, % 7 1/2 to 8 hours			66, 0.3%
#, % 8 to 8 1/2 hours			30, 0.1%

TABLE 2.* Reported Cases of Exercise-related Hyponatraemia: 1985-2001

Main Presenting Symptoms	Number & %	Mean Serum Na+#	Serum Na+ Range#
Disorientation	34 (49%)	125	117 - 131
Pulmonary oedema	13 (19%)	121	115 - 127
Respiratory arrest	2 (3%)	118	113 - 123
Seizure	22(31%)	117	108 - 124
Coma	6 (9%)	113	107 - 117

*: 70 Non-fatal cases with significant illness
#: Na+ values in mEq per L

Proper Hydration for Distance Running-Identifying Individual Fluid Needs

A USA TRACK & FIELD Advisory

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INTRODUCTION

Any time a runner hits the road, track, or trail to perform in a race or training session, the need to properly hydrate becomes an issue that will influence the quality of the effort. The evaporation of sweat from the skin's surface is a powerful cooling mechanism to allow you to release the heat that is being produced by working muscles. The replenishment of fluid being lost as sweat is an important consideration during any effort. It has long been preached to runners (and all athletes) that you should consume "as much fluid as possible" to ward off the demons of dehydration. More recently, runners and medical staff have been told to limit hydration due to the potential dangers associated with overhydrating that can occur when running for an extended period of time.

Thus, we have a double-edged sword situation: drink enough fluids during activity to prevent dehydration - which could be detrimental to health and performance - but do not consume too much fluid - which could cause the potentially dangerous problem of hyponatremia.

So, what does the competitive runner do to address the issues related to hydration in order to minimize the likelihood of dehydration and hyponatremia? The answer lies in the process of determining individual fluid needs and then developing a hydration protocol based on those individual needs. This is a simple process that can maximize performance and minimize any potential hazards that may be associated with inappropriate hydration practices. The ensuing pages will provide an overview of dehydration and hyponatremia and provide USATF guidelines for distance runners and other athletes that can be utilized to determine individual fluid needs.

Dehydration

<u>What is dehydration?</u>

Dehydration is caused by two distinct factors that may occur during exercise.

- **The loss of fluids from sweat, urine, and respiratory losses.** Dehydration is the acute change of fluid stores from that of a steady-state condition of normal body water to that being something less than normal body water. If the decreased body water stores remain for an extended period of time, the individual is said to be in a "state of hypohydration", which is a steady-state condition of decreased body water. Since the human body is approximately 65% water, a significant decrease in body water stores will alter normal physiological function. For instance, cardiovascular function (i.e. heart rate), thermoregulatory capacity (i.e. sweating) and muscle function (i.e. endurance capacity) can be detrimentally altered if the amount of dehydration reaches critical thresholds to alter the physiological function of these processes.
- **Fluid intake does not match up to fluid losses.** When fluid consumption is less than fluid losses, dehydration will ensue. The magnitude in which these two factors are out of balance will determine the degree of dehydration. Fluid can be lost in sweat, urine, feces, and during respiration (breathing). The great majority of the loss is that in sweat. Fluid losses can be replaced by that consumed orally or intravenously and that which is produced during metabolism [a small amount of water is actually formed during the metabolic pathways that allow muscles to contract]. The great majority of fluid intake occurs from the oral consumption of fluids (including fluids in food products). So, generally speaking, during exercise, when sweat losses exceed fluid intake via oral consumption, a condition of dehydration will ensue. Mild dehydration, about 1-2% of total body weight, is quite likely and is not a great concern. But, losses beyond this should be avoided if at all possible.

Dehydration occurs:

- During moderate and intense activity- As the intensity of an activity increases, the sweat rate increases. Additionally, as intensity reaches high levels (e.g. >75% VO_2max), the rate at which fluid can be processed and comfortably handled by the stomach and intestines and emptied into the bloodstream is decreased. Also, increasing intensity will likely decrease the amount of time the individual can focus on rehydration.
- During activity in warm and hot conditions- As the temperature increases the sweat rate increases.
- In those with high sweat rates- Those individuals with high sweat rates (and great differences can exist between individuals) will have the need to replenish more fluids for a certain time.
- When proper hydration is not attained at the start- When individuals begin an exercise session not properly hydrated, they may reach a dangerous dehydration level more rapidly.
- During multiple practices the same day- As the number of exercise sessions in a day increases this will increase the amount of fluid needed during the course of the day.
- When there is improper access to meals- A majority of fluid consumption occurs during meal times, so a disturbance in normal meals may alter the ability to maintain proper hydration.
- When there is improper access to fluids- When fluids are not readily accessible during races or training sessions, the likelihood will increase for dehydration.
- When there is poor vigilance- Athletes who are not educated about the needs to properly hydrate will not actively pursue a proactive hydration protocol to address individual fluid needs.

- In larger individuals- A person's size influences sweat rate, so those who are larger will generally have a higher sweat rate.
- Due to personal preferences- If the temperature of the rehydration fluid is extremely hot or extremely cold or if it is a flavor the individual dislikes or is made of non-ideal compounds then this may alter the degree of voluntary rehydration.
- Due to individual differences in fluid tolerance- Some individuals cannot comfortably handle the amounts of fluid to approximate fluid losses during activity. A possible solution to this may be gradually drinking over time and not having one large amount after a period of time. Also, people may be able to alter the amount when the hydration protocol is practiced during training sessions.
- Due to illness.

How do you recognize dehydration?

It is important to remember that while dehydration is an important factor that contributes to hyperthermia associated with exercise, other factors are also very important. For example, intensity of activity, environmental conditions (humidity, temperature, shade/cloud cover), level of fitness, degree of heat acclimatization, amount of clothing/equipment, illness, etc. all contribute to the rate of rise in body temperature and athletes should consider these when looking to decrease the risk associated with exercise in the warm and hot conditions.

Runners, coaches, and medical staff must be adept at recognizing that a problem with hyperthermia exists and treating that first. If it is mild, then the runner needs to slow down or stop depending on the symptoms observed. If the symptoms are more severe, an immediate effort must to made to reduce core body temperature. Runners should be able to recognize the basic signs and symptoms of the onset of heat illness for which dehydration may be a cause: irritability, and general discomfort, then headache, weakness, dizziness, cramps, chills, vomiting, nausea, head or neck heat sensations (e.g. pulsating sensation in the brain), disorientation and decreased performance. Runners have been instilled with the concept that adequate hydration will negate the adverse effect of high heat and humidity. Runners need to learn that core body temperature can rise to dangerous levels despite a proper level of hydration.

In the absence of guidelines for optimum hydration, thirst can be a guiding factor. Runners have been instilled with the concept that hydration must be ahead of thirst and that the presence of thirst indicates dehydration. However, staying ahead of thirst can lead to overhydration as thirst is no longer available as a natural signal to know individual fluid needs. The sensation of thirst is a general indicator of dehydration. It is a clear signal to drink. If the signal of thirst is not used for rehydration, there is greater danger of dehydration and heat illness.

Symptoms that complicate the diagnosis are the feeling of dizziness or weakness and collapsing. When this happens at a point when the runner has stopped either along the course or at the finish line, rather than while in motion, the likely cause is postural hypotension which is a pooling of blood in the legs and inadequate blood supply to the upper body. This can be avoided by walking or flexing the legs when standing in place. When a runner collapses from postural hypotension, the legs should be raised above the head and held there for 3-4 minutes. That should relieve the symptoms.

How do you treat dehydration?

A conscious, cognizant, dehydrated runner without gastrointestinal distress can aggressively rehydrate orally, while one with mental compromise or gastrointestinal distress should be transported to a medical facility for intravenous rehydration. If an exertional heat illness beyond dehydration is suspected then medical treatment would be necessary. Additionally, dehydration itself, if severe, may require medical assistance. See the citation for the Exertional Heat Illness Position Statement at the end of this paper for specifics regarding the prevention, recognition, and treatment of the common exertional heat illnesses.

Exertional Hyponatremia

What is hyponatremia?

Exertional hyponatremia (EH), or low blood sodium (generally defined by sodium levels less than 130mmol/L), is caused by two distinct but often additive conditions that may arise during prolonged exercise, most often 4 hours or more. They include:

- **The excessive intake of fluid**. In this scenario, athletes ingest significantly more fluid than they lose in sweat and urine over a given period of time. Doing so causes them to become hyper-hydrated and blood sodium falls. This is the most critical contributory factor to the onset of EH.
- **The ingestion of low-sodium fluids.** In this scenario, athletes drink fluids that are low in sodium. In doing so, they dilute their blood sodium and fail to replace what they're naturally losing in sweat during exercise. Sports drinks have low-sodium levels in order to be appetizing to the general public. EH results when plasma sodium levels go below approximately 130 mmol/L. The more pronounced the drop, the greater the risk of medical consequences. Runners can still be at risk with higher sodium intake when overhydrating. Excessive fluids are the crux of the problem, but having fluids with sodium is better than without it, excessive drinking or not.

Runners, coaches, and medical staff must be adept at recognizing this condition because rehydration could cause further problems. Severe cases of EH may involve grand mal seizures, increased intracranial pressure, pulmonary edema, and respiratory arrest. The fact is EH can and has led to death—and not just in running, but in a variety of athletic, military, and recreational settings.

When does EH occur?

EH occurs most frequently:

- **In sports that last for longer than four hours-** This gives athletes more time to drink and to lose large amounts of sodium through prolonged sweating.
- **During lower-intensity endurance activities**-where athletes have the opportunity to ingest large volumes of fluid.
- **When athletes drink large volumes of water without adequate sodium intake-**Blood sodium levels fall quickly whenever excess water is ingested, particularly during or after exercise in which large amounts of sweat and salt are lost. This can even happen during exercise or at rest when athletes drink lots of water in a misguided attempt to ward off cramping.

How do you recognize EH?

Unfortunately, EH may mimic many of the signs and symptoms of exertional heat stroke, such as nausea, vomiting, extreme fatigue, respiratory distress, and central nervous system disturbances (i.e. dizziness, confusion, disorientation, coma, seizures).

EH also has unique characteristics that distinguish it from other like conditions such as low plasma sodium levels (< 130 mmol/L). Other symptoms may include:

- A progressively worsening headache.
- Normal exercise core temperature (generally not > 104^{o}F)
- Swelling of the hands and feet (which may be noted with tight wedding bands, watches, shoes, etc.).

How do you treat EH?

If you suspect this condition it is important to be sure of the following:

- Make sure runner is not dangerously hyperthermic. If an immediate measure of rectal temperature reveals extreme hyperthermia (>104^{o}F), begin ice/cold water immersion therapy.
- If hyponatremia is suspected, have the athlete transported immediately to an emergency room where a physician can monitor care and if necessary administer an IV of a hypertonic sodium replacement, diuretic (if hyperhydrated), and/or anti-convulsive drug (if still having seizures).

Rapid and prudent response, along with that of on-site medical personnel, can assure a healthy outcome.

How do you prevent EH?

The most important aspect of preventing EH lies in your having an appropriate hydration protocol for the event or task being performed. This process was discussed in the dehydration section. A few key points include:

- Education regarding replacing fluids in appropriate amounts, not to exceed sweat rates.
- Assuring easy access to a sports drink containing an adequate amount of sodium.
- Monitoring body weights when feasible to identify those who have gained weight from overdrinking.

Additional steps to consider:

- Encourage athletes to be well-acclimatized to the heat because this is an effective way to decrease sweat sodium losses.
- Maintain normal meal patterns and don't restrict dietary sodium intake, so sodium levels are normal prior to the start of an event.
- Consume a little extra sodium with meals and snacks during continuous days of exercise in hot weather to help maintain blood sodium levels.

  There is a great performance benefit associated with proper hydration during exercise, but overdrinking must be avoided. Athletes who lose and replace fluids at equal rates greatly diminish the risk of EH—especially if they drink fluids that contain adequate sodium.

How do you prevent dehydration without overhydrating?

Optimum hydration is geared around the general premise that fluid intake should match fluid losses and that these processes are extremely individualized. It is an individual process because rehydration practices vary based on a wide-variety of issues (discussed earlier). The crux of this process is trying, to the best of your ability, to match fluid intake with fluid losses. If this can be done relatively closely, then all of the hazards of under or overhydrating are avoided and the likelihood of a safe and productive exercise session is maximized. The following guidelines should assist in establishing a hydration protocol:

USATF Self-testing Program for Optimum Hydration

Establish a hydration strategy that considers the sweat rate, sport dynamics (rest breaks, fluid access), environmental factors, acclimatization state, exercise duration, exercise intensity, and individual preferences. To correctly assess rehydration needs for each individual, it is of great importance to calculate the individual's sweat rate. For this process, we recommend the following program:

Calculate sweat rate (Sweat Rate = body weight pre-run – body weight post-run + fluid intake – urine volume/exercise time in hours) for a representative range of environmental conditions, practices, and competitions (Table 1 provides a sample worksheet). This calculation is the most fundamental consideration when establishing a hydration protocol. Average sweat rates from the scientific literature or other athletes can vary from .5 l/h to over 2.5 l/h (1.1 lb/hr to 5.5 lb/hr) and should not be used.

When establishing an individual sweat rate that will be applicable during a long race, try to run at race intensity (for races of 1 hour or more) in a 1-hour training session. Try to establish a sweat rate in similar climatic conditions expected for a targeted race or for long training runs leading up to the race, whichever are in a higher temperature. Follow this procedure:

- Do a warm-up run to the point where perspiration is generated.
- Urinate if necessary.
- Weigh yourself naked on an accurate scale.
- Run for one hour at intensity similar to the targeted race.
- Drink a measured amount of a beverage of your choice during the run.
- Do not urinate during the run (unless you choose to measure the amount of urine).
- Weigh yourself in the buff again on the same scale after the run.
- Enter data into table 1.

You now know your approximate fluid needs per hour.

Clubs may want to organize hydration-testing clinics at which they provide an accurate scale and a means of privacy for disrobing to get weighed along with supporting information about the subject of hydration and supervision of the USATF testing program.

It should be noted that metabolism of carbohydrates, fats, and protein during exercise accounts for a very small amount of the weight lost during activity. The effect of fuel oxidation on weight loss during high sweat efforts is a small enough amount that weight changes that occur following an activity can largely be attributed to sweat losses. However, it should be calculated in when measuring a low-sweat effort at about 15% of the total weight loss.

Heat acclimatization induces physiologic changes that may alter individual fluid replacement considerations.

First, sweat rate generally increases after 10 to 14 days of heat exposure, requiring a greater fluid intake for a similar bout of exercise. An athlete's sweat rate should be reassessed after acclimatization.

Second, moving from a cool environment to a warm environment increases the overall sweat rate for a bout of exercise. Athletes must closely monitor hydration status for the first week of exercise in a warm environment.

Third, increased sodium intake may be warranted during the first 3 to 5 days of heat exposure, since the increased thermal strain and associated increased sweat rate increase the sodium lost in sweat. Adequate sodium intake optimizes fluid palatability and absorption during the first few days and may decrease exercise-associated muscle cramping. After 5 to 10 days, sweat sodium concentration decreases, but the overall sweat rate is higher so the athlete should still be cognizant of sodium ingestion.

Consider the event/training session and how you can approximate your calculated fluid needs. Things to consider are the location of hydration stations, what fluids you want to use, and when and how you can refill fluid containers if you choose to carry your own fluids with you.

Fluid replacement beverages should be easily accessible in individual fluid containers and flavored to the athlete's preference. Individual containers permit easier monitoring of fluid intake. Clear water bottles marked in 100-ml (3.4 fl oz) increments provide visual reminders to help runners gauge proper amounts. Carrying water bottles or other hydration systems during running encourages greater fluid volume ingestion. Hydration systems, in contrast to water bottles, will keep fluids cooler which optimizes the hydration process.

Individual differences will exist with regards to tolerance of amount of fluids that can be comfortably consumed, gastric emptying and intestinal absorption rates, and availability of fluids during the workout or event. Each individual's rehydration procedures should be tested in practice and modified regularly if necessary to optimize hydration while maximizing performance in competition. Individuals should be encouraged to retest themselves during different seasons depending on their training/racing schedule to know their hydration needs during those seasons.

Hydration

Pre-Event Hydration

Runners should begin all exercise sessions well hydrated. Hydration status can be approximated by runners in several ways (Table 2). Assuming proper hydration, pre-exercise body weight should be relatively consistent across exercise sessions. Remember that body weight is dynamic. Frequent exercise sessions can induce nonfluid-related weight loss influenced by timing of meals and defecation, time of day, and calories expended in exercise. The simplest method is comparison of urine color (from a sample in a container) with a urine color chart (Figure 1). A urine color of 1-3 indicates a good hydration status while 6-8 indicates some degree of dehydration. Note that urine color can be offset by recent, excessive supplemental vitamin intake. Urine volume is another general indicator of hydration status. A runner should frequently have the need to urinate during the course of the day. Remember that body weight changes during exercise give the best indication of hydration needs.

To ensure proper pre-exercise hydration, the athlete should consume approximately 500 to 600 ml (17 to 20 fl oz) of water or a sports drink 2 to 3 hours before exercise and 300 to 360 ml (10 to 12 fl oz) of water or a sports drink 0 to 10 minutes before exercise.

Post-Event Hydration

Post-exercise hydration should aim to correct any fluid loss accumulated during the practice or event. Ideally completed within 2 hours, rehydration should contain water to restore hydration status, carbohydrates to replenish glycogen stores, and electrolytes to speed rehydration. The primary goal is the immediate return of physiologic function (especially if an exercise bout will follow). When rehydration must be rapid, the athlete should compensate for obligatory urine losses incurred during the rehydration process and drink about 25% more than sweat losses to assure optimal hydration 4 to 6 hours after the event.

Fluid temperature influences the amount consumed. While individual differences exist, a cool beverage of 10^o to 15^oC (50^o to 59^oF) is recommended.

The Role and Use of Carbohydrates

In many situations, athletes benefit from including carbohydrates (CHO) and electrolytes (especially sodium) in their rehydration beverages. Include CHO in the rehydration beverage during exercise if the session lasts longer than 45 to 50 minutes or is intense. An ingestion rate of about $1\ g \cdot min^{-1}$ (.04 oz/min) maintains optimal carbohydrate metabolism: for example, 1 liter of a 6% carbohydrate drink per hour of exercise. CHO concentrations >8% increase the rate of CHO delivery to the body, but compromise the rate of fluid emptying from the stomach and absorbed from the intestine. Fruit juices, CHO gels, sodas, and some sports drinks have CHO concentrations >8% and are not recommended DURING an exercise session as the sole beverage. Athletes should consume CHO at least 30 minutes before the normal onset of fatigue and earlier if the environmental conditions are unusually extreme, although this may not apply for very intense short-term exercise which may require earlier intake of CHO. Most CHO forms (i.e., glucose, sucrose, maltodextrins) are suitable, and the absorption rate is maximized when multiple forms are consumed simultaneously. Substances to be limited include fructose (may cause gastrointestinal distress), and those that should be avoided include alcohol or high amounts of caffeine (may increase urine output and reduce fluid retention), and carbonated beverages (may decrease voluntary fluid intake due to stomach fullness).

Electrolyte Considerations

A modest amount of sodium (0.5 to $0.7\ g \cdot l^{-1}$) would be an acceptable addition to all hydration beverages since it stimulates thirst, increases voluntary fluid intake, may decrease the risk of hyponatremia, and causes no harm. Inclusion of sodium chloride in fluid replacement beverages should be considered under the following conditions: There is inadequate access to meals or meals are not eaten; when the physical activity exceeds 4h in duration; and/or during the initial days of hot weather. Under the above conditions, addition of modest amounts of sodium (0.5 to $0.7\ g \cdot l^{-1}$) can offset sodium lost in sweat and may minimize medical events associated with electrolyte imbalances (e.g. muscle cramps, hyponatremia).

Potassium levels lost in sweat can be a concern for people in general and especially for people taking diuretics for high blood pressure. Diuretics cause excessive excretion of potassium, and running could result in hypokalemia. Also, plain water intake or hyperhydration will exacerbate losses of potassium by sending the excess fluid to the kidneys for excretion at the expense of potassium.

For more information on hydration, exertional hyponatremia and exertional heat illnesses please see:

Binkley HM, J Beckett, DJ Casa, D Kleiner, P Plummer. National Athletic Trainers Association position statement: Exertional heat illnesses. *Journal of Athletic Training*. 37(3):329-343, 2002.
(can be found at www.nata.org/members1/jat/37.3/attr_37_03_0329.pdf)

Casa DJ, LE Armstrong, SK Hillman, SJ Montain, RV Reiff, B Rich, WO Roberts, JA Stone. National Athletic Trainers' Association position statement: Fluid replacement for athletes. *Journal of Athletic Training*. 35(2):212-224, 2000.
(can be found at www.nata.org/members1/jat/jt0200/jt020000212p.pdf)

Noakes, T., Martin, D.E. IMMDA-AIMS Advisory statement on guidelines for fluid replacement during marathon running. *New Studies in Athletics* 17 (1): 15-24, 2002.

Table 1: Sample Sweat Rate Calculation

Table 3. Sample Sweat Rate Calculation*

A	B	C	D	E	F	G	H	I	J
		Body Weight							
Name	Date	Before Exercise	After Exercise	ΔBW (C-D)	Drink Volume	Urine Volume†	Sweat Loss (E+F−G)	Exercise Time	Sweat Rate (H/I)
		kg	kg	g	mL	mL	mL	min	mL/min
		(lb/2.2)	(lb/2.2)	(kg × 1000)	(oz × 30)	(oz × 30)	(oz × 30)	h	mL/h
		kg	kg	g	mL	mL	mL	min	mL/min
		(lb/2.2)	(lb/2.2)	(kg × 1000)	(oz × 30)	(oz × 30)	(oz × 30)	h	mL/h
		kg	kg	g	mL	mL	mL	min	mL/min
		(lb/2.2)	(lb/2.2)	(kg × 1000)	(oz × 30)	(oz × 30)	(oz × 30)	h	mL/h
		kg	kg	g	mL	mL	mL	min	mL/min
		(lb/2.2)	(lb/2.2)	(kg × 1000)	(oz × 30)	(oz × 30)	(oz × 30)	h	mL/h
Kelly K.‡	9/15	61.7 kg	60.3 kg	1400 g	420 mL	90 mL	1730 mL	90 min	19 mL/min
		(lb/2.2)	(lb/2.2)	(kg × 1000)	(oz × 30)	(oz × 30)	(oz × 30)	1.5 h	1153 mL/h

*Reprinted with permission from Murray R. Determining sweat rate. *Sports Sci Exch*. 1996;9(Suppl 63).
†Weight of urine should be subtracted *if urine was excreted prior to postexercise body weight.*
‡In the example, Kelly K. should drink about 1 L (32 oz) of fluid during each hour of activity to remain well hydrated.

Table 2: Indices of Hydration Status (general guidelines)

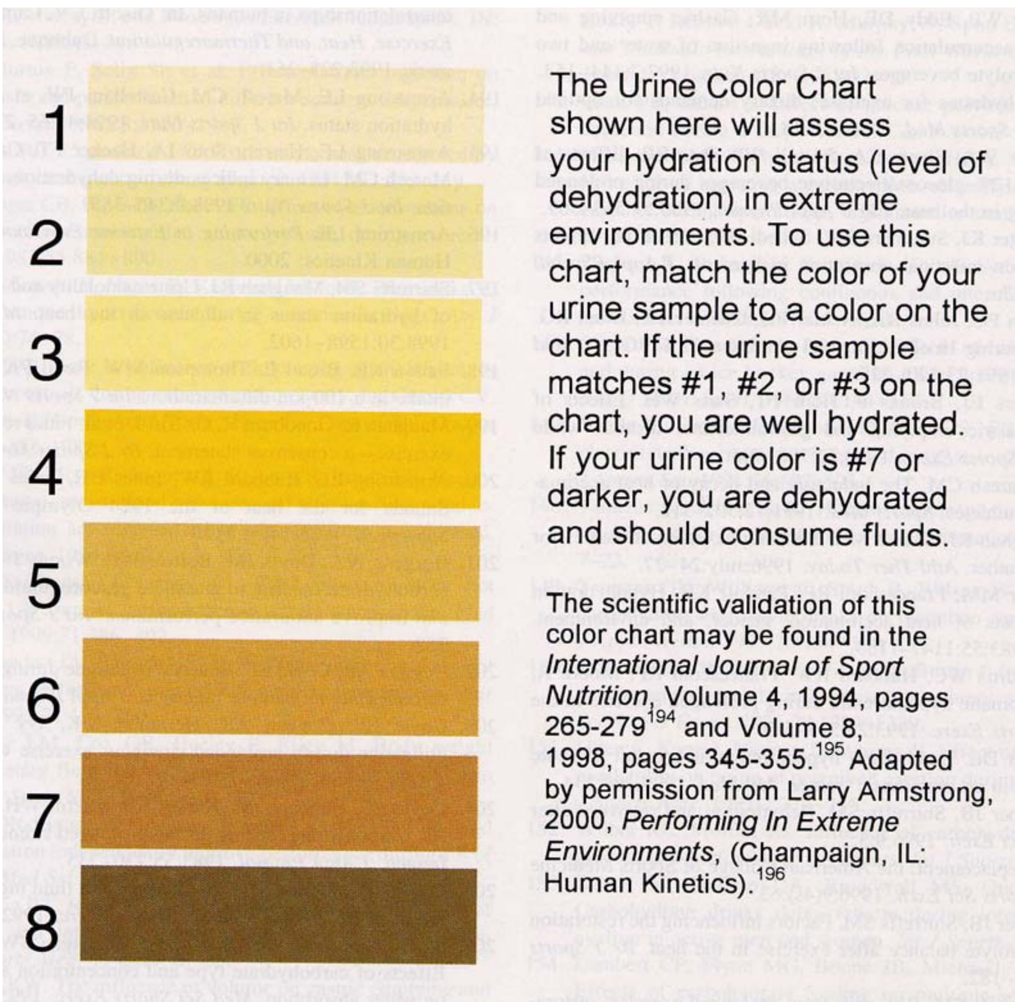
	% Body Weight Change	Urine Color
Well-Hydrated	+1 to -1 %	1 or 2
Minimal Dehydration	-1 to -3 %	3 or 4
Significant Dehydration	-3 to -5 %	5 or 6
Serious Dehydration	> 5 %	> 6

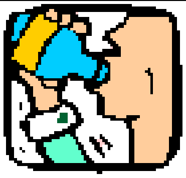
$$\% \text{ Body Weight Change} = \frac{\text{Pre Body Weight} - \text{Post Body Weight}}{\text{Pre Body Weight}} \times 100$$

See Figure 1 for Urine Color Chart and appropriate reference. Please note that a urine sample may not be possible during serious dehydration.

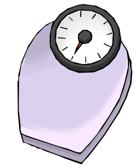
Also, these are physiologically independent entities and the numbers provided are only general guidelines.

<u>Figure 1: Urine Color Chart</u>





Self-Testing Program for Optimal Hydration



from *Proper Hydration for Distance Running – Identifying Individual Fluid Needs,* by Douglas J. Casa, PhD, ATC, FACSM.

Any time a runner hits the road, track, or trail to perform in a race or training session, the need to properly hydrate becomes an issue. It has long been preached to runners (and all athletes) that you should consume “as much fluid as possible” to ward off the demons of dehydration. More recently, runners and medical staff have been told to limit hydration due to the potential dangers associated with overhydrating that can occur when running for an extended period of time. So what does the runner do to address the issues related to hydration?

In USATF's new hydration guidelines, long-distance runners are instructed to consume 1 liter of fluid for every liter lost during a race. Runners should determine their fluid needs well before any race longer than an hour, by using the following procedure during a 1-hour training run. If possible, do this session in climatic conditions similar to those at the race.

1. Make sure you are properly hydrated BEFORE the workout – your urine should be clear.
2. Do a warm-up run to the point where perspiration is generated, then stop. Urinate if necessary
3. Weigh yourself naked on an accurate scale
4. Run for one hour at an intensity similar to your targeted race.
5. Drink a measured amount of a beverage of your choice during the run if and when you are thirsty. It is important that you keep track of exactly how much fluid you take in during the run.
6. Do not urinate during the run.
7. Weigh yourself naked again on the same scale you used in Step 3.
8. You may now urinate and drink more fluids as needed. Calculate your fluid needs using the following formula:

A. Enter your body weight from Step 3 in Kilograms* *(To convert from pounds to kilograms, divide pounds by 2.2)*	–	____________
B. Enter your body weight from Step 7 in Kilograms* *(To convert from pounds to kilograms, divide pounds by 2.2)*		____________
C. Subtract B from A	=	____________
	x	1000
D. Convert your total in C to grams by multiplying by 1000	=	____________
E. Enter the amount of fluid you consumed during the run in milliliters *(To convert from ounces to milliliters, multiply ounces by 30)*	+	____________
F. Add E to D	=	____________

This final figure is the number of milliliters (ml) that you need to consume per hour to remain well-hydrated. If you want to convert milliliters back to ounces, simply divide by 30.

Now you know how much you need to drink per hour in order to stay properly hydrated during a race or a long hard training run. Keep in mind that as you get in better shape over time, you may need to perform this test again to make sure that your fluid needs have not changed. By the same token, if you reduce or change your training significantly, you may also need to perform the test again.

If the expected climatic conditions for your race or long training runs change, you will also need to perform the test again in as close to the new climatic conditions as possible. Keep in mind that we now know that when conditions get hot, drinking sufficient water will not be enough to prevent heat-related illness. As the temperature rises, you simply have to slow down.

Of additional importance is determining the type of fluids to drink. In many situations, athletes can benefit from including carbohydrates and electrolytes (especially sodium) in their rehydration beverages. However, just as individual differences exist in sweat lost during exercise, individuals also can differ in the types of beverages that are most suitable. Once you have determined how much fluid you need to consume, you should begin incorporating this fluid consumption into your training runs. It is during these practice sessions that you can find out what type(s) of beverage will work best for you.

More information on hydration, including the full paper by Dr. Douglas Casa and other important information on fluid intake from Dr. Lewis Maharam, can be found at www.usatf.org.

Fluids On Race Day

Water and sports drinks provide you with fluid. Follow these recommendations and you will remain healthy! BUT DON'T OVER-DRINK! Remember, too much is as bad as too little. Use your urine color as a guide (see below):

- Drink at least 16 ounces of fluid 1-2 hours before the race.
- Drink another 16 ounces of fluid in the hour before the race.
- Check your urine 1/2 hour before the race…if clear to dark yellow…you are well pre-hydrated…if dark and concentrated…drink more fluids!
- ***<u>During the race drink no more than 1 cup (8-10 ounces)</u>*** of fluid every 15-20 minutes along the way - that does not mean a cup at EVERY water station! Water/Sports Drink stations are usually located throughout the course much closer than the 15-20 minute rule..
- **DO NOT** take any product with ephedra in it. Ephedra increases your risk of "heat illness." It should not be used while training or on race day!

Too Much Fluid Can Be Harmful

Most athletes understand the importance of drinking fluids, but some don't understand that drinking too much can be harmful as well. Over-hydrating can lead to a dangerous condition known as hyponatremia (low blood sodium). Runners or walkers out on the course for long periods, losing lots of sodium in sweat, are at risk. Overzealous drinkers who drink lots of water in the days prior to the race and then stop at every fluid station along the course, and /or drink quarts after finishing also may risk hyponatremia. This condition can lead to nausea, fatigue, vomiting, weakness, sleepiness, changes in sensorium and in the most severe instances, seizures, coma and death.

To avoid hyponatremia follow these easy guidelines:

- Follow the fluid recommendations.
- Try not to drink more than you sweat.
- Include pretzels or a salted bagel in your pre-race meal.
- Favor a sports drink that has some sodium in it over water, which has none.
- In the days before the race, add salt to your foods (provided that you don't have high blood pressure or your doctor has restricted your salt intake).
- Eat salted pretzels during the last half of the race.
- Carry a small salt packet with you, and during the last half of the race, if you feel that you have been sweating a lot or that it's a warm/hot day, consume that single packet.

- After the race, drink a sports drink that has sodium in it and eat some pretzels or a salted bagel.
- Stop taking non-steroidal anti-inflammatories 24 hours before your race and do not start again until a minimum of 6 hours after finishing the race.

Weigh In Daily during the hot months of summer

Step out of bed every morning and onto the scale.

- If you're anywhere from 1% to 3% lighter than yesterday, re-hydrate by drinking 8 ounces of fluid for each pound lost before training again.
- Between 3% and 6% lighter, re-hydrate and back off that day's training intensity.
- Over 7%, get to the doctor.

Drink During Workouts

Two hours before your workout, drink about half a quart. Drink again as early as 15 minutes into the session, but keep the doses small - 4 to 7 ounces.

And After Workouts?

Weigh yourself right before and after workouts. For every pound you lost, drink a pint of electrolyte replacement fluid watered down to whatever strength you like.

Pain Relievers

Recent medical research has shown that non-steroidal anti-inflammatories (NSAIDs) like Advil, Motrin, Aleve, ibuprofen, naproxen, etc. may be harmful to runners' kidney function if taken within 24 hours of running; acetaminophen (Tylenol®) has been shown to be safe. These NSAIDs are thought to increase the possibility of hyponatremia while running long distances due to their decreasing blood flow to the kidneys and interfering with a hormone that helps the body retain salt. Therefore it is recommended that on race day (specifically beginning midnight before you run) you do not use anything but acetaminophen (Tylenol®) if needed until 6 hours after you have finished the race, are able to drink without any nausea or vomiting, have urinated once, and feel physically and mentally back to normal. Then, an NSAID would be of benefit in preventing post-event muscle soreness.

Example School District Action Plan for Unhealthful Air Quality

Purpose of the Plan: The (*district name*) Unified School District acknowledges the potentially adverse effects of unhealthful air quality on the health of students and employees. It is the purpose of this Plan to: (1) establish a communications protocol from the Idaho Department of Environmental Quality (DEQ) to the school district and school sites and to students and employees; (2) identify action levels based on State regulations and federal air quality index (AQI) levels reported by the air district; and (3) provide guidance for reducing student exposures to unhealthy air.

Notification of Unhealthy Air Quality

Receipt of air district information: It is the responsibility of the Superintendent of the (*district name*) USD, or his or her designee to monitor air quality information available from the Idaho DEQ on a daily basis. The prior day's 24-hr forecast for each school site in the district shall be verified on the morning of the effective date by viewing the DEQ Web page at www.deq.idaho.gov, or by calling the DEQ's hot line at (208) 373-0313. The (*district name*) USD will also subscribe to the DEQ automated e-mail notification system for air quality alerts and Air Quality Index (AQI) notification. The (*district name*) USD should contact the local with phone and facsimile numbers for receipt of Health Advisory Notices.

Transmitting air quality information: The (*name of district*) USD shall determine when to notify the schools and employees that actions should be taken to reduce exposures to unhealthy air. The district superintendent will notify principals or their designees at affected school sites by telephone, facsimile and e-mail to ensure that the message is received. In turn, principals or their designees shall disseminate by telephone, facsimile, and e-mail the air quality information, relevant parts of this Action Plan, and guidance for outdoor activities to teachers and coaches. Color-coded flags or pennants may be used as visual alerts to changing air quality.

School site responsibilities: Upon notification by the (*name of district*) USD, school sites should confirm that they are located in the geographical area of the current or forecast unhealthy air quality by viewing the DEQ Web page and confirm the valid time for the air quality alert or notification. School sites should implement the school district's policies and procedures for reducing children's and employees' exposures.

Unhealthful Air Quality

The AQI is a guide for reporting daily air quality. It indicates how clean or polluted the air is in a particular area and identifies potential health impacts. The AQI focuses on health effects that can happen within a few hours or days after breathing polluted air. DEQ uses the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each of these pollutants, EPA has established National Ambient Air Quality Standards (NAAQS) to protect against harmful health effects. The NAAQS can be found at www.epa.gov/air/criteria.html. Further information on the AQI can be found at www.airnow.gov.

Actions and Cautionary Health Messages Under Federal Air Quality Categories

The AQIs for ozone are typically based on the average of eight 1-hour field measurements or computer-modeled predictions compared to the national 8-hr standard. The AQIs for fine particulates (PM2.5) are based on the average of twenty-four 1-hour measurements compared to the 24-hr average federal air quality standard. There have been times when both the 8-hr ozone and 24-hr PM AQIs were based on fewer measurements in order to portray current conditions. The cautionary health messages that accompany the AQI categories below are based on the duration of a person's exposure being similar to the averaging times. Currently, there are no composite AQIs representing two or more pollutants or composite cautionary health messages for the cumulative effects of two or more pollutants.

US EPA's five categories of AQI for ozone and particulate material (PM):

AQI	Descriptor	Health Cautionary Messages
0 – 50	Good air quality (green flag)	No health impacts expected
51 – 100	Moderate air quality (yellow flag)	Ozone: *Unusually** sensitive people should consider limiting prolonged outdoor exertion; Particulate matter: *Unusually** sensitive people should consider reducing *prolonged** or heavy exertion.
101 – 150	Unhealthy for Sensitive Groups (orange flag)	Ozone: Active children and adults, and people with respiratory disease, such as asthma, should *limit** prolonged or heavy outdoor exertion; Particulate matter: People with respiratory or heart disease, the elderly and children should reduce prolonged or *heavy exertion**.
151 – 200	Unhealthy (red flag)	Ozone: Active children and adults, and people with

		respiratory disease, such as asthma, should avoid prolonged or heavy outdoor exertion; everyone else, especially children, should limit prolonged outdoor exertion; Particulate matter: People with respiratory or heart disease, older adults, and children should avoid prolonged exertion, everyone else should limit prolonged exertion.
201 – 300	Very Unhealthy (purple flag)	Ozone: Active children and adults, and people with respiratory disease, such as asthma, should avoid all outdoor exertion; everyone else, especially children, should limit outdoor exertion; Particulate matter: People with heart disease, older adults, and children should avoid all physical activity outdoors; everyone else should avoid prolonged or heavy exertion.

As used above, the following terms can be generally defined as:
"*unusually sensitive people*" – typically, these people know who they are and are likely to have physical limitations and/or medical conditions that cause them to be more sensitive to air pollutants.
"*prolonged*" - U.S. EPA defines as 4 hours or more
"limit" - shorten duration or reduce intensity
"moderate exertion" – breathing rate 25 to 45 liters per minute
"*heavy exertion*" – breathing rate greater than 45 liters per minute

Specific Considerations and Actions to Reduce Exposures

When air quality is determined by the air district to be "unhealthy for sensitive groups" (AQI = 101 to 150), special consideration shall be given to those who would have trouble breathing or show other health symptoms resulting from outdoor activities. Children with asthma action plans developed in conjunction with their physician, parents, and school nurse should follow their plan. (Responsible person or office) shall ensure that space indoors is available for children with asthma or other respiratory diseases; such children should be allowed to remain indoors if they request to do so. Sensitive children who remain outdoors should reduce the intensity of their activities commensurate with the increase in the AQI. Breathing rates for sensitive groups should not exceed the normal resting (walking) rate as the AQI nears 150.

Options for Physical Education Classes and Recesses on Poor Air Quality Days are provided in attachment #1.

Options for Physical Education Classes and Recess on Poor Air Quality Days

It is important to remember that ozone or PM 2.5 affects each child differently. Children with asthma or other respiratory diseases are more susceptible to the health effects that can be triggered by ozone or PM 2.5. Each child may show symptoms at different levels of pollution. Therefore, the best way to monitor activities during times of elevated exposure is to ask children to report any symptoms related to difficulty in breathing to school staff (teacher, nurse, coach). If a child is particularly affected, or has been in the past, take steps to ensure their exposure or activity level is reduced to decrease the chance of symptoms. Alternatively, children could be moved indoors for continued exercise (indoor environments can have 20 to 80% less ozone or PM 2.5). Children with asthma should have an asthma management plan on file at their school so that symptoms can be treated immediately and appropriately.

The cautionary health statements and recommendations that follow relate to 8-hr ozone AQIs reported on DEQ or AIRNOW websites. Outdoor activities of shorter duration (e.g., 15-minute recess or 1-hour physical education class) would not require the same restrictive measures because the exposures would be less. If ozone is accompanied by elevated levels of fine particulate material (PM2.5), it is recommended that schools also review the cautionary health statements for this pollutant that are available on US EPA's Web page (http://www.epa.gov/airnow/aqi/aqi_conc_calc.html).

50 to 100 is "moderate" air quality (yellow days)

US EPA recommends that *unusually sensitive people should consider limiting prolonged outdoor exertion.*

101 to 150 is "unhealthy for sensitive groups" (orange days)

U.S. EPA recommends that *active children and those with respiratory disease, such as asthma, should limit prolonged outdoor exertion*.

Limit outdoor physical activities to less than one hour (e.g., split time between morning and afternoon). Indoor activities should be made available to children with respiratory disease, such as asthma.

151 to 200 is "unhealthy" (red days)

US EPA recommends that *active children and those with respiratory disease such as asthma should avoid prolonged outdoor exertion*.

Healthy children should reduce the intensity of outdoor activities lasting an hour or more. Children with asthma or respiratory disease should reduce the intensity and duration of any outdoor activities and be given the opportunity to continue their activities indoors.

200 and greater is "very unhealthy" (purple days).
U.S. EPA recommends *active children and those with asthma should avoid* <u>*all*</u> *outdoor exertion.*
High ozone days are often bright and warm sunshine days. It is always recommended that school staff *watch children carefully for signs of distress and ensure ready access to medications for kids with asthma*.

Options for outdoor physical activities

What would normally be considered safe exposure to ozone or PM 2.5 ("safe" means not likely to result in adverse health effects in the general population") becomes less so with increased breathing rates and the duration of exposures. Therefore, a risk reduction strategy involves reducing intensity (breathing rates) and duration (time) of vigorous outdoor activities.

Possible ways to reduce risks from exposures to ozone:

1) Reduce intensity of the activities:
    a. Switch out players more often during practice and games
    b. Focus on skill development versus endurance training
    c. Alternate endurance activities with skills development
    d. Take frequent rest and water breaks
2) Spend part of practice indoors and part outdoors
3) Split practice into two parts: one before and one after school
4) During weeks or months of high ozone, move practices to before school
5) Shorten the length of practices
6) Move inside when practical

Examples of activities that are of relatively low-to-moderate intensity include: diving, walking, gymnastics, wrestling, golf, karate, isometrics (stretching exercises), baseball, boxing, tetherball, four-square, horseback riding; non-competitive swimming, tennis, cycling, and volleyball.

Examples of activities of high intensity that result in sustained aerobic activity: Football, long-distance running, competitive cycling, basketball, soccer, rugby, ice hockey, ice skating, and cross-country skiing. Each of these involves some form of running.

Physical education instructors are encouraged to develop lesson plans that include options for reduced intensity and duration of outdoor activities on poor air quality days. Coaches of competitive sports should consider training (a situation when aerobic activity can be greater than the sports event itself) during times of the day when air quality is better (typically morning hours).

The iDOT™ Thermochromatic Patch

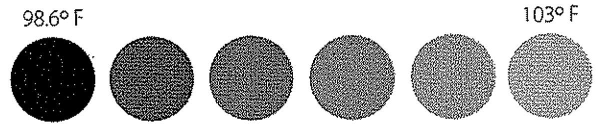
A brilliant (and affordable) solution to help prevent the risk of overheating and hyperthermia.

What is the iDOT?

The iDOT is a disposable body temperature indicator from Lexington-based IonX. With the same characteristics of an elastic cotton bandage, the patch is easy to stick on the body before a workout or strenuous activity.

With the use of patented, ionized thermochromatic inks, the patch will change color to indicate the rise and fall of body temperature – a combination of skin and core temperatures – and help prevent the potential risk of overheating and hyperthermia.

IonX specifically formulated the iDOT with a black ink called ionized liquid crystals (ILC). When an individual's core temperature reaches 100.5°F to 101°F, these inks begin to vibrate, causing the iDOT to change from black to a bright yellow.

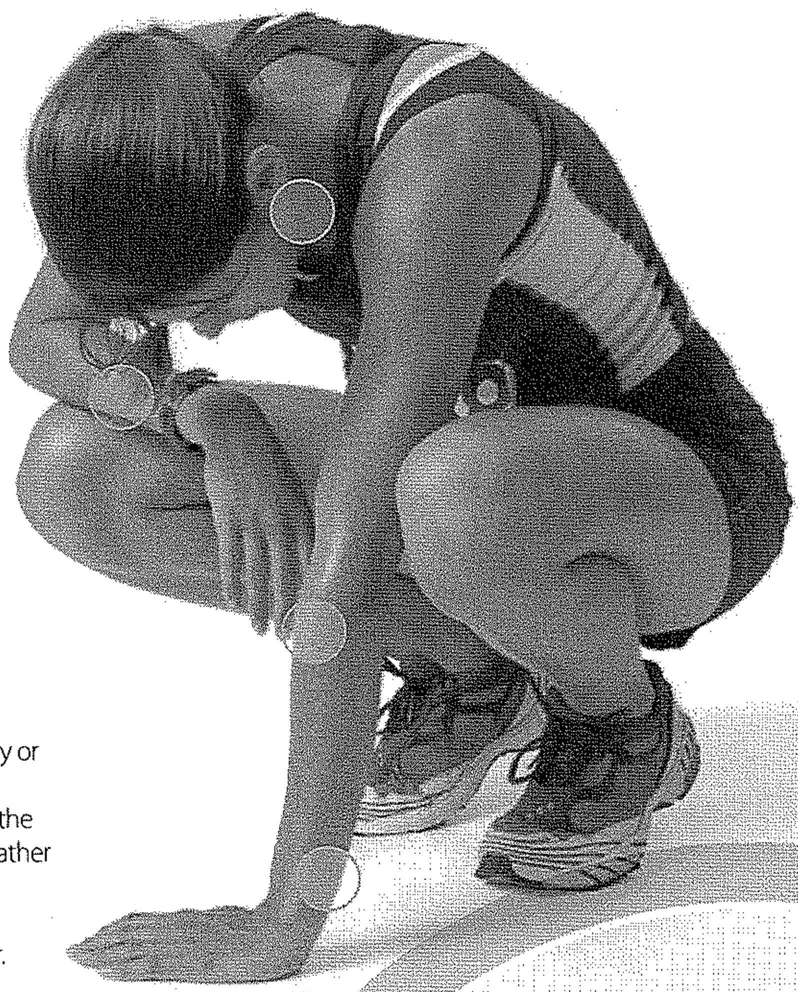


When the body reaches 100.5° F, the Black ink will begin "clear" and disappear, allowing the bright yellow color to be seen.

How do you use it?

Just like a bandage, the iDOT applies to the body with a strong adhesive that is also easy to remove. It is a circular knit fabric (95% cotton and 5% Lycra) that provides the flexibility and comfort of elastic.

Because the patch is designed to measure skin and core temperatures, it must be placed on an area of the body with blood vessels close to the surface of the skin. The graphic at right demonstrates recommended areas of placement.



Additional features and facts

- The iDOT will not react to external temperatures, humidity or direct sunlight.
- Once the patch is applied to the skin, it will only indicate the individual's skin and core temperature – regardless of weather or environment.
- The patch is water-resistant and durable.
- The inks on the patch will not wear out if it changes color. For example, it will return to black when the body cools.
- Once activity is finished, simply remove and dispose of the patch.
- The iDOT will be sold in affordable bulk packages as well as convenient 30 packs.

For more information on the iDOT, please contact:

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Available Soon!

Sign up to be the first to know.

A proactive solution for active people

From professional athletes to beginner players, heat-related deaths had an impact on all levels of sports. That's why IonX® has created the iDOT™ body temperature alert patch. This disposable indicator warns the wearer if and when there is a danger of overheating. The iDOT patch has the same characteristics of a cotton bandage and is round, elastic and waterproof to stay secure during activity.

Here's how it works: Ionized inks change color to indicate the rise and fall of body temperature - a combination of skin and core temperatures. When an individual's temperature reaches 100.5°F to 101°F, the iDOT patch begins to change from black to yellow. At 103°F, the patch turns a noticeable yellow that is easily visible at a distance or from the sidelines.

Because the patch is designed to measure skin and core temperatures, it must be placed on an area of the body with blood vessels close to the surface of the skin, such as the neck and inside wrist or arm. The patch does not react to external temperatures or humidity and, since the inks do not wear out, will continue to change color and measure body temperature as long as it is worn.

The iDOT patch is just one of many new technologies created for improved health and wellness by IonX, a research and development company in Lexington, KY.

Click here to download our flyer with additional product information.

WHAT IS A HEAT STROKE?

A heat stroke, or hyperthermia, is caused when body temperature reaches dangerously high levels. The body's natural defenses against heat - such as sweating - can no longer maintain normal core temperature and internal organs begin to fail. In fact, this condition can be fatal if not properly and promptly treated.

THE FACTS ABOUT HEAT STROKES

The Center for Disease Control's Morbidity and Mortality Weekly Report (MMWR) identified 3,442 deaths from 1999-2003 "resulting from exposure to extreme heat." The National Center for Catastrophic Sports Injury Research identified more than 100 athlete deaths in America that were directly related to heat strokes. And these numbers have certainly grown in the past decade as people push themselves to new limits, despite the risk of permanent injury or even fatality.

WHO NEEDS AN IDOT PATCH?

While the patch is ideal for competitive athletes, anyone who works or plays in extreme heat environments can utilize this potentially life-saving product, including:

- Agricultural workers
- Hikers and joggers
- Construction workers
- Recreational athletes
- Landscapers
- Roofers
- Postal workers

The iDOT™ body temperature alert patch is an innovative patent pending device that warns the user if they're getting close to overheating or hyperthermia. And that could potentially prevent heat strokes, letting today's athletes reach peak performance without risking their health.

***David Bensema, MD, FACP.** Director. Dr. Bensema is a board certified internist who, after 16 years of private practice in Lexington, became the Executive Director of Physician Services for Central Baptist Hospital and Medical Director of Baptist Physicians Lexington, Inc. in August 2006. Dr. Bensema received a bachelor's degree in biology from the University of Kentucky in 1982, followed by his medical degree in 1986. Dr. Bensema continued his training at UK completing his residency in internal medicine in 1989 and his chief residency in 1990. Dr. Bensema has participated in the start-up of three life insurance companies and in 2004 became board certified in insurance medicine. Since 2007 he has served on the e-Health Board for the Commonwealth of Kentucky. He is a past-president of the Lexington Medical Society and currently serves as the Trustee for the 10th District to the Board of Trustees of the Kentucky Medical Association. He is a founding investor and Board Member for the Bank of Lexington.

Former Governor Martha Layne Collins. Director. Ms. Collins served as Governor for the Commonwealth of Kentucky from 1983 through 1987 and the Lieutenant Governor of Kentucky from 1979 to 1983. Ms. Collins is the former Director of International Business and Management Center at the University of Kentucky. She served as President of Saint Catharine College, in Springfield, KY from 1990 to 1996. She was President of Martha Layne Collins and Associates from 1988 to 1987. During her term as Governor, Ms. Collins negotiated for Toyota Manufacturing to build a manufacturing facility in Kentucky. She has served on the Board of Directors of Kodak and R.R. Donnelly & Sons and the Advisory Board of Norfolk Southern. Ms. Collins has a Bachelors Degree from the University of Kentucky.

Dan Short. Founder, Chairman and Director. Mr. Short has over 25 years of experience in the textile industry. His primary focus has been fabrics and fabric related technologies. Mr. Short is the inventor and patent holder for IONX sportswear products marketed worldwide by Canterbury New Zealand. Mr. Short's fabrics have been worn by the NFL, the Atlanta Falcons, two English Premier League Soccer teams and eight of the ten final Rugby Cup teams. Additionally, he has designed fabrics for the United States military, including the Special Forces, as well as the Israeli military. Mr. Short has a bachelor's degree in

History from Georgetown College.

Paige Shumate Short. Co-Founder, Vice Chairman and Director. Ms. Short is currently the CEO of Four Tigers, LLC, Berryceuticals, LLC, Kentucky Technical Textiles, IONX International, Inc. and Berryco International, LLC. She began her career at Kentucky Technical Textiles, a seventy year old family textile company, where she implemented the transformation of the business. She is a founder of Four Tigers, LLC which is a bio-tech company performing studies to support the advanced anti-inflammatory, antioxidant, anti-bacterial, antiviral, and anti-cancer properties of blackberries. The Four Tigers portfolio includes medical products as well as equine supplements. Ms. Short has degrees in Economics and Business from Georgetown College.

General Guidelines for Developing Emergency Action Plans

1. **Establish Roles** – adapt to specific team/sport/venue, may be best to have more than one person assigned to each role in case of absence/turnover

- Immediate care of the athlete
  - Typically physician, ATC, first responder but also those trained in basic life support
- Activation of Emergency Medical System
  - Could be school administrator, anyone
- Emergency equipment retrieval
  - Could be student assistant, coach, anyone
- Direction of EMS to scene
  - Could be administrator, coach, student assistant, anyone

2. **Communication**

- Primary method
  - May be fixed (landline) or mobile (cellular phone, radio)
  - List all key personnel and all phones associated with this person
- Back-up method
  - Often a landline
- Test prior to event
  - Cell phone/radio reception can vary, batteries charged, landline working
  - Make sure communication methods are accessible (identify and post location, are there locks or other barriers, change available for pay-phone)
- Activation of EMS
  - Identify contact numbers (911, ambulance, police, fire, hospital, poison control, suicide hotline)
  - Prepare script (caller name/location/phone number, nature of emergency, number of victims and their condition, what treatment initiated, specific directions to scene)
  - Post both of the above near communication devices, other visible locations in venue, and circulate to appropriate personnel
- Student emergency information
  - Critical medical information (conditions, medications, allergies)

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National Athletic Trainers' Association Position Statement: Emergency Planning in Athletics

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Objectives: To educate athletic trainers and others about the need for emergency planning, to provide guidelines in the development of emergency plans, and to advocate documentation of emergency planning.

Background: Most injuries sustained during athletics or other physical activity are relatively minor. However, potentially limb-threatening or life-threatening emergencies in athletics and physical activity are unpredictable and occur without warning. Proper management of these injuries is critical and should be carried out by trained health services personnel to minimize risk to the injured participant. The organization or institution and its personnel can be placed at risk by the lack of an emergency plan, which may be the foundation of a legal claim.

Recommendations: The National Athletic Trainers' Association recommends that each organization or institution that sponsors athletic activities or events develop and implement a written emergency plan. Emergency plans should be developed by organizational or institutional personnel in consultation with the local emergency medical services. Components of the emergency plan include identification of the personnel involved, specification of the equipment needed to respond to the emergency, and establishment of a communication system to summon emergency care. Additional components of the emergency plan are identification of the mode of emergency transport, specification of the venue or activity location, and incorporation of emergency service personnel into the development and implementation process. Emergency plans should be reviewed and rehearsed annually, with written documentation of any modifications. The plan should identify responsibility for documentation of actions taken during the emergency, evaluation of the emergency response, institutional personnel training, and equipment maintenance. Further, training of the involved personnel should include automatic external defibrillation, cardiopulmonary resuscitation, first aid, and prevention of disease transmission.

Key Words: policies and procedures, athletics, planning, catastrophic

Although most injuries that occur in athletics are relatively minor, limb-threatening or life-threatening injuries are unpredictable and can occur without warning.[1] Because of the relatively low incidence rate of catastrophic injuries, athletic program personnel may develop a false sense of security over time in the absence of such injuries.[1–4] However, these injuries can occur during any physical activity and at any level of participation. Of additional concern is the heightened public awareness associated with the nature and management of such injuries. Medicolegal interests can lead to questions about the qualifications of the personnel involved, the preparedness of the organization for handling these situations, and the actions taken by program personnel.[5]

Proper emergency management of limb- or life-threatening injuries is critical and should be handled by trained medical and allied health personnel.[1–4] Preparation for response to emergencies includes education and training, maintenance of emergency equipment and supplies, appropriate use of personnel, and the formation and implementation of an emergency plan. The emergency plan should be thought of as a blueprint for handling emergencies. A sound emergency plan is easily understood and establishes accountability for the management of emergencies. Furthermore, failure to have an emergency plan can be considered negligence.[5]

POSITION STATEMENT

Based on an extensive survey of the literature and expert review, the following is the position of the National Athletic Trainers' Association (NATA):

1. Each institution or organization that sponsors athletic activities must have a written emergency plan. The emergency plan should be comprehensive and practical, yet flexible enough to adapt to any emergency situation.
2. Emergency plans must be written documents and should be distributed to certified athletic trainers, team and at-

tending physicians, athletic training students, institutional and organizational safety personnel, institutional and organizational administrators, and coaches. The emergency plan should be developed in consultation with local emergency medical services personnel.

3. An emergency plan for athletics identifies the personnel involved in carrying out the emergency plan and outlines the qualifications of those executing the plan. Sports medicine professionals, officials, and coaches should be trained in automatic external defibrillation, cardiopulmonary resuscitation, first aid, and prevention of disease transmission.
4. The emergency plan should specify the equipment needed to carry out the tasks required in the event of an emergency. In addition, the emergency plan should outline the location of the emergency equipment. Further, the equipment available should be appropriate to the level of training of the personnel involved.
5. Establishment of a clear mechanism for communication to appropriate emergency care service providers and identification of the mode of transportation for the injured participant are critical elements of an emergency plan.
6. The emergency plan should be specific to the activity venue. That is, each activity site should have a defined emergency plan that is derived from the overall institutional or organizational policies on emergency planning.
7. Emergency plans should incorporate the emergency care facilities to which the injured individual will be taken. Emergency receiving facilities should be notified in advance of scheduled events and contests. Personnel from the emergency receiving facilities should be included in the development of the emergency plan for the institution or organization.
8. The emergency plan specifies the necessary documentation supporting the implementation and evaluation of the emergency plan. This documentation should identify responsibility for documenting actions taken during the emergency, evaluation of the emergency response, and institutional personnel training.
9. The emergency plan should be reviewed and rehearsed annually, although more frequent review and rehearsal may be necessary. The results of these reviews and rehearsals should be documented and should indicate whether the emergency plan was modified, with further documentation reflecting how the plan was changed.
10. All personnel involved with the organization and sponsorship of athletic activities share a professional responsibility to provide for the emergency care of an injured person, including the development and implementation of an emergency plan.
11. All personnel involved with the organization and sponsorship of athletic activities share a legal duty to develop, implement, and evaluate an emergency plan for all sponsored athletic activities.
12. The emergency plan should be reviewed by the administration and legal counsel of the sponsoring organization or institution.

BACKGROUND FOR THIS POSITION STAND

Need for Emergency Plans

Emergencies, accidents, and natural disasters are rarely predictable; however, when they do occur, rapid, controlled response will likely make the difference between an effective and an ineffective emergency response. Response can be hindered by the chaotic actions and increased emotions of those who make attempts to help persons who are injured or in danger. One method of control for these unpredictable events is an emergency plan that, if well designed and rehearsed, can provide responders with an organized approach to their reaction. The development of the emergency plan takes care and time to ensure that all necessary contingencies have been included. Lessons learned from major emergencies are also important to consider when developing or revising an emergency plan.

Emergency plans are applicable to agencies of the government, such as law enforcement, fire and rescue, and federal emergency management teams. Furthermore, the use of emergency plans is directly applicable to sport and fitness activities due to the inherent possibility of ‘‘an untoward event’’ that requires access to emergency medical services.[6] Of course, when developing an emergency plan for athletics, there is one notable difference from those used by local, state, and federal emergency management personnel. With few exceptions, typically only one athlete, fan, or sideline participant is at risk at one time due to bleeding, internal injury, cardiac arrest, shock, or traumatic head or spine injury. However, emergency planning in athletics should account for an untoward event involving a game official, fan, or sideline participant as well as the participating athlete. Although triage in athletic emergency situations may be rare, this does not minimize the risks involved and the need for carefully prepared emergency care plans. The need for emergency plans in athletics can be divided into 2 major categories: professional and legal.

Professional Need. The first category for consideration in determining the need for emergency plans in athletics is organizational and professional responsibility. Certain governing bodies associated with athletic competition have stated that institutions and organizations must provide for access to emergency medical services if an emergency should occur during any aspect of athletic activity, including in-season and off-season activities.[6] The National Collegiate Athletic Association (NCAA) has recommended that all member institutions develop an emergency plan for their athletic programs.[7] The National Federation of State High School Associations has recommended the same at the secondary school level.[8] The NCAA states, ‘‘Each scheduled practice or contest of an institution-sponsored intercollegiate athletics event, as well as out-of-season practices and skills sessions, should include an emergency plan.’’[6] The *1999–2000 NCAA Sports Medicine Handbook* further outlines the key components of the emergency plan.[6]

Although the *1999–2000 NCAA Sports Medicine Handbook* is a useful guide, a recent survey of NCAA member institutions revealed that at least 10% of the institutions do not maintain any form of an emergency plan.[7] In addition, more than one third of the institutions do not maintain emergency plans for the off-season strength and conditioning activities of the sports.

Personnel coverage at NCAA institutions was also found to be an issue. Nearly all schools provided personnel qualified to administer emergency care for high-risk contact sports, but fewer than two thirds of institutions provided adequate personnel to sports such as cross-country and track.[9] In a memorandum dated March 25, 1999, and sent to key personnel at all schools, the president of the NCAA reiterated the recommendations in the *1999–2000 NCAA Sports Medicine Handbook* to maintain emergency plans for all sport activities, including skill instruction, conditioning, and the nontraditional practice seasons.[8]

A need for emergency preparedness is further recognized by several national organizations concerned with the delivery of health care services to fitness and sport participants, including the NATA Education Council,[10] NATA Board of Certification, Inc,[11] American College of Sports Medicine, International Health Racquet and Sports Club Association, American College of Cardiology, and Young Men's Christian Association.[12] The NATA-approved athletic training educational competencies for athletic trainers include several references to emergency action plans.[10] The knowledge of the key components of an emergency plan, the ability to recognize and appraise emergency plans, and the ability to develop emergency plans are all considered required tasks of the athletic trainer.[11] These responsibilities justify the need for the athletic trainer to be involved in the development and application of emergency plans as a partial fulfillment of his or her professional obligations.

In addition to the equipment and personnel involved in emergency response, the emergency plan must include consideration for the sport activity and rules of competition, the weather conditions, and the level of competition.[13] The variation in these factors makes venue-specific planning necessary because of the numerous contingencies that may occur. For example, many youth sport activities include both new participants of various sizes who may not know the rules of the activity and those who have participated for years. Also, outdoor sport activities include the possibility of lightning strikes, excessive heat and humidity, and excessive cold, among other environmental concerns that may not be factors during indoor activities. Organizations in areas of the country in which snow may accumulate must consider provisions for ensuring that accessibility by emergency vehicles is not hampered. In addition, the availability of safety equipment that is necessary for participation may be an issue for those in underserved areas. The burden of considering all the possible contingencies in light of the various situations must rest on the professionals, who are best trained to recognize the need for emergency plans and who can develop and implement the venue-specific plans.

Legal Need. Also of significance is the legal basis for the development and application of an emergency plan. It is well known that organizational medical personnel, including certified athletic trainers, have a legal duty as reasonable and prudent professionals to ensure high-quality care of the participants. Of further legal precedence is the accepted standard of care by which allied health professionals are measured.[14] This standard of care provides necessary accountability for the actions of both the practitioners and the governing body that oversees those practitioners. The emergency plan has been categorized as a written document that defines the standard of care required during an emergency situation.[15] Herbert[16] emphasized that well-formulated, adequately written, and periodically rehearsed emergency response protocols are absolutely required by sports medicine programs. Herbert[16] further stated that the absence of an emergency plan frequently is the basis for claim and suit based on negligence.

One key indicator for the need for an emergency action plan is the concept of foreseeability. The organization administrators and the members of the sports medicine team must question whether a particular emergency situation has a reasonable possibility of occurring during the sport activity in question.[14,15,17] For example, if it is reasonably possible that a catastrophic event such as a head injury, spine injury, or other severe trauma may occur during practice, conditioning, or competition in a sport, a previously prepared emergency plan must be in place. The medical and allied health care personnel must constantly be on guard for potential injuries, and although the occurrence of limb-threatening or life-threatening emergencies is not common, the potential exists. Therefore, prepared emergency responders must have planned in advance for the action to be taken in the event of such an emergency.

Several legal claims and suits have indicated or alluded to the need for emergency plans. In *Gathers v Loyola Marymount University*,[18] the state court settlement included a statement that care was delayed for the injured athlete, and the plaintiffs further alleged that the defendants acted negligently and carelessly in not providing appropriate emergency response. These observations strongly support the need to have clear emergency plans in place, rehearsed, and carried out. In several additional cases,[19–21] the courts have stated that proper care was delayed, and it can be reasoned that these delays could have been avoided with the application of a well-prepared emergency plan.

Perhaps the most significant case bearing on the need for emergency planning is *Kleinknecht v Gettysburg College*, which came before the appellate court in 1993.[5,17] In a portion of the decision, the court stated that the college owed a duty to the athletes who are recruited to be athletes at the institution. Further, as a part of that duty, the college must provide "prompt and adequate emergency services while engaged in the school-sponsored intercollegiate athletic activity for which the athlete had been recruited."[17] The same court further ruled that reasonable measures must be ensured and in place to provide prompt treatment of emergency situations. One can conclude from these rulings that planning is critical to ensure prompt and proper emergency medical care, further validating the need for an emergency plan.[5]

Based on the review of the legal and professional literature, there is no doubt regarding the need for organizations at all levels that sponsor athletic activities to maintain an up-to-date, thorough, and regularly rehearsed emergency plan. Furthermore, members of the sports medicine team have both legal and professional obligations to perform this duty to protect the interests of both the participating athletes and the organization or institution. At best, failure to do so will inevitably result in inefficient athlete care, whereas at worst, gross negligence and potential life-threatening ramifications for the injured athlete or organizational personnel are likely.

Components of Emergency Plans

Organizations that sponsor athletic activities have a duty to develop an emergency plan that can be implemented immediately and to provide appropriate standards of health care to all sports participants.[5,14,15,17] Athletic injuries may occur at any time and during any activity. The sports medicine team must be prepared through the formulation of an emergency plan, proper coverage of events, maintenance of appropriate emergency equipment and supplies, use of appropriate emergency medical personnel, and continuing education in the area of emergency medicine. Some potential emergencies may be averted through careful preparticipation physical

Sample Venue-Specific Emergency Protocol

__________ University Sports Medicine Football Emergency Protocol

1. Call 911 or other emergency number consistent with organizational policies
2. Instruct emergency medical services (EMS) personnel to "report to __________ and meet __________ at __________ as we have an injured student-athlete in need of emergency medical treatment."
   University Football Practice Complex: __________ Street entrance (gate across street from __________) *cross street:* __________ Street
   University Stadium: Gate __________ entrance off __________ Road
3. Provide necessary information to EMS personnel:
   - name, address, telephone number of caller
   - number of victims; condition of victims
   - first-aid treatment initiated
   - specific directions as needed to locate scene
   - other information as requested by dispatcher
4. Provide appropriate emergency care until arrival of EMS personnel: on arrival of EMS personnel, provide pertinent information (method of injury, vital signs, treatment rendered, medical history) and assist with emergency care as needed

Note:

- sports medicine staff member should accompany student-athlete to hospital
- notify other sports medicine staff immediately
- parents should be contacted by sports medicine staff
- inform coach(es) and administration
- obtain medical history and insurance information
- appropriate injury reports should be completed

Emergency Telephone Numbers

________ Hospital	________ - ________
________ Emergency Department	________ - ________
University Health Center	________ - ________
Campus Police	________ - ________

Emergency Signals

Physician: arm extended overhead with clenched first
Paramedics: point to location in end zone by home locker room and wave onto field
Spine board: arms held horizontally
Stretcher: supinated hands in front of body or waist level
Splints: hand to lower leg or thigh

screenings, adequate medical coverage, safe practice and training techniques, and other safety measures.[1,22] However, accidents and injuries are inherent with sports participation, and proper preparation on the part of the sports medicine team will enable each emergency situation to be managed appropriately.

The goal of the sports medicine team is the delivery of the highest possible quality health care to the athlete. Management of the emergency situation that occurs during athletic activities may involve certified athletic trainers and students, emergency medical personnel, physicians, and coaches working together. Just as with an athletic team, the sports medicine team must work together as an efficient unit to accomplish its goals.[22] In an emergency situation, the team concept becomes even more critical, because time is crucial and seconds may mean the difference among life, death, and permanent disability. The sharing of information, training, and skills among the various emergency medical care providers helps reach the goal.[22,23]

Implementation. Once the importance of the emergency plan is realized and the plan has been developed, the plan must be implemented. Implementation of the emergency plan requires 3 basic steps.[23]

First, the plan must be committed to writing (Table) to provide a clear response mechanism and to allow for continuity among emergency team members.[14,16] This can be accomplished by using a flow sheet or an organizational chart. It is also important to have a separate plan or to modify the plan for different athletic venues and for practices and games. Emergency team members, such as the team physician, who are present at games may not necessarily be present at practices. Moreover, the location and type of equipment and communication devices may differ among sports, venues, and activity levels.

The second step is education.[23] It is important to educate all the members of the emergency team regarding the emergency plan. All personnel should be familiar with the emergency medical services system that will provide coverage to their venues and include their input in the emergency plan. Each team member, as well as institution or organization administrators, should have a written copy of the emergency plan that provides documentation of his or her roles and responsibilities in emergency situations. A copy of the emergency plan specific to each venue should be posted prominently by the available telephone.

Third, the emergency plan and procedures have to be rehearsed.[16] This provides team members a chance to maintain their emergency skills at a high level of competency. It also provides an opportunity for athletic trainers and emergency medical personnel to communicate regarding specific policies and procedures in their particular region of practice.[22] This rehearsal can be accomplished through an annual in-service meeting, preferably before the highest-risk sports season (eg, football, ice hockey, lacrosse). Reviews should be undertaken as needed throughout the sports season, because emergency medical procedures and personnel may change.

Personnel. In an athletic environment, the first person who responds to an emergency situation may vary widely[22,24]; it may be a coach or a game official, a certified athletic trainer, an emergency medical technician, or a physician. This variation in the first responder makes it imperative that an emergency plan be in place and rehearsed. With a plan in place and rehearsed, these differently trained individuals will be able to work together as an effective team when responding to emergency situations.

The plan should also outline who is responsible for summoning help and clearing the uninjured from the area.

In addition, all personnel associated with practices, competitions, skills instruction, and strength and conditioning activities should have training in automatic external defibrillation and current certification in cardiopulmonary resuscitation, first aid, and the prevention of disease transmission.[5,7]

Equipment. All necessary supplemental equipment should be at the site and quickly accessible.[13,25] Equipment should be in good operating condition, and personnel must be trained in advance to use it properly. Improvements in technology and emergency training require personnel to become familiar with the use of automatic external defibrillators, oxygen, and advanced airways.

It is imperative that health professionals and organizational administrators recognize that recent guidelines published by the American Heart Association call for the availability and use of automatic external defibrillators and that defibrillation is considered a component of basic life support.[26] In addition, these guidelines emphasize use of the bag-valve mask in emergency resuscitation and the use of emergency oxygen and advanced airways in emergency care. Personnel should consider receiving appropriate training for these devices and should limit use to devices for which they have been trained.

To ensure that emergency equipment is in working order, all equipment should be checked on a regular basis. Also, the use of equipment should be regularly rehearsed by emergency personnel, and the emergency equipment that is available should be appropriate for the level of training of the emergency medical providers and the venue.

Communication. Access to a working telephone or other telecommunications device, whether fixed or mobile, should be ensured.[5,17,21] The communications system should be checked before each practice or competition to ensure proper working order. A back-up communication plan should be in effect in case the primary communication system fails. A listing of appropriate emergency numbers should be either posted by the communication system or readily available, as well as the street address of the venue and specific directions (cross streets, landmarks, and so on) (Table).

Transportation. The emergency plan should encompass transportation of the sick and injured. Emphasis should be placed on having an ambulance on site at high-risk events.[15] Emergency medical services response time should also be factored in when determining on-site ambulance coverage. Consideration should be given to the level of transportation service that is available (eg, basic life support, advanced life support) and the equipment and training level of the personnel who staff the ambulance.[23]

In the event that an ambulance is on site, a location should be designated with rapid access to the site and a cleared route for entering and exiting the venue.[19] In the emergency evaluation, the primary survey assists the emergency care provider in identifying emergencies that require critical intervention and in determining transport decisions. In an emergency situation, the athlete should be transported by ambulance to the most appropriate receiving facility, where the necessary staff and equipment can deliver appropriate care.[23]

In addition, a plan must be available to ensure that the activity areas are supervised if the emergency care provider leaves the site to transport the athlete.

Venue Location. The emergency plan should be venue specific, based on the site of the practice or competition and the activity involved (Table). The plan for each venue should encompass accessibility to emergency personnel, communication system, equipment, and transportation.

At home sites, the host medical providers should orient the visiting medical personnel regarding the site, emergency personnel, equipment available, and procedures associated with the emergency plan.

At away or neutral sites, the coach or athletic trainer should identify, before the event, the availability of communication with emergency medical services and should verify service and reception, particularly in rural areas. In addition, the name and location of the nearest emergency care facility and the availability of an ambulance at the event site should be ascertained.

Emergency Care Facilities. The emergency plan should incorporate access to an emergency medical facility. In selection of the appropriate facility, consideration should be given to the location with respect to the athletic venue. Consideration should also include the level of service available at the emergency facility.

The designated emergency facility and emergency medical services should be notified in advance of athletic events. Furthermore, it is recommended that the emergency plan be reviewed with both medical facility administrators and in-service medical staff regarding pertinent issues involved in athlete care, such as proper removal of athletic equipment in the facility when appropriate.[22,23,27]

Documentation. A written emergency plan should be reviewed and approved by sports medicine team members and institutions involved. If multiple facilities or sites are to be used, each will require a separate plan. Additional documentation should encompass the following[15,16]:

1. Delineation of the person and/or group responsible for documenting the events of the emergency situation
2. Follow-up documentation on evaluation of response to emergency situation
3. Documentation of regular rehearsal of the emergency plan
4. Documentation of personnel training
5. Documentation of emergency equipment maintenance

It is prudent to invest organizational and institutional ownership in the emergency plan by involving administrators and sport coaches as well as sports medicine personnel in the planning and documentation process. The emergency plan should be reviewed at least annually with all involved personnel. Any revisions or modifications should be reviewed and approved by the personnel involved at all levels of the sponsoring organization or institution and of the responding emergency medical services.

SUMMARY

The purpose of this statement is to present the position of the NATA on emergency planning in athletics. Specifically, professional and legal requirements mandate that organizations or institutions sponsoring athletic activities have a written emergency plan. A well-thought-out emergency plan consists of a number of factors, including, but not necessarily limited to, personnel, equipment, communication, transportation, and documentation. Finally, all sports medicine professionals, coaches, and organizational administrators share professional and legal duties to develop, implement, and evaluate emergency plans for sponsored athletic activities.

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    - Emergency contact information (parent / guardian)
    - Accessible (keep with athletic trainer for example)

3. Emergency Equipment

- e.g. Automated External Defibrillators, bag-valve mask, spine board, splints
- Personnel trained in advance on proper use
- Must be accessible (identify and post location, within acceptable distance for each venue, are there locks or other barriers)
- Proper condition and maintenance
    - document inspection (log book)

4. Emergency Transportation

- Ambulance on site for high risk events (understand there is a difference between basic life support and advanced life support vehicles / personnel)
    - Designated location
    - Clear route for exiting venue
- When ambulance not on site
    - Entrance to venue clearly marked and accessible
    - Identify parking/loading point and confirm area is clear
- Coordinate ahead of time with local emergency medical services

5. Additional considerations

- Must be venue specific (football field, gymnasium, etc)
- Put plan in writing
- Involve all appropriate personnel (administrators, coaches, sports medicine, EMS)
    - Development
    - Approval with signatures
- Post the plan in visible areas of each venue and distribute
- Review plan at least annually
- Rehearse plan at least annually

- Document
    - Events of emergency situation
    - Evaluation of response
    - Rehearsal, training, equipment maintenance

Additional Considerations for Specific Conditions When Developing an EAP

1. Sudden Cardiac Arrest

- Goal of initiating Cardio-Pulmonary Resuscitation within 1 minute of collapse
    - Targeted first responders (e.g. ATC, first responders, coaches) should receive CPR training and maintain certification
- Goal of “shock” from a defibrillator within 3-5 minutes of collapse
    - Consider obtaining Automated External Defibrillator(s)
        - Understand that in most communities the time from EMS activation to shock is 6.1 minutes on average and can be longer in some places
        - Appropriate training, maintenance, and access
        - Notify EMS of AED type, number, and exact location
- Additional equipment to consider beyond AED
    - Barrier shield device/pocket masks for rescue breathing
    - Bag-valve mask
    - Oxygen source
    - Oral and nasopharyngeal airways

2. Heat Illness

- Follow NCHSAA heat and humidity guidelines on p. 50-51 (developed for football but applicable to other sports) http://www.nchsaa.org/intranet/downloadManagerControl.php?mode=getFile&elementID=5876&type=5&atomID=6445
- Inquire about sickle cell trait status on Pre-Participation form
    - consider those with the trait to be “susceptible to heat illness”
    - those with the trait should not be subject to timed workouts
    - those with the trait should be removed from participation immediately if any sign of “exhaustion” or “struggling” is observed

- If heat illness is suspected
    - Activate EMS immediately
    - Begin cooling measures
        - Shade, cool environment
        - Ice water immersion, ice packs, soaked towels, fan and mist
- Any victim of heat illness should see a physician before return to play

3. Head and Neck injury

- Athletic trainer / First responder should be prepared to remove the face-mask from a football helmet in order to access a victim's airway without moving the cervical spine
- Sports medicine team should communicate ahead of time with local EMS
    - Agree upon C-spine immobilization techniques (e.g. leave helmet and shoulder pads on for football players)
    - Type of immobilization equipment available on-site and from EMS
- Athletes and coaches should be trained not to move victims

4. Asthma

- Students with asthma should have an "asthma action plan"
    - Lists medications, describes actions to take based on certain symptoms and/or peak flow values as determined by a licensed physician / PA / NP
    - On file with sports medicine coordinator
    - Available at games / practice / conditioning
    - Can be same as that on file with school nurse

(see http://nhlbi.nih.gov/health/prof/lung/asthma/asth_sch.htm or www.aafa.org for examples)

- Students with asthma should have:
    - Rescue inhaler and spacer if prescribed
        - Readily accessible during games / practice /conditioning
        - Athletic trainer / first responder should have an extra inhaler prescribed individually for each student as back-up
        - Before each activity test to be certain it is functional, contains medication, is not expired
    - Pulmonary function measuring device

- Use in coordination with asthma action plan

5. Anaphylaxis

- Documentation of known anaphylactic allergy to bee stings, foods, medications, etc. should be on file with sports medicine coordinator
    - Describes symptoms that occur
    - What action to take if specific symptoms occur
- Students with known anaphylactic allergy should have
    - Rescue prescription medication (usually an epi-pen)
        - Readily accessible during games / practice /conditioning
        - Athletic trainer / first responder should have an extra supply of the rescue medication prescribed individually for each student as back-up
        - Before each activity examine to be certain it is functional, contains medication, is not expired

6. Lightning

- Assign the role of monitoring for threatening weather conditions
    - Typically athletic trainer, administrator
    - Discuss in advance of games the role of this person (Baseball, softball, football)
- Methods to monitor for lightning risk

o Consult National Weather Service (http://www.weather.gov/alerts/nc.html) or local media for severe weather watches and warnings

o Flash-to-bang method

- Count the time in seconds that passes between a "flash" of lightning and the "bang" of thunder that follows. If count is less than 30 seconds stop activity and seek safe shelter

- Communicate the need to stop activity and seek shelter
    - P.A. announcement
    - Signal sound from a horn, siren, whistle, bell
- Identify safe shelter for each venue and be sure it is accessible (within reasonable distance, unlocked, capacity)
    - Building (with four walls, a ceiling, and plumbing or wiring that acts to electrically ground the structure)

    - Secondary option is a metal roof vehicle with all windows completely rolled up

    - Last option is thick grove of small trees surrounded by larger trees or a dry ditch assuming proper posture (crouch, grab knees, lower head, minimize contact with ground)

- Determine when to resume activity

    - Flash-to bang count greater than 30 seconds or pre-determined time period (usually 30 minutes) after last visible lightning

Emergency Medical Plan

University of Georgia Sports Medicine
Emergency Plan

Introduction

Emergency situations may arise at anytime during athletic events. Expedient action must be taken in order to provide the best possible care to the athletes of emergency and/or life threatening conditions. The development and implementation of an emergency plan will help ensure that the best care will be provided.
Athletic organizations have a duty to develop an emergency plan that may be implemented immediately when necessary and to provide appropriate standards of health care to all sports participants. As athletic injuries may occur at any time and during any activity, the sports medicine team must be prepared. This preparation involves formulation of an emergency plan, proper coverage of events, maintenance of appropriate emergency equipment and supplies, utilization of appropriate emergency medical personnel, and continuing education in the area of emergency medicine. Hopefully, through careful pre-participation physical screenings, adequate medical coverage, safe practice and training techniques and other safety avenues, some potential emergencies may be averted. However, accidents and injuries are inherent with sports participation, and proper preparation on the part of the sports medicine team will enable each emergency situation to be managed appropriately.

Components of the Emergency Plan

There are three basic components of this plan:

1. Emergency personnel
2. Emergency communication
3. Emergency equipment

Emergency Plan Personnel

With athletic association practice and competition, the first responder to an emergency situation is typically a member of the sports medicine staff, most commonly a certified athletic trainer. A team physician may not always be present at every organized practice or competition. The type and degree of sports medicine coverage for an athletic event may vary widely, based on such factors as the sport or activity, the setting, and the type of training or competition. The first responder in some instances may be a coach or other institutional personnel. Certification in cardiopulmonary resuscitation (CPR), first aid, prevention of disease transmission, and emergency plan review is required for all athletics personnel associated with practices, competitions, skills instruction, and strength and conditioning.

The development of an emergency plan cannot be complete without the formation of an emergency team. The emergency team may consist of a number of healthcare providers including physicians, emergency medical technicians, certified athletic trainers; student athletic trainers; coaches; managers; and, possibly, bystanders. Roles of these individuals within the emergency team may vary depending on various factors such as the number of members of the team, the athletic venue itself, or the preference of the head athletic trainer. There are four basic roles within the emergency team. The first and most important role is immediate care of the athlete. Acute care in an emergency situation should be provided by the most qualified individual on the scene. Individuals with lower credentials should yield to those with more appropriate training. The second role, equipment retrieval, may be done by anyone on the emergency team who is familiar with the types and location of the specific equipment needed. Student athletic trainers, managers, and coaches are good choices for this role. The third role, EMS activation, may be necessary in situations where emergency transportation is not already present at the sporting event. This should be done as soon as the situation is deemed an emergency or a life-threatening event. Time is the most critical factor under emergency conditions. Activating the EMS system may be done by anyone on the team. However, the person chosen for this duty should be someone who is calm under pressure and who communicates well over the telephone. This person should also be familiar with the location and address of the sporting event. After EMS has been activated, the fourth role in the emergency team should be performed, that of directing EMS to the scene. One member of the team should be responsible for meeting emergency medical personnel as they arrive at the site of the contest. Depending on ease of access, this person should have keys to any locked gates or doors that may slow the arrival of medical personnel. A student athletic trainer, manager, or coach may be appropriate for this role.

Roles Within the Emergency Team

1. Immediate care of the athlete
2. Emergency equipment retrieval

3. Activation of the Emergency Medical System
4. Direction of EMS to scene

Activating the EMS System

Making the Call:

- 911 (if available)
- telephone numbers for local police, fire department, and ambulance service

Providing Information:

- name, address, telephone number of caller
- number of athletes
- condition of athlete(s)
- first aid treatment initiated by first responder
- specific directions as needed to locate the emergency scene ("come to south entrance of coliseum")
- other information as requested by dispatcher

When forming the emergency team, it is important to adapt the team to each situation or sport. It may also be advantageous to have more than one individual assigned to each role. This allows the emergency team to function even though certain members may not always be present.

Emergency Communication

Communication is the key to quick delivery of emergency care in athletic trauma situations. Athletic trainers and emergency medical personnel must work together to provide the best possible care to injured athletes. Communication prior to the event is a good way to establish boundaries and to build rapport between both groups of professionals. If emergency medical transportation is not available on site during a particular sporting event then direct communication with the emergency medical system at the time of injury or illness is necessary. Access to a working telephone or other telecommunications device, whether fixed or mobile, should be assured. The communications system should be checked prior to each practice or competition to ensure proper working order. A back-up communication plan should be in effect should there be failure of the primary communication system. The most common method of communication is a public telephone. However, a cellular phone is preferred if available. At any athletic venue, whether home or away, it is important to know the location of a workable telephone. Pre-arranged access to the phone should be established if it is not easily accessible.

Emergency Equipment

All necessary emergency equipment should be at the site and quickly accessible. Personnel should be familiar with the function and operation of each type of emergency equipment. Equipment should be in good operating condition, and personnel must be trained in advance to use it properly. Emergency equipment should be checked on a regular basis and use rehearsed by emergency personnel. The emergency equipment available should be appropriate for the level of training for the emergency medical providers.

It is important to know the proper way to care for and store the equipment as well. Equipment should be stored in a clean and environmentally controlled area. It should be readily available when emergency situations arise

Transportation

Emphasis is placed at having an ambulance on site at high risk sporting events. EMS response time is additionally factored in when determining on site ambulance coverage. The athletic association coordinates on site ambulances for competition in football, soccer, gymnastics, and men's and women's basketball. Ambulances may be coordinated on site for other special events/sports, such as major tournaments or SEC/NCAA regional or championship events. Consideration is given to the capabilities of transportation service available (i.e., Basic Life Support or Advanced Life Support) and the equipment and level of trained personnel on board the ambulance. In the event that an ambulance is on site, there should be a designated location with rapid access to the site and a cleared route for entering/exiting the venue.

In the emergency evaluation, the primary survey assists the emergency care provider in identifying emergencies requiring critical intervention and in determining transport decisions. In an emergency situation, the athlete should be transported by ambulance, where the necessary staff and equipment is available to deliver appropriate care. Emergency care providers should refrain from transporting unstable athletes in inappropriate vehicles. Care must be taken to ensure that the activity areas are supervised should the emergency care provider leave the site in transporting the athlete.

Conclusion

The importance of being properly prepared when athletic emergencies arise cannot be stressed enough. An athlete's survival may hinge on how well trained and prepared athletic healthcare providers are. It is prudent to invest athletic department "ownership" in the emergency plan by involving the athletic administration and sport coaches as well as sports medicine personnel. The emergency plan should be reviewed at least once a year with all athletic personnel, along with CPR and first aid refresher training. Through development and implementation of the emergency plan, the athletic association helps ensure that the athlete will have the best care provided when an emergency situation does arise.

Approved by ____ Medical Director
Date: ____________________

Emergency Plan: Spec Towns Track & Field Stadium Venue

Emergency Personnel: certified athletic trainer and student athletic trainer(s) on site for practice and competition; additional sports medicine staff accessible from Butts-Mehre athletic training facility (adjacent to track) and Stegeman Coliseum athletic training facility (across street from track)

Emergency Communication: fixed telephone line under practice shed (542-8962); additional fixed telephone lines accessible from Butts-Mehre athletic training facility adjacent to track (542-9060 and 542-8984)
Emergency Equipment: supplies maintained under practice shed; additional emergency equipment (AED, trauma kit, splint kit, spine board) accessible from Butts-Mehre athletic training facility adjacent to track
Roles of First Responders
1. Immediate care of the injured or ill student-athlete
2. Emergency equipment retrieval
3. Activation of emergency medical system (EMS)

    a. 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested

    b. notify campus police at 542-2200

4. Direction of EMS to scene

    a. open appropriate gates

    b. designate individual to "flag down" EMS and direct to scene

    c. scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions: Track and field stadium is located on Lumpkin Street (cross street Pinecrest) adjacent to Butts-Mehre Hall. Three gates provide access to track:
1. Lumpkin Street (most direct route): directly across from Catholic Student Center
2. Smith Street: opens to artificial turf practice field adjacent to track; accesses practice field drive to track
3. Rutherford Street: opens directly to practice field drive to track; gate must be activated from outside by 5 digit security code or opened by personnel from inside (either by 5 digit security code, weight sensor or trip switch in storage building adjacent to gate)
Venue Map

Emergency Plan: Butts-Mehre Hall and Football Practice Fields

Emergency Personnel:
Butts-Mehre Hall: certified athletic trainers, student athletic trainers, and physician (limited basis) on site in athletic training facility, located on 1st floor
Football practice fields: certified athletic trainers and student athletic trainers on site for practice and work-outs
Emergency Communication:
Butts-Mehre Hall: fixed telephone lines in Butts-Mehre athletic training facility adjacent to practice fields (542-9060 and 542-8984)
Football practice fields: certified athletic trainer carries cellular telephone (706-540-2955); fixed telephone line under practice shed (542-8962); additional fixed telephone

lines accessible from Butts-Mehre athletic training facility adjacent to practice fields (542-9060 and 542-8984)
Emergency Equipment:
Butts-Mehre Hall: emergency equipment (AED, trauma kit, splint kit, Banyan kit, spine board, ProPak vital signs monitor) located within athletic training facility on 1st floor
Football practice fields: emergency equipment (AED, trauma kit, splint kit, Banyan kit, spine board) maintained on motorized medical cart parked adjacent to practice shed during practice; additional supplies maintained under practice shed; additional emergency equipment accessible from Butts-Mehre athletic training facility adjacent to track
Roles of First Responders
1. Immediate care of the injured or ill student-athlete
2. Emergency equipment retrieval
3. Activation of emergency medical system (EMS)

   a. 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested

   b. notify campus police at 542-2200

4. Direction of EMS to scene

   a. open appropriate gates

   b. designate individual to "flag down" EMS and direct to scene

   c. scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions:
Butts-Mehre Hall is located on Pinecrest Street (cross street Lumpkin). Three entrances provide access to building:
1. Main entrance: front of building on Pinecrest Street (directly across from Barrow Elementary School)
2. Side entrance: from side parking lot (across street from Foley Field baseball stadium)
3. Rear entrance: must be accessed from practice field drive through security gate on Rutherford Street

Football practice fields: are located with two fields adjacent to Rutherford Street and two fields adjacent to Smith Street. Two gates provide access to football practice fields:
1. Smith Street: opens to artificial turf practice field adjacent to track
2. Rutherford Street: gate directly across from Alumni House; opens directly to practice field drive; gate must be activated from outside by 5 digit security code or opened by personnel from inside (either by 5 digit security code, weight sensor or trip switch in storage building adjacent to gate)

Venue Map

Emergency Plan: Foley Field Baseball Stadium Venue

Emergency Personnel: certified athletic trainer and student athletic trainer(s) on site for practice and competition; additional sports medicine staff accessible from Butts-Mehre athletic training facility (across street from stadium)
Emergency Communication: fixed telephone line in baseball satellite athletic training room (542-6142)
Emergency Equipment: supplies (AED, trauma kit, splint kit, spine board) maintained in baseball satellite athletic training room; additional emergency equipment accessible from Butts-Mehre athletic training facility across street from stadium (542-9060 and 542-8984)
Roles of First Responders

1. Immediate care of the injured or ill student-athlete
2. Emergency equipment retrieval
3. Activation of emergency medical system (EMS)

    a. 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested

    b. notify campus police at 542-2200

4. Direction of EMS to scene

    a. open appropriate gates

    b. designate individual to "flag down" EMS and direct to scene

    c. scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions: Foley Field baseball stadium is located on corner of Pinecrest Street and Rutherford
Street adjacent to Butts-Mehre Hall. Two gates provide access to the stadium:

1. Pinecrest Street (1st base side): drive leads to field as well as rear door of complex (locker room, athletic training room)
2. Rutherford Street: turn into Coliseum parking lot by Alumni House, take right at bottom of drive, leads to gate in left outfield

Venue Map

Emergency Plan: Sanford Stadium Venue

Emergency Personnel: certified athletic trainers and student athletic trainers on both home and visiting team (host coverage as needed) sidelines; MDs (primary care/sports medicine, orthopedic, neurosurgery, internal medicine) and paramedic crew on home sideline; radiological technicians on home sideline with fluoroscope in field level first aid room (SW corner of stadium); ambulance for field of play is positioned inside stadium on ramp via player gate entrance from East Campus Road: paramedics for ambulance positioned on field at SE corner of stadium; additional ambulance located by first aid room in SW corner of stadium; medical cart is available to transport injured athlete from field

Emergency Communication: fixed telephone lines in athletic training rooms off locker rooms:
Home team: 542-7857
Visiting team: 542-7831
Emergency Equipment: emergency equipment (AED, trauma kit, splint kit, Banyan kit, spine board) maintained on home sidelines; additional emergency equipment with paramedic crews on sideline stretcher and in field of play ambulance in SE tunnel
Roles of First Responders

1. Immediate care of the injured or ill student-athlete
2. Emergency equipment retrieval
3. Activation of emergency medical system (EMS)
    a. signal paramedics on site
    b. campus police on site will assist in coordinating as necessary
4. Direction of EMS to scene
    a. open appropriate gates/doors
    b. designate individual to "flag down" EMS and direct to scene
    c. scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions: Sanford Stadium is located centrally on campus between East Campus Road and Sanford Drive. Two gates provide access to the field of play:

1. Players Gate off East Campus Road: follow ramp down to field level (SE corner of stadium)
2. Gate 10: enter through parking off off Lumpkin (cross street Baxter) and follow under Sanford Drive bridge to field level (SW corner of stadium: adjacent to field level first aid room)

Venue Map

Emergency Plan: Ramsey Center: Gymnastics & Volleyball Venues

Emergency Personnel: certified athletic trainer and student athletic trainer(s) on site for practice and competition; additional sports medicine staff accessible from University Health Center Sports Medicine Department (542-8636)
Emergency Communication: fixed telephone line in Ramsey Center satellite athletic training room (542-4695)
Emergency Equipment: supplies (AED, trauma kit, splint kit, spine board) maintained in Ramsey Center satellite athletic training room
Roles of First Responders

1. Immediate care of the injured or ill student-athlete
2. Emergency equipment retrieval
3. Activation of emergency medical system (EMS)
    a. 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific

directions, including which EMS entrance to turn in off the River Road loop (Main Entrance or Natatorium/Loading Dock)

b. notify Ramsey Center staff at front desk at 542-1454: notify staff that ambulance is in route, which entrance it has been directed to (Main Entrance or Natatorium/Loading Dock), and where the injured person is located. Rec Sports will send a staff member with a radio to meet the ambulance at the appropriate EMS turn off from the loop, open appropriate traffic gates, and direct EMS personnel to scene.

c. notify campus police at 542-2200

4. Direction of EMS to scene

a. open appropriate gates

b. designate individual to "flag down" EMS and direct to scene

c. scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions: Ramsey Center is located on River Road, the one-way loop which surrounds the center. Three roads provide access to the River Road loop.
1. College Station Road entrance: across from UGA Intramural Fields, just north of Hwy. 10 loop
2. Carlton Street entrance off East Campus Road
3. River Road, which is continuous with the loop
Ramsey Center has multiple entrances. The following provide the quickest access for the specific venue:
1. Gymnastics: take College Station Road entrance to River Road loop. Turn off River Road loop at EMS Main Entrance sign. Facility staff members will direct EMS down the sidewalk to Spectator Lobby and the Gymnastics Gym.
2. Volleyball: Carlton Street entrance to River Road loop. Turn off River Road Loop at EMS Natatorium/Loading Dock sign. Facility staff members will direct EMS to facility entrance adjacent to the loading dock and into the Volleyball Arena.
Venue Map

Emergency Plan: Ramsey Center: Gabrielson Natatorium Venue

Emergency Personnel: certified athletic trainer and student athletic trainer(s) on site for practice and competition; life guard on deck for practice and competition; additional sports medicine staff accessible from University Health Center Sports Medicine Department (542-8636)
Emergency Communication: fixed telephone line in Ramsey Center satellite athletic training room (542-4695)
Emergency Equipment: supplies (AED, trauma kit, splint kit, spine board) maintained in Ramsey Center satellite athletic training room; spine board on pool deck
Roles of First Responders
1. Immediate care of the injured or ill student-athlete

a. lifeguards will execute water rescue for athlete in water; athletic trainers will initiate care as soon as athlete reaches pool deck

2. Emergency equipment retrieval
3. Activation of emergency medical system (EMS)

a. 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested

b. notify Ramsey Center staff at front desk at 542-1454: notify staff that ambulance is in route, which entrance it has been directed to (Main Entrance or Natatorium/Loading Dock), and where the injured person is located. Rec Sports will send a staff member with a radio to meet the ambulance at the appropriate EMS turn off from the loop, open appropriate traffic gates, and direct EMS personnel to scene.

c. notify campus police at 542-2200

4. Direction of EMS to scene

a. open appropriate gates

b. designate individual to "flag down" EMS and direct to scene

c. scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions: Ramsey Center is located on River Road, the one-way loop which surrounds the center. Three roads provide access to the River Road loop.
1. College Station Road entrance: across from UGA Intramural Fields, just north of Hwy. 10 loop
2. Carlton Street entrance off East Campus Road
3. River Road, which is continuous with the loop
Ramsey Center has multiple entrances. The following provides the quickest access for the Gabrielson Natatorium swimming venue:
1. Swimming: Carlton Street entrance to River Road loop. Turn off River Road Loop at EMS Natatorium/Loading Dock sign. Facility staff members will direct EMS to driveway that leads to the natatorium deck level entrance and into the natatorium.
Venue Map

Emergency Plan: Stegeman Coliseum Venue: basketball/gymnastics

Emergency Personnel: certified athletic trainer and student athletic trainer(s) on site for practice and competition; additional sports medicine staff accessible from Stegeman Coliseum athletic training facility (542-6521); MD on site for competition; paramedic crew on site for competition: stationed on floor by X seating section; ambulance for competition positioned outside SE side of Stegeman Coliseum (adjacent to Olympic Gym)
Emergency Communication: fixed telephone line on basketball court for practice (542-8052)

Emergency Equipment: supplies (AED, trauma kit, splint kit, spine board) maintained in Stegeman Coliseum athletic training facility

Roles of First Responders

1. Immediate care of the injured or ill student-athlete
2. Emergency equipment retrieval
3. Activation of emergency medical system (EMS)

    a. 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested

    b. notify campus police at 542-2200

6. Direction of EMS to scene

    a. open appropriate gates

    b. designate individual to "flag down" EMS and direct to scene

    c. scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions: Stegeman Coliseum is located between Smith and Carlton Streets, across the street from Butts-Mehre football practice fields. Stegeman Coliseum has multiple entrances. The following provides the quickest access to the court level as well as the athletic training facility:

Court level entrance: follow Smith Street (one-way) around curve past Stegeman Coliseum and Olympic Gym; turn left into drive by horse stable; follow drive around between Stegeman Coliseum and Olympic Gym

Venue Map

Emergency Plan: Women's Soccer/Softball Complex Venues

Emergency Personnel: certified athletic trainer and student athletic trainer(s) on site for practice and competition

Emergency Communication: the certified athletic trainer carries a cellular phone; fixed telephone line in sport press boxes:

Soccer press box: 227-

Softball press box: 227-

Emergency Equipment: supplies (AED, trauma kit, splint kit, spine board) transported to venue each practice or competition from Stegeman Coliseum athletic training facility

Roles of First Responders

1. Immediate care of the injured or ill student-athlete
2. Emergency equipment retrieval
3. Activation of emergency medical system (EMS)

    a. 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested

    b. notify campus police at 542-2200

1. Direction of EMS to scene

    a. open appropriate gates

    b. designate individual to "flag down" EMS and direct to scene

    c. scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions: UGA Women's Soccer/Softball Complex is located on South Milledge (approximately 7/10 mile past Hwy. 441. There is a large UGA billboard at the entrance just past
Will Hunter Road. Turn into complex just before billboard. Upon entering complex, turn left just past soccer field: the practice soccer field is on left, the softball field on right, and game soccer field straight ahead.
Venue Map

Emergency Plan: Dan Magill Tennis Complex Venue

Emergency Personnel: student athletic trainer(s) on site for practice and competition in direct radio contact with certified athletic trainer in adjacent Stegeman Coliseum athletic training facility; certified athletic trainer on site as available for competition; additional sports medicine staff accessible from Stegeman Coliseum athletic training facility (542-6521)
Emergency Communication: fixed telephone lines as follows:
Outdoor tennis clubhouse 542-1622
Indoor tennis clubhouse 542-4584
Coach Diaz office 542-8066 or 542-9348
Coach Wallace office 542-5090
Emergency Equipment: supplies (AED, trauma kit, splint kit, spine board) maintained in Stegeman Coliseum athletic training facility
Roles of First Responders
1. Immediate care of the injured or ill student-athlete
2. Emergency equipment retrieval
3. Activation of emergency medical system (EMS)

    a. 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested

    b. notify campus police at 542-2200

4. Direction of EMS to scene

    a. open appropriate gates (punch code to McWhorter Courts gate: 543)

    b. designate individual to "flag down" EMS and direct to scene

    c. scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions: Dan Magill Tennis Complex is located in the Stegeman Coliseum parking area between Foley Baseball Field and McWhorter Hall. The parking area is accessed by two roads:
1. Rutherford Street (cross street Smith)
2. Brooks Drive (cross street Carlton)
The Dan Magill Tennis Complex consists of three areas:
1. Tennis stadium (6 courts)
2. Indoor Tennis Center (4 courts)
3. Practice area (6 courts) on hill behind indoor tennis center
Venue Map

Emergency Plan:UGA Cross-Country Racing Venue

Emergency Personnel: certified athletic trainer and student athletic trainer(s) on site for competitions.
Emergency Communication: the certified athletic trainer carries a cellular phone;
Emergency Equipment: supplies (AED, trauma kit, splint kit, spine board) transported to venue each competition from Stegeman Coliseum athletic training facility
Roles of First Responders
1. Immediate care of the injured or ill student-athlete
2. Emergency equipment retrieval
3. Activation of emergency medical system (EMS)

    a. 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested

    b. notify campus police at 542-2200

2. Direction of EMS to scene

    c. open appropriate gates

    d. designate individual to "flag down" EMS and direct to scene

    e. scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions: UGA Cross Country Racing Complex is located on South Milledge (approximately 1.50 miles past Hwy. 441. There is a UGA sign (Golf Maintainence Shop Entrance) at the entrance on the left past the State Botanical Garden entrance. Turn into complex just before the Sign. Upon entering complex, turn left just past the Railroad tracks. The Start line is located by the Large Red Barn straight ahead.
Venue Map

Emergency Plan:UGA Golf Course Venue

Emergency Personnel: UGA golf coach(es) on site for practice and competitions (current first aid/CPR training).
Emergency Communication: fixed telephone line at Boyd Golf Center (369-5932)
Emergency Equipment: first aid kit with limited supplies maintained in Boyd Golf Center
Roles of First Responders
1. Immediate care of the injured or ill student-athlete
2. Emergency equipment retrieval
3. Activation of emergency medical system (EMS)

a. 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested

b. notify campus police at 542-2200

4. Direction of EMS to scene

a. open appropriate gates

b. designate individual to "flag down" EMS and direct to scene

c. scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions: UGA Golf Course is on Riverbend Road off South Milledge:
Follow South Milledge to Riverbend Road (4/10 mile past Hwy. 441)
Turn left on Riverbend Road; UGA Golf Course is 2/10 mile on right
Venue Map

MEMORANDUM

Date: August 30, 1999
To: Sparky Wilson, EMT-P, Director of EMS, St. Mary's Hospital Don Cargile, EMT-P, Director of Emergency Services, Athens Regional Medical Center Chuck Horton, Chief, UGA Public Safety
From: Ron Courson, Director of Sports Medicine
RE: Athletic Venue Emergency Plans
Emergency Plan:
Enclosed along with this memorandum is a copy of the newly revised University of Georgia Sports Medicine Emergency Plan. This plan features specific information for each athletic venue and has been reviewed with all UGA sports medicine staff members as well as coaches and strength and conditioning personnel. Venue specific plans have been posted by telephones at each facility. The plan emphasizes proper communication with both EMS and campus police and provision of specific directions applicable to each venue.
Athletic Practice and Competition Coverage
With the exception of golf, all UGA athletic teams have a member of the UGA sports medicine staff at all practices and competitions. In addition, with competition, St. Mary's EMS will have an ambulance and EMS crew at football (designated field of play), men's

and women's basketball, gymnastics, and soccer. Attached is an overview of our sports medicine coverage.

Emergency Training:

All UGA certified athletic trainers are CPR and first aid trained. All UGA student athletic trainers are, at a minimum, CPR trained. In addition, beginnng this year, all UGA coaches and strength and conditioning personnel have completed a National Safety Council course in child and adult CPR and first aid. Eleven of the certified athletic trainers with the UGA sports medicine staff are additionally currently taking an EMT-I course through Glenn Henry, EMT-P with Northeast Georgia EMS.

Emergency Equipment:

Basic emergency equipment is on site at each venue as outlined in the emergency plan. All UGA certified athletic trainers and team physicians have received AED training and four PhysioControl Life-Pak 500 AED units are accessible at venues for athletic cardiac emergencies.

Fortunately, athletic emergencies are rare occurences. However, when they do occur, advance preparation and communication between all members of the emergency team helps effect a better outcome. I hope that sharing this information in advance with EMS providers and campus police will be beneficial. I appreciate the assistance that each of your respective departments provides to the Athletic Association and the sports medicine program.

Cc: Vince Dooley, Director of Athletics

Lewis Gainey, Athletic Director: Event Management

Central Cabarrus High School Athletics Department

Emergency Action Plan

Contents

Central Cabarrus High School Emergency Action Plan

Introduction

Emergency situations may arise at anytime during athletic events. Expedient action must be taken in order to provide the best possible care to the athletes of emergency and/or life threatening conditions. The development and implementation of an emergency plan will help ensure that the best care will be provided.
Athletic departments have a duty to develop an emergency plan that may be implemented immediately when necessary and to provide appropriate standards of health care to all sports participants. As athletic injuries may occur at any time and during any activity, the sports medicine team must be prepared. This preparation involves formulation of an emergency plan, proper coverage of events, maintenance of appropriate emergency equipment and supplies, utilization of appropriate emergency medical personnel, and continuing education in the area of emergency medicine. Hopefully, through careful pre-participation physical screenings, adequate medical coverage, safe practice and training techniques and other safety avenues, some potential emergencies may be averted. However, accidents and injuries are inherent with sports participation, and proper preparation on the part of the sports medicine team will enable each emergency situation to be managed appropriately

Components of the Emergency Plan

There are three basic components of this plan:
1. Emergency personnel
2. Emergency communication
3. Emergency equipment

Emergency Plan Personnel

With athletic association practice and competition, the first responder to an emergency situation is typically a member of the sports medicine staff, most commonly a certified athletic trainer, student assistant, or coach. A team physician may not always be present at every organized practice or competition. The type and degree of sports medicine coverage for an athletic event may vary widely, based on such factors as the sport or activity, the setting, and the type of training or competition. The first responder in some instances may be a coach, or other institutional personnel. Certification in cardiopulmonary resuscitation (CPR), first aid, prevention of disease transmission, and emergency plan review is required for all athletics personnel associated with practices, competitions, skills instruction, and strength and conditioning.
The development of an emergency plan cannot be complete without the formation of an emergency team. The emergency team may consist of a number of healthcare providers including physicians, emergency medical technicians, certified athletic trainers; student assistants; coaches; managers; and possibly, bystanders. Roles of these individuals within the emergency team may vary depending on various factors such as the number of members of the team, the athletic venue itself, or the preference of the head athletic trainer. There are four basic roles within the emergency team. The first and most

important role is immediate care of the athlete. The most qualified individual on the scene should provide acute care in an emergency situation. Individuals with lower credentials should yield to those with more appropriate training. The second role, equipment retrieval, may be done by anyone on the emergency team who is familiar with the types and location of the specific equipment needed. Student assistants, managers, and coaches are good choices for this role. The third role, EMS activation, may be necessary in situations where emergency transportation is not already present at the sporting event. This should be done as soon as the situation is deemed an emergency or a life-threatening event. Time is the most critical factor under emergency conditions. Activating the EMS system may be done by anyone on the team. However, the person chosen for this duty should be someone who is calm under pressure and who communicates well over the telephone. This person should also be familiar with the location and address of the sporting event. After EMS has been activated, the fourth role in the emergency team should be performed, directing EMS to the scene. One member of the team should be responsible for meeting first responders such as firemen or rescue squad personnel as they arrive at the site of the contest and a second person should direct Paramedics. Depending on ease of access, this person should have keys to any locked gates or doors that may slow the arrival of medical personnel. A student assistant, manager, or coach may be appropriate for this role.

Roles Within the Emergency Team

1. Immediate care of the athlete
2. Emergency equipment retrieval
3. Activation of the Emergency Medical System
4. Direction of EMS to scene

Activating the EMS System

Making the Call:

- 911 (if available)
- Telephone numbers for local police, fire department, and ambulance service

Providing Information:

- Name, address, telephone number of caller
- Number of athletes
- Condition of athlete(s)
- First aid treatment initiated by first responder
- Specific directions as needed to locate the emergency scene ("come to south entrance of coliseum")
- Other information as requested by dispatcher

When forming the emergency team, it is important to adapt the team to each situation or sport. It may also be advantageous to have more than one individual assigned to each role. This allows the emergency team to function even though certain members may not always be present.

Emergency Communication

Communication is the key to quick delivery of emergency care in athletic trauma situations. Athletic trainers and emergency medical personnel must work together to provide the best possible care to injured athletes. Communication prior to the event is a good way to establish boundaries and to build rapport between both groups of professionals. Prior to the beginning of each fall season Athletic Trainers and EMTs will meet as designated by Cabarrus County Schools Athletics Director. If emergency medical transportation is not available on site during a particular sporting event then direct communication with the emergency medical system at the time of injury or illness is necessary. Access to a working telephone or other telecommunications device, whether fixed or mobile, should be assured. The communications system should be checked prior to each practice or competition to ensure proper working order. A back-up communication plan should be in effect should there be failure of the primary communication system. The most common method of communication is a public telephone. However, a cellular phone is preferred if available. At any athletic venue, whether home or away, it is important to know the location of a workable telephone. Pre-arranged access to the phone should be established if it is not easily accessible.

Emergency Equipment

All necessary emergency equipment should be at the site and quickly accessible. Personnel should be familiar with the function and operation of each type of emergency equipment. Equipment should be in good operating condition, and personnel must be trained in advance to use it properly. Emergency equipment should be checked on a regular basis and use rehearsed by emergency personnel. The emergency equipment available should be appropriate for the level of training for the emergency medical providers.

It is important to know the proper way to care for and store the equipment as well. Equipment should be stored in a clean and environmentally controlled area. It should be readily available when emergency situations arise.

Transportation

Emphasis is placed at having an ambulance on site at high risk sporting events. EMS response time is additionally factored in when determining on site ambulance coverage. The athletics director coordinates on site ambulances for competition in home football and soccer. Ambulances may be coordinated on site for other special events/sports, such as major tournaments or NCHSAA regional or championship events. Consideration is given to the capabilities of transportation service available (i.e., Basic Life Support or Advanced Life Support) and the equipment and level of trained personnel on board the ambulance. In the event that an ambulance is on site, there should be a designated location with rapid access to the site and a cleared route for entering/exiting the venue. In the emergency evaluation, the primary survey assists the emergency care provider in identifying emergencies requiring critical intervention and in determining transport decisions. In an emergency situation, the athlete should be transported by ambulance, where the necessary staff and equipment is available to deliver appropriate care. Emergency care providers should refrain from transporting unstable athletes in inappropriate vehicles. Care must be taken to ensure that the activity areas are supervised should the emergency care provider leave the site in transporting the athlete.

Conclusion

The importance of being properly prepared when athletic emergencies arise cannot be stressed enough. An athlete's survival may hinge on how well trained and prepared athletic healthcare providers are. It is prudent to invest athletic department "ownership" in the emergency plan by involving the athletic administration and sport coaches as well as sports medicine personnel. The emergency plan should be reviewed at least once a year with all athletic personnel, along with CPR and first aid refresher training. Through development and implementation of the emergency plan, the athletics department helps ensure that the athlete will have the best care provided when an emergency situation does arise.

Approved by ____
Date: _____________________

Football Stadium (Football, Soccer, Track)

Emergency Personnel
- Athletic trainers, student assistants, assistant coaches

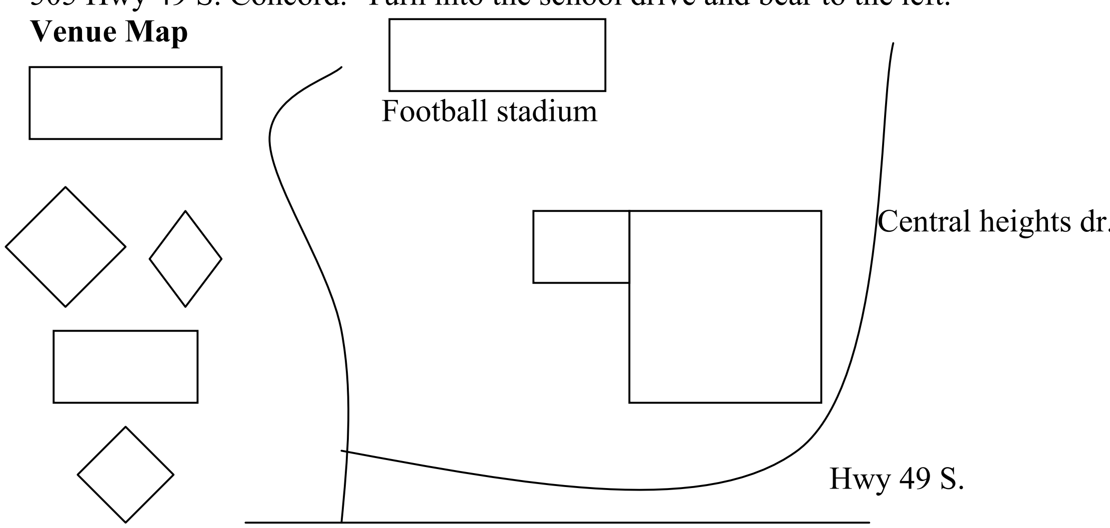
Emergency Communication
- Fixed phone line in the old field house 704-793-1407
- Fixed phone line in the new field house offices and athletic training room 704-782-7563 (line 2)
- Mobile phone carried by the athletic trainer 704-737-8255
- Pager carried by athletic trainer 704-217-0950
- Two way radio carried by student assistants and athletic trainer

Emergency Equipment
- Trauma kit, splint kit, spine board, cervical collar, rescue shears, FM Extractor

Roles of the First Responders
1) Immediate care of the injured athlete or ill student (Most qualified at the scene shall assume this role)
2) Emergency equipment retrieval – student assistant
3) Activation of EMS – student or coach
   a) 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested)
   b) Notify parents as soon as possible (travel cards in each kit have parent contact numbers)
4) Direction of EMS to scene
   a. Open appropriate gates
   b. Designate one to two people to "flag down" EMS and direct to scene. May be students or coaches
   c. Scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions
505 Hwy 49 S. Concord. Turn into the school drive and bear to the left.

Venue Map



Baseball Field

Emergency Personnel
- Athletic trainer, student assistants, coaches

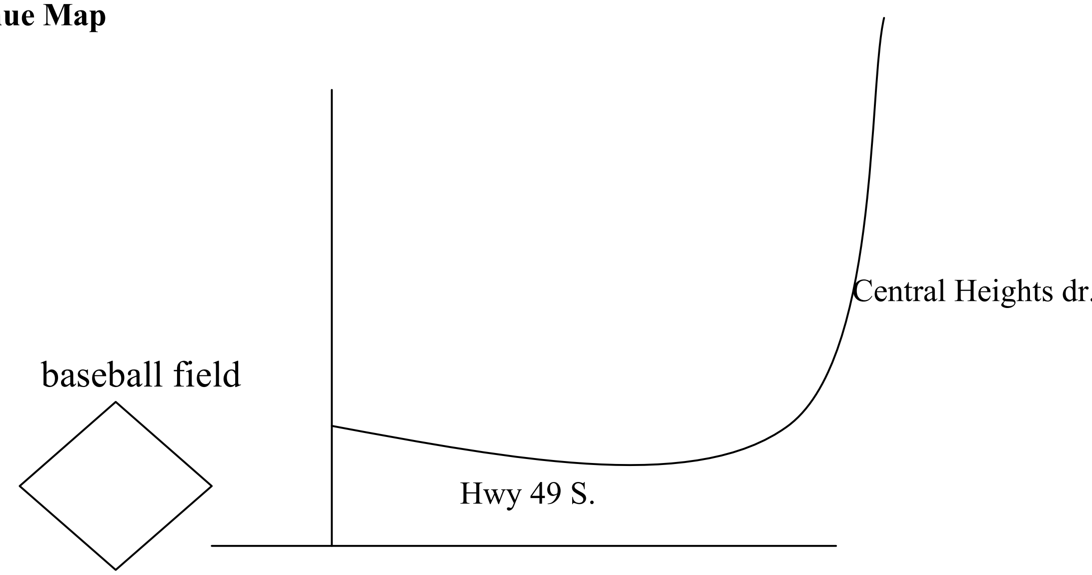
Emergency Communication
- Fixed phone line in the baseball office 704-784-9906
- Mobile phone carried by the athletic trainer 704-737-8255
- Pager carried by athletic trainer 704-217-0950
- Two way radio carried by student assistants and athletic trainer

Emergency Equipment
- Trauma kit. All other equipment (splints, spine board, cervical collars, crutches are maintained n the new field house

Roles of the First Responders
1) Immediate care of the injured athlete or ill student (Most qualified at the scene shall assume this role)
2) Emergency equipment retrieval – student assistant
3) Activation of EMS – student or coach
   a) 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested)
   b) Notify parents as soon as possible (travel cards in each kit have parent contact numbers).
4) Direction of EMS to scene
   c) Open appropriate gates
   d) Designate one to two people to "flag down" EMS and direct to scene. May be students or coaches
   e) Scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions
505 Hwy 49 S. Concord. Directly on the right after turning into the school

Venue Map



Softball Field

Emergency Personnel
- Athletic Trainer, student assistants, coaches

Emergency Communication
- Fixed phone in the new field house 704-782-7563
- Mobile phone carried by athletic trainer 704-737-8255
- Pager carried by athletic trainer 704-217-0950
- Two way radio carried by student assistants and athletic trainer

Emergency Equipment
- Trauma kit. Other equipment maintained in new field house (splints, spine board, cervical collar, crutches)

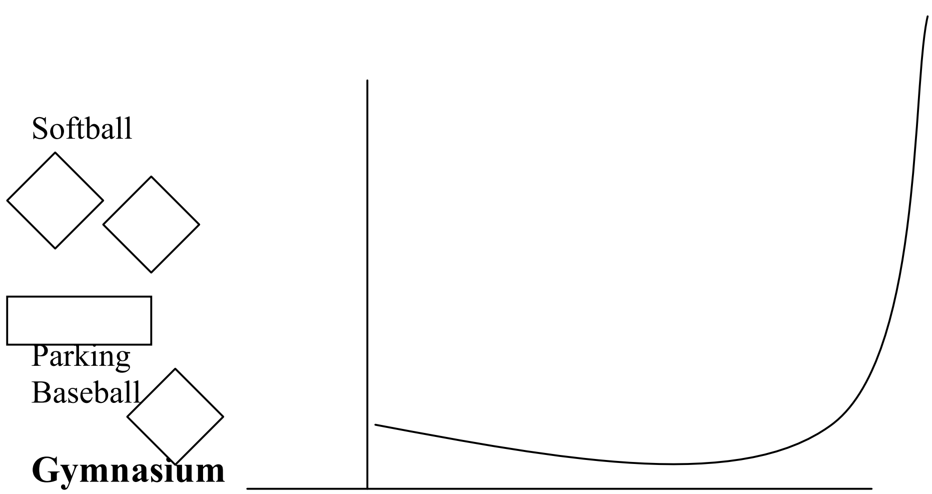
Roles of the First Responders

1) Immediate care of the injured athlete or ill student (Most qualified at the scene shall assume this role)
2) Emergency equipment retrieval – student assistant
3) Activation of EMS – student or coach
   a) 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested)
   b) Notify parents as soon as possible (travel cards in each kit have parent contact numbers).
4) Direction of EMS to scene
   a) Open appropriate gates
   b) Designate one to two people to "flag down" EMS and direct to scene. May be students or coaches
   c) Scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions

505 Hwy 49 S. Concord. After turning into the school road, bear to the left and go past the first field, which is the baseball field. The softball field is the next field.

Venue Map



Emergency Personnel

- Athletic Trainer, student assistants, coaches

Emergency Communication

- Fixed phone in the athletic directors office adjacent to gymnasium locker rooms 704-786-0125 ext 319
- Mobile phone carried by athletic trainer 704-737-8255
- Pager carried by athletic trainer 704-217-0950
- Two way radio carried by student assistants and athletic trainer

Emergency Equipment

- Trauma kit. Other equipment maintained in new field house (splints, spine board, cervical collar, crutches)

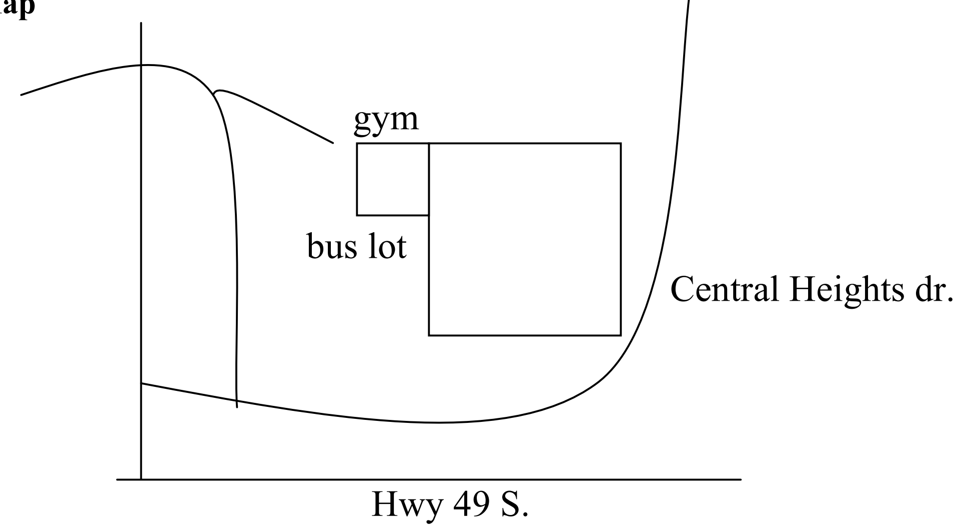
Roles of the First Responders

1) Immediate care of the injured athlete or ill student (Most qualified at the scene shall assume this role)
2) Emergency equipment retrieval – student assistant
3) Activation of EMS – student or coach
   a) 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested)
   b) Notify parents as soon as possible (travel cards in each kit have parent contact numbers).
4) Direction of EMS to scene
   a) Open appropriate gates
   b) Designate one to two people to "flag down" EMS and direct to scene. May be students or coaches
   c) Scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions

505 Hwy 49 S. Concord. Enter from bus parking lot or from front of school

Venue Map



Wrestling Room/Weight Room

Emergency Personnel

Emergency Communication

- Athletic Directors office adjacent to gymnasium locker rooms 704-786-0125
- Mobile phone carried by athletic trainer 704-737-8255
- Pager carried by athletic trainer 704-217-0950
- Two way radio carried by student assistant and athletic trainer

Emergency Equipment

- Trauma kit. Other equipment maintained in new field house (splints, spine board, cervical collar, crutches)

Roles of the First Responders

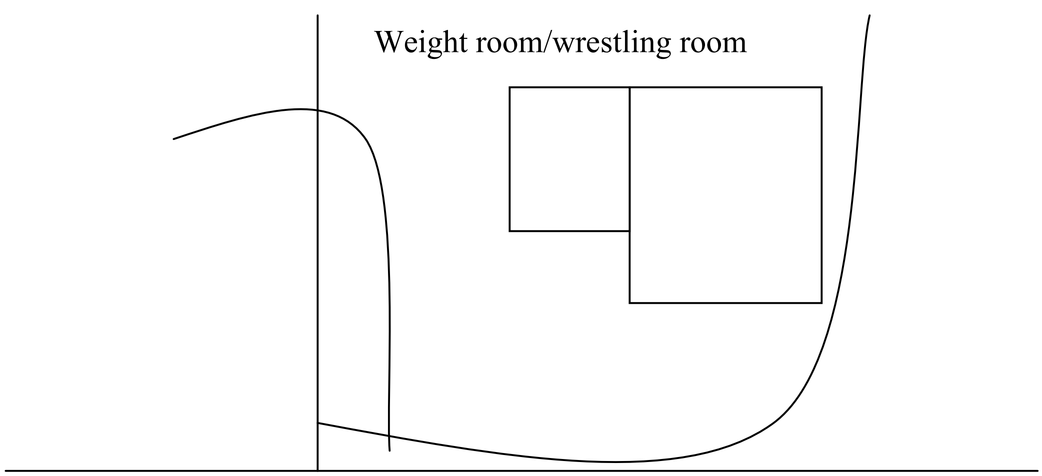
1) Immediate care of the injured athlete or ill student (Most qualified at the scene shall assume this role)
2) Emergency equipment retrieval – student assistant
3) Activation of EMS – student or coach
   a) 911 call (provide name, address, telephone number; number of individuals injured; condition of injured; first aid treatment; specific directions; other information as requested)
   b) Notify parents as soon as possible (travel cards in each kit have parent contact numbers).
4) Direction of EMS to scene
   a) Open appropriate gates
   b) Designate one to two people to "flag down" EMS and direct to scene. May be students or coaches

Scene control: limit scene to first aid providers and move bystanders away from area

Venue Directions

505 Hwy 49 S. Concord. Enter from bus parking lot.

Venue Map



Inclement Weather Policies

Hot Weather Guidelines

From the NATA Fluid Replacement Statement

Dehydration can compromise athletic performance and increase the risk of exertional heat injury. Athletes do not voluntarily drink sufficient water to prevent dehydration during physical activity. Drinking behavior can be modified by education, increasing fluid accessibility, and optimizing palatability. However, excessive overdrinking should be avoided because it can also compromise physical performance and health. We will provide practical guidelines regarding fluid replacement for athletes.

- Acclimatization will take place over 11 days
- Unlimited amounts of water will be made readily available and for events lasting >90 continuous minutes a sports drink will be made available to help replace electrolytes.
- It is recommended that 6-10oz of water be consumed every 20 minutes.
- Wet bulb temperatures will be taken to determine training standards using a sling psychrometer or equivalent device (see table).

Temperature (F)	Humidity	Procedure
80 – 90	**< 70**	**Watch Obese athletes, provide unlimited water**
80 – 90	**> 70**	**Breaks recommended every half hour**
90 – 100	**< 70**	**All athletes should be under careful supervision**
90 – 100	**> 70**	**Abbreviated practice with light equipment or suspended practice**
> 100		

- A 3% dehydration rule will be in effect using a weight chart to monitor athletes during the acclimatization period.

Lightening Policy

From the NATA Position Statement on Lightening Safety in Athletics

Lightning may be the most frequently encountered severe-storm hazard endangering physically active people each year. Millions of lightning flashes strike the ground annually in the United States, causing nearly 100 deaths and 400 injuries. Three quarters of all lightning casualties occur between May and September, and nearly four fifths occur between 10:00 AM and 7:00 PM, which coincides with the hours for most athletic or recreational activities. Additionally, lightning casualties from sports and recreational activities have risen alarmingly in recent decades.

Recommendations

The National Athletic Trainers' Association recommends a proactive approach to lightning safety, including the implementation of a lightning-safety policy that identifies safe locations for shelter from the lightning hazard. Further components of this policy are monitoring local weather forecasts, designating a weather watcher, and establishing a chain of command. Additionally, a flash-to-bang count of 30 seconds or more should be used as a minimal determinant of when to suspend activities. Waiting 30 minutes or longer after the last flash of lightning or sound of thunder is recommended before athletic or recreational activities are resumed. Lightning safety strategies include avoiding shelter under trees, avoiding open fields and spaces, and suspending the use of landline telephones during thunderstorms. Also outlined in this document are the pre-hospital care guidelines for triaging and treating lightning-strike victims. It is important to evaluate victims quickly for apnea, asystole, hypothermia, shock, fractures, and burns. Cardiopulmonary resuscitation is effective in resuscitating pulse less victims of lightning strike. Maintenance of cardiopulmonary resuscitation and first-aid certification should be required of all persons involved in sports and recreational activities.

Guidelines for CCHS

- The game official, athletics director, principle or assistant principle will make the official call to remove individuals from the game field. The athletic trainer or coach will make the call to remove individuals from the practice field(s).
- Thirty minutes time will be given for the storm to pass.
- The athletic trainer or an assistant coach will be the designated weather watcher, actively looking for signs of threatening weather.
- The athletic trainer or athletic director shall monitor weather through the use of a Sky Scan, local forecast, or **www.weather.com**.

- The criteria for postponement and resumption of activities will be the thirty second flash to bang method. After the first flash is seen, a count will commence. Counting is ceased when the associated bang is heard. This count is divided by five to determine the distance in miles from the venue. When the count reaches thirty, individuals should be in a safe shelter. This is the thirty-thirty rule.

- Safe shelters for each venue are as follows:

  Football/Soccer/Cross Country/Track/Field

    1. Gymnasium or New and old field house
    2. Car

  Baseball

    1. Gymnasium or New field house locker room
    2. Car

  Softball

    1. Gymnasium or New Field house
    2. Car

Note: the secondary choice for some venues is a fully enclosed vehicle with a metal roof and the windows completely closed.

- The following first aid will be observed for lightening strike victims:
    1) Survey the scene for safety
    2) Activate EMS
    3) If necessary move lightening victims to a safe shelter
    4) Evaluate airway, breathing, circulation, and begin CPR if necessary
    5) Evaluate and treat for hypothermia, shock, fractures, and/or burns

National Federation of State High School Associations

SUPPLEMENTS POSITION STATEMENT

National Federation of State High School Associations (NFHS)
Sports Medicine Advisory Committee (SMAC)

The National Federation of State High School Associations (NFHS) recently advised the membership of a heightened level of concern about nutritional supplements. Empirical data has demonstrated widespread use of such products by persons of high-school age. The products are unregulated by the Food and Drug Administration (FDA), and they may contain potentially harmful ingredients such as (but not limited to) creatine, ephedrine or excessive amounts of caffeine.

In 1998, the NFHS Board of Directors issued a position statement on the use of drugs, medications and supplements by participants in interscholastic sports. The NFHS' strong recommendation then and remains today that all student-athletes and their parents/guardians should consult with their physicians before taking any supplement product. In addition, school personnel, including coaches should not dispense any drug, medication or supplement except with extreme caution and in accordance with state regulations and school district policy. School district policies should be developed in consultation with health-care professionals, senior administrative staff of the school district and parents.

The new warning about nutritional supplements was issued by the NFHS through its Sports Medicine Advisory Committee, and was intended to serve as a reminder to student-athletes, parents and school officials. The warning reminded all interested parties that supplements in the form of pills, powder, drinks and food sources (medications, supplements and consumables) purporting to enhance strength and/or endurance should be ingested, if at all, only in accordance with applicable laws, and the advice of one's own health-care provider. Now because of the reported high level of supplement usage by teenagers, the NFHS is asking that its warning be given increased emphasis by all concerned parties.

Approved November 2002

National Federation of State High School Associations

INVASIVE MEDICAL PROCEDURES ON THE DAY OF COMPETITION

POSITION STATEMENT

National Federation of State High School Associations (NFHS)
Sports Medicine Advisory Committee (SMAC)

The NFHS SMAC was formed in 1996 to assist the NFHS in ensuring the safety of high school athletes across the nation. The SMAC investigates numerous issues, rules, and situations and considers their potential risks to athletes. Recently, the SMAC has reviewed the issue of invasive medical procedures such as intravenous (IV) rehydration and the use of injectable anesthetic/analgesic drugs during or before athletic contests and events.

While we believe these practices are not widespread at the high school level, a handful of such incidents have been reported to the SMAC over the past year. It is reported that these procedures are carried out at the college and professional levels. The SMAC is very concerned that occurrence of, or the desire for, such medical procedures will continue to "trickle down" to high school athletics.

The SMAC encourages a philosophy that high school athletics serve the purpose of providing young men and women the opportunity for personal growth in a controlled environment. The pursuit of victory is not, by itself, justification for medical intervention. We believe that invasive procedures such as the administration of IV fluids and the use of injectable anesthetic/analgesic drugs performed on the day of competition with the sole purpose of enabling a student athlete to participate are inconsistent with the philosophy of high school sports.

This position applies to any athlete requiring a local (example: lidocaine) or systemic (example: Toradol) pain-killing medication to enable him or her to play. This practice increases the risk of further injury to the affected body part. The use of prescription medication that is administered by injection for chronic medical conditions (such as insulin for diabetes or Imitrex for migraine headaches) is appropriate, and will not be affected.

Second, performing medical procedures in a locker room, training room, or other facility is fraught with the potential for infection and other complications. The placement of an intravenous catheter or the administration of an intramuscular or subcutaneous injection is a medical procedure and should be treated as such. Thus, a medical facility is the proper venue for any such invasive procedures to be carried out.

Finally, while our primary concern is with protecting the health of the young athlete, we believe this is also a matter of participation equity. Due to a variety of factors, few high school sports programs have team physicians attending their competitions and in many instances these volunteers do not have special training in sports medicine. Thus, teams and individuals who have a physician or other medical provider willing and able to provide such services will have a significant competitive advantage over their opponents who may not have such a specialist available.

After a review of the potential risks, consequences, and limited medical benefits of these invasive procedures, the NFHS Sports Medicine Advisory Committee takes the position that there is no proper role for these procedures in high school athletics. We strongly recommend to coaches, school administrators, athletic trainers, and team physicians that athletes should not be allowed to participate in athletic contests or events if they have received IV hydration or been injected with an anesthetic or analgesic medication on that same day.

Approved April 2009

National Federation of State
High School Associations

POSITION STATEMENT ON ANABOLIC STEROIDS

National Federation of State High School Associations (NFHS)
Sports Medicine Advisory Committee (SMAC)

EXISTING POLICIES/STANDS

The NFHS strongly opposes the use of anabolic steroids and other performance-enhancing substances by high school student-athletes. Such use violates legal, ethical and competitive equity standards, and imposes unreasonable long-term health risks. The NFHS supports prohibitions by educational institutions, amateur and professional organizations and governmental regulators on the use of anabolic steroids and other controlled substances, except as specifically prescribed by physicians for therapeutic purposes.

BACKGROUND

Anabolic, androgenic steroids (AAS) are synthetic derivatives of the male hormone testosterone. Natural testosterone regulates, promotes and maintains physical and sexual development, primarily in the male, but with effects in the female as well. Like testosterone, AAS have both an anabolic effect (increase in muscle tissue) and an androgenic effect (masculinizing effects that boys experience during puberty). No AAS is purely anabolic. As a result, the use of AAS won't lead to muscle growth without also leading to other unintended, undesirable side effects.

According to national surveys, the use of AAS among high school students has been decreasing since about 2001. There are no national studies that measure the extent of AAS use by high school student-athletes, although some states publish statewide prevalence data. Nearly one-third of high-school age steroid users do not participate in organized athletics and are taking AAS primarily to modify their physical appearance. Athletes who use AAS do so for two main reasons: 1) to gain strength and 2) to recover more quickly from injury.

AAS are controlled substances and are illegal to use or possess without a prescription from a physician for a legitimate medical diagnosis. Some AAS are used by veterinarians to treat pigs, horses and cows. In humans, medical uses of AAS include weight gain in wasting diseases such as HIV-infection or muscular dystrophy, absent gonadal function in males, and metastatic breast cancer in women. AAS should not be confused with corticosteroids, which are steroids that doctors prescribe for medical conditions such as asthma and inflammation. AAS are prohibited by all sports governing organizations.

FACTS ABOUT ANABOLIC STEROIDS

- Anabolic steroids are controlled substances and are illegal to possess or sell without a prescription for a legitimate medical condition by the prescribing physician.
- Androstenedione, norandrostenedione and other similar prohormones, at one time available over the counter as dietary supplements, are now defined as controlled anabolic steroids.
- Athletes who have injected anabolic steroids in high school have tested positive in collegiate drug tests – months after they stopped injecting.
- Athletes who have injected anabolic steroids are at greater risk for infections, HIV and hepatitis.

POTENTIAL NEGATIVE SIDE EFFECTS FROM THE USE OF ANABOLIC STEROIDS

- Decreased eventual height if consumed before growth plates have fused in pre-pubertal youngsters
- Secondary sex characteristic changes
- Increased acne
- Growth of body/facial hair in girls
- Loss of hair in boys
- Permanent voice-lowering in girls
- Violent, combative behavior
- Sexual dysfunction and impotence
- Mood swings, loss of sleep, paranoia
- Depression upon stopping use
- Organ damage and death from heavy use

PREVENTING ATHLETES FROM TAKING ANABOLIC STEROIDS

- School personnel, coaches and parents can reduce steroid abuse by speaking out against such use.
- Talk with your athletes about frustrations they may have about how they look or how they are performing in their sport. Help them establish healthy expectations of their bodies.
- Talk to athletes about realistic performance standards.
- Focus on proper nutrition and hydration. Work with a registered dietician to develop a plan for appropriate weight gain and/or weight loss.
- Don't trust Internet marketing messages about quick fixes.
- Restrict athletes' access to environments where steroid use might occur and to people who are involved with anabolic steroids.
- Don't subscribe to publications such as muscle magazines that depict unrealistic pictures of men and women.
- Help athletes understand that using anabolic steroids not only is illegal but also is cheating.
- Consider initiating a formal performance-enhancing, drug-education program to educate athletes and deter use.

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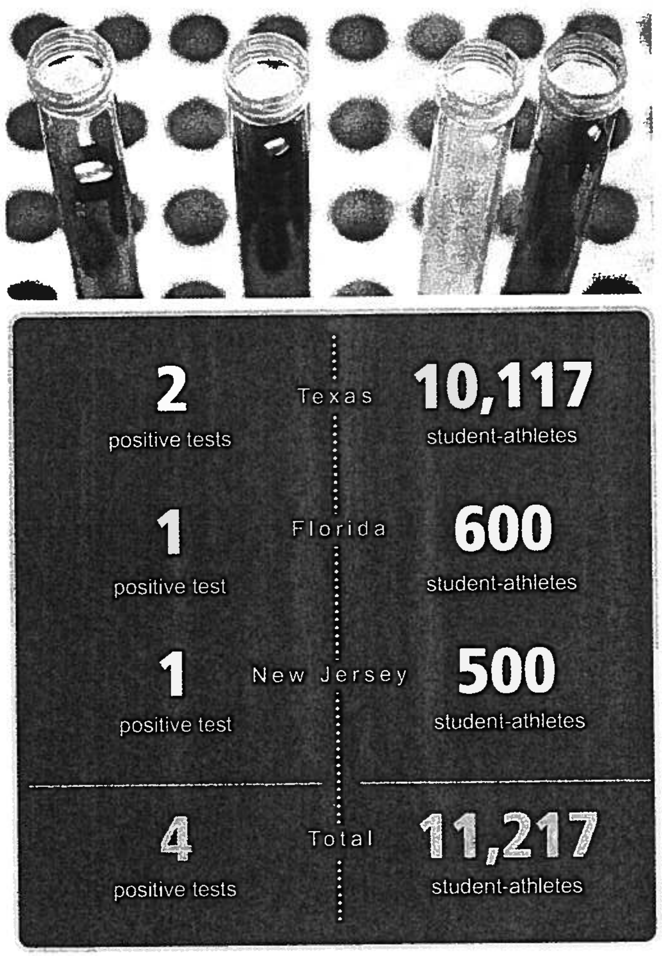
Revised and Approved in April 2009

Rethinking Steroid-testing Programs

BY STEVE APPELHANS

With the concern about steroids and other performance-enhancing drugs at an all-time high, it seems logical that testing high school student-athletes for such illegal substances is a good thing. So why are many state representatives thinking twice before implementing steroid-testing programs? And why are some of those states with a steroid-testing program choosing to discontinue it?



Simply put – almost no one has tested positive.

According to the most recent statistics, only four of the 11,217 student-athletes who were screened nationwide tested positive for steroids.

The vast majority of student-athletes who were tested – 10,117 to be exact – reside in Texas, and only two of them tested positive. One positive test came from the 600 student-athletes tested in Florida, while the other came from one of 500 student-athletes tested in New Jersey.

In addition to Texas, New Jersey – which started the nation's first high school testing program in 2006 – and Illinois – which is starting its first year of testing – currently have steroid-testing programs in place. On the other hand, Florida discontinued its program after one year, and Indiana has decided against implementing a program of its own.

"We're not against steroid testing," Bobby Cox, assistant commissioner at the Indiana High School Athletic Association, told USA Today. "You look at Florida and New Jersey, and they have two positive tests. Is it really worth it to put that much money to get that kind of return?"

That kind of money ranges from Florida's former $100,000 program to Texas's current $3 million program. So the question becomes: Is it worth it?

For many states, the answer is no.

In most cases, individual state governments are responsible for funding the steroid testing programs. However, some legislators believe the money used for testing could be put to better use.

"I thought it was a ridiculous use of money at the time and now we're finding it's even more ridiculous than I expected," Debbie Riddle, Texas State Representative, told USA Today. "Their intentions are honorable, but I think if they had to do it again, I bet there would be four people voting for it rather than four people voting against it."

Riddle doubts the program, which concludes after the 2008-09 school year, will be renewed.

The Illinois High School Associations (IHSA) has decided to take a different approach. Instead of getting the state to fund a program, the IHSA is spending $150,000 to test as many as 750 students – a cost that will be covered by ticket sales during the postseason. ◉

*See related story on page 26.

Steve Appelhans was a summer intern in the NFHS Publications/Communications Department. He is a senior at the University of Wisconsin-La Crosse majoring in sport management.

24.

People Informing People THE HAWK EYE
THE HAWK EYE

Steroid testing working in high schools

Only 20 tests in four states have come back positive.

By GEOFF MULVIHILL

The Associated Press

MOUNT LAUREL, N.J. -- At one time, testing high school athletes for steroids was seen as the best way to fight performance-enhancing drug use among the young. Now, those efforts are losing steam because of high costs and few positive results.

New Jersey, Florida, Texas and Illinois have tried steroid testing since 2006, and an examination of the results by The Associated Press shows that only 20 tests out of 30,799 have come back positive.

That's far short of what one study concluded about use of the drugs that are associated with stunted growth, hormonal problems, strokes and heart ailments. University of Michigan surveys conducted in 2007 and '08 each found 2.2 percent of seniors said they had tried steroids at least once -- down from 4 percent in 2002.

Testing advocates argue that results from the four states show the program works as a deterrent. Critics say they show the flaws in how the tests were conducted. Either way, it's becoming harder amid a recession to justify spending up to $200 each on tests that rarely catch cheaters.

Missouri state Sen. Matt Bartle tried to push his colleagues to adopt a statewide high school steroid testing program because he was concerned that young athletes were emulating the bad habits of some professionals.

But when Florida dropped its program in 2008 after a costly one-year trial in which there was only one positive out of 600 students tested, Bartle decided a similar effort wouldn't be cost-effective in Missouri, and he didn't submit a proposal this year.

"Is there enough steroid use out there that spending a couple million bucks a year against everything else that the state needs to spend money on is worth it?" Bartle asked.

The state programs grew out of health concerns and doping scandals in baseball, cycling and track and field. Last month, New York Yankees slugger Alex Rodriguez became the latest name tied to performance-enhancing drugs, admitting he used them while with the Texas Rangers from 2001-03.

All four states chose athletes at random. In New Jersey and Illinois, only those on teams in state tournaments were subject to the testing, while all athletes in Texas were, although no tests were given in the summer after the academic and athletic year is over. In Florida, all participants in six sports (baseball, football, softball, girls' flag football and boys' and girls' weightlifting) were eligible.

The AP's examination of the states' steroid tests showed limited impact when it came to catching users:

-- While 20 tests came back positive, six were granted medical exemptions.

-- Another 12 tests in Texas are being rechecked because the results were unresolved. Officials there also have classified another 70 cases as "process positives" because students refused to give urine samples or had unexcused absences when they were called.

-- Accounting for the exemptions and process positives, and assuming every unresolved test is positive, that still means tests revealed 78 steroid users at most. That translates into one user for every 320 tests given.

Bob Colgate, assistant director of the National Federation of State High School Associations, used to get calls from sports administrators across the country asking about steroid testing. As state budgets have tightened, he said, such calls have ended. And those involved with high school sports still debate whether testing is effective.

"Did we have a problem? Do we have a problem, or is this taking care of the problem?" Colgate asked. "I don't think everybody's come to grips with this."

Such uncertainty doesn't play well in legislatures.

Critics in Texas say the program has failed to get enough positive results to justify the cost -- $6 million to test up to 50,000 students for two years.

State Sen. Dan Patrick of Houston said in 2008 that the program should be abolished, calling it "a colossal waste of taxpayer money." He was unsuccessful, although testing advocates concede the program is likely to be scaled back for the upcoming school year.

"I could support something that is narrowed and tailored to focus on the students and sports who are more likely to be implicated in those tests," Patrick said.

The state representative who championed the program counters that testing works as a deterrent.

"The idea was not a 'gotcha' program," said Texas state Rep. Dan Flynn. Because of testing, coaches, parents and students know more about dangers of steroids and how to identify the signs that a teen is using them, he said.

New Jersey state Senate President Richard Codey said he knew something should be done in 2005 when his basketball-playing sons -- then in high school and college -- told him they were aware of peers who used steroids.

At Codey's urging, the state began testing for the 2006-07 school year, randomly checking students who were in state tournaments. The cost of $100,000 per year is split between the state government and the New Jersey Interscholastic Athletic Association.

In the first two years, two of the 1,001 tests given to players chosen at random from playoff teams in all sports came back positive.

Linn Goldberg, a professor at the Oregon Health and Science University, said New Jersey's program -- which is similar to Illinois' -- doesn't work because students know they'll only be tested during the playoffs.

That means they can use steroids with no chance of being caught for most of the year, he said.

Frank Uryasz, president of Drug Free Sport of Kansas City, which conducts testing for all the states with mandatory tests, as well as for the NCAA, said surveys on steroid use by college athletes show that testing is a deterrent.

He acknowledges there are built-in problems in testing high school students.

"How likely is it we're going to test a high school athlete in July?" he asked. "Zero. It's not going to happen."

Codey disagrees.

"You've got to think it makes a kid say, 'I'm going to lay off for the next four months,'" he said. "That's a positive."

Goldberg, who developed a steroids education program that was implemented in schools with funding from the NFL, said testing is not "a quick fix." He added: "There has to be peer pressure to do the right thing."

Zach Greenwald, a star on the powerhouse football and wrestling teams at New Jersey's Paulsboro High, said peer pressure works.

He said he's not aware of anyone at his school using steroids and he isn't tempted because he knows about their health effects.

Still, the 17-year-old junior said not everyone his age has the same perspective, which is why he doesn't mind that he was tested last fall.

"It cuts back on teams cheating," he said.

Associated Press writer Jim Vertuno in Austin, Texas, contributed to this.

FLORIDA PROGRAM – DROPPED AFTER 2007-2008

2007-08 State of Florida/FHSAA Anabolic Steroid Testing Program

The State of Florida has directed the FHSAA to test student-athletes in grades 9-12 for the use of anabolic steroids during the 2007-08 school year. Student-athletes who are participating in the sports of baseball, football and weightlifting will be randomly selected to undergo testing. Florida Law 2007-192 establishes the basic guidelines for the testing program.

This document contains information on how the testing program will be conducted, the penalties for tests resulting in positive findings, and the procedures for appealing positive findings and the resulting penalties. It also outlines the responsibilities and obligations of member schools and individual student-athletes.

WHO WILL BE TESTED?

Approximately 1 percent of all student-athletes in grades 9-12 who participate in the sports of boys baseball, girls flag football, boys tackle football, girls softball and girls & boys weightlifting may be tested. Student-athletes in grades 6-8 will not be tested. Neither will student-athletes in grades 9-12 who participate in sports other than the six target sports.

WHO WILL CONDUCT THE TESTS?

The FHSAA has contracted with the National Center for Drug Free Sport, Inc.™ to administer the testing program. Specimens will be analyzed at UCLA's Olympic laboratory, the leading anti-doping lab in the world, which is certified by the World Anti-Doping Agency (WADA).

HOW WILL STUDENT-ATHLETES BE SELECTED FOR TESTING?

FHSAA will submit to Drug Free Sport, a list of all athletes who participate in the identified sports. Drug Free Sport will first randomly select the schools and then randomly select students from each school. At the end of the 2007-08 school year, a maximum of 1 percent of student-athletes participating in the named sports will have been tested.

IS IT POSSIBLE THAT A STUDENT-ATHLETE COULD BE TESTED TWICE?

Yes. Because the method of selection is completely random a student-athlete who participates in more than one of the six targeted sports could possibly be selected for testing in any one or more of those sports.

WHAT SUBSTANCES WILL STUDENT-ATHLETES BE TESTED FOR?

Student-athletes will be tested for anabolic steroids, including but not limited to THG and Madol, as well as substances that are used to mask the use of anabolic steroids. Student-athletes will not be tested for recreational drugs.

WHAT IS THE PROCESS FOR REPORTING NAMES OF PARTICIPATING STUDENT-ATHLETES TO THE FHSAA OFFICE?

Each school must provide to the FHSAA Office by sport a roster containing the names of all student-athletes in grades 9-12 who are participating in any of the six target sports. Each roster must be submitted by email on the Microsoft Excel spreadsheet template that is available for download at

http://www.fhsaa.org/compliance/steroid_testing/

Only the name of each student-athlete – last name followed by first name and current grade level– is needed. The initial roster in each target sport must be received in the FHSAA Office the week before the first permissible date of competition in that sport. The rosters will be forwarded to Drug Free Sport, which will make confidential, objective random selections of student-athletes from the rosters submitted by the schools selected for testing in the target sport.

HOW OFTEN DOES A SCHOOL HAVE TO SUBMIT UPDATED ROSTERS IN A SPORT AND WHAT HAPPENS IF A STUDENT-ATHLETE LEAVES THE PROGRAM?

It is not necessary for a school to submit an updated roster in a sport unless the school is selected for testing. Once a school is notified that it has been selected for testing in a sport, the school must submit to the FHSAA Office within 72 hours (3 days) a complete and up-to-date roster. The roster is to include **ALL** participants, including injured student-athletes. If a student-athlete leaves the program, for whatever reason, he/she **WILL NOT** be allowed to rejoin the team at any time during the 2007-08 school year.

WHAT IF A SCHOOL DOES NOT WANT ITS STUDENT-ATHLETES TO BE TESTED?

Participation in the testing program by a school is not optional. Florida Law 2007-192 has made participation in the testing program a prerequisite for membership in the FHSAA. If your school does not consent to participate in the testing program, its membership in the FHSAA will be suspended for the 2007-08 school year. There will be no exceptions.

WHAT IF A STUDENT-ATHLETE DOES NOT WANT TO BE TESTED, OR A STUDENT-ATHLETE'S PARENT(S)/LEGAL GUARDIAN(S) REFUSE TO CONSENT FOR THEIR CHILD TO BE TESTED?

Participation in the testing program by a student-athlete is not optional. Florida Law 2007-192 requires each student-athlete participating in the target sports, as well as the student-athlete's parent(s), to give their consent in writing for the student-athlete to be tested as a prerequisite for eligibility to participate in these sports. If a student-athlete does not provide to the school a consent form signed by the student-athlete and his/her parent(s), the student-athlete will not be eligible to participate in practice or competition in these sports. The student-athlete, however, will be eligible to participate in other sports.

WHEN WILL THE TESTING TAKE PLACE?

Student-athletes participating in any one of the six target sports will be subject to selection and testing at any time during the season for each of those sports.

WHAT WILL BE THE PROCEDURE FOR THE ACTUAL TEST?

Once Drug Free Sport randomly selects a student-athlete for testing, the procedure will be as follows:

1. Drug Free Sport will notify both the school administration and the FHSAA Office at least seven days in advance of when a certified specimen collector will visit the school to collect a urine specimen from the student. The name of the student to be tested, however, will not be disclosed.

2. When the specimen collector arrives at the school, he/she will disclose to the school administration the name(s) of the student-athlete(s) selected for testing. The student-athlete(s) will be called to the main office, directed to a private room, and required to provide a specimen.

3. The specimen collector will forward the specimen(s) to the lab, which will divide the specimen into an "A" sample and a "B" sample. The lab will only analyze the "A" sample during this period of testing. The "B" sample will be retained for analysis in the event of a challenge to a positive finding. The lab will provide to the FHSAA Office its findings within 10 – 14 business days, and the FHSAA will immediately notify the schools.

4. If a test produces a positive finding, the school administration, upon receipt of the notification, must immediately suspend the student-athlete from practice and competition in all sports. The school administration must notify and schedule a meeting with the student-athlete and his/her parents to review with them the positive finding, the procedure for challenging the finding, the penalties, and the procedure for appealing the penalties.

WHAT IF A STUDENT-ATHLETE WHO IS SELECTED FOR TESTING IS ABSENT ON THE DAY OF TESTING OR OTHERWISE FAILS TO REPORT FOR THE TEST WHEN CALLED?

Regardless of the reason why a student-athlete does not report to be tested when called (including an excused absence), the student-athlete must be immediately suspended from practice and competition in all interscholastic sports until a specimen is provided. A Drug Free Sport representative will be required to make a second trip to the school to collect that specimen. Therefore, the cost of the test will be the responsibility of the student-athlete or school. A test administered by any entity other than Drug Free Sport will not be accepted.

WHAT ARE THE PENALTIES TO A STUDENT-ATHLETE WHO TESTS POSITIVE?

1. **Suspension from practice and competition.** A student-athlete who tests positive will be suspended from practice and competition in all sports for 90 school days. The suspension will begin immediately on the day the school receives notice of a positive finding. The student-athlete must undergo a mandatory exit test no sooner than the 60th school day of the suspension. If the

exit test is negative, the student-athlete will be immediately reinstated. If the exit test is positive, the student-athlete will remain suspended until a subsequent retest results in a negative finding.

2. **Drug education program.** The student-athlete must attend and complete a drug education program conducted by the school, the school district or a third-party organization contracted by the school or school district.

WHAT IF A SCHOOL ALLOWS A STUDENT-ATHLETE WHO HAS NOT BEEN REPORTED TO THE FHSAA OFFICE FOR TESTING TO PARTICIPATE IN ONE OF THE TARGET SPORTS?

The student-athlete is ineligible. The school, therefore, will be required to forfeit each and every contest in which the student-athlete participated (dressed in uniform). Furthermore, the school may face a minimum fine of $2,500 and administrative or restrictive probation in the sport in which the violation occurred.

WHAT RIGHTS DO A SCHOOL AND/OR STUDENT-ATHLETE HAVE TO CHALLENGE A POSITIVE FINDING OR APPEAL A SUSPENSION?

1. **Challenging a positive finding.** A school may challenge a positive finding and must challenge the finding at the request of the student-athlete. The challenge must be filed with the FHSAA Office. The "B" sample of the student-athlete's original specimen that was retained by the lab will be analyzed. The cost of this analysis must be paid by the school or the student-athlete's parent(s). If the analysis results in a confirmed positive finding, the student-athlete will remain suspended. If the analysis results in a negative finding, the FHSAA will reinstate the student-athlete and refund the cost of the analysis. The student-athlete will remain suspended during the challenge.

2. **Appealing a suspension.** A school may appeal a suspension and must appeal the suspension at the request of the student-athlete. The appeal must be made to the Commissioner, who may uphold the full suspension, reduce the suspension by half, or reinstate the student-athlete. The school and/or student-athlete may appeal an unfavorable decision by the Commissioner to the Board of Directors, which, likewise, may uphold the full suspension, reduce the suspension by half or reinstate the student-athlete. The student-athlete, however, will remain suspended until he/she tests negative on an exit test.

WHO PAYS FOR THE TESTS?

The FHSAA will pay for the initial test of a student-athlete (analysis of "A" sample) and one exit test if needed. The school or student-athlete's family must pay the cost of any subsequent exit tests. If the school or student-athlete challenges a positive finding, then they must pay for the cost of the "B" sample analysis. If the challenge test produces a negative finding, the FHSAA will reimburse them for the cost of the challenge test

CAN A STUDENT-ATHLETE SUBMIT TEST RESULTS FROM ANOTHER AGENCY?

No. Only those tests administered by Drug Free Sport will be accepted.

WILL THE RESULTS OF A TEST BECOME A PART OF A STUDENT-ATHLETE'S PERMANENT EDUCATIONAL RECORD?

No. Florida Law 2007-193 states that all records relating to the test, and to any challenge or appeal resulting from a positive finding, must be maintained separately from the student-athlete's educational records.

WILL A POSITIVE TEST SUBJECT A STUDENT-ATHLETE TO CRIMINAL PROSECUTION?

No. Florida Law 2007-193 states that the result of test is not admissible as evidence in a criminal prosecution.

ARE RECORDS AND PROCEEDINGS PERTAINING TO THE TESTS SUBJECT TO PUBLIC RECORDS AND PUBLIC MEETINGS REQUIREMENTS?

No. Florida Law 2007-194 exempts all records relating to the tests from Florida's public records laws. Test results may be disclosed only to the FHSAA Office, the student-athlete, the parents of the student-athlete, the administration of the student-athlete's school, and the administration of any other school to which the student-athlete may transfer during a suspension resulting from a positive finding. All these individuals must keep the information confidential. Likewise, appeals before the FHSAA Board of Directors relating to the tests are exempt from the state's open meetings laws and will be closed to the public.

HOW LONG IS THE TESTING PROGRAM EXPECTED TO LAST?

The testing program currently is for the 2007-08 school year only. Florida Law 2007-193 will stand repealed on Oct. 2, 2008, unless renewed by the Florida Legislature during its 2008 session.

WILL SCHOOLS BE PROVIDED INFORMATION REGARDING THE SUBSTANCES THAT MAY CAUSE A POSITIVE FINDING SO THAT IT CAN EDUCATE ITS STUDENT-ATHLETES AND THEIR PARENTS?

Anyone needing information regarding anabolic steroids and other substances can visit the Center for Drug Free Sport web site, www.drugfreesport.com. The Hanley Center web site, www.hanleycenter.org, or its facility at 5200 East Avenue, West Palm Beach, Florida, also can provide resources to schools, student-athletes and parents.

WHAT RESPONSIBILITIES ASSOCIATED WITH THE TESTING PROGRAM DOES A MEMBER SCHOOL ADMINISTRATION HAVE?

The administration of each member senior high school sponsoring a program in baseball, football and/or weightlifting will have the following responsibilities:

1. Meet with student-athletes participating in the six target sports, as well as their parents, before the first day of practice in the sport to explain the testing program.

2. Distribute to every student-athlete participating in the six target sports a consent form for the testing program. This form must be signed by the student-athlete and his/her parents and returned to the school before the student-athlete can be permitted to participate in any practice or competition in these sports.

3. Provide to the FHSAA Office using the Microsoft Excel template a roster by sport containing the name of every student in grades 9-12 participating in the target sports who has turned in a signed consent form. A student-athlete will not be eligible to participate in any of these sports until his/her name has been reported to the FHSAA Office.

4. Provide to the FHSAA Office an updated roster in a sport for which it has been selected for testing within 72 hours (3 days) of receiving notification of the test.

5. Do not inform coaches or student-athletes as to when a specimen collector will visit the school.

6. Provide a site coordinator, who must cooperate fully with a specimen collector who visits the school. The site coordinator is responsible for calling the selected student-athlete to the office, presenting signed consent forms, and helps maintain proper conduct in the testing area.

7. Provide a private room for the specimen to be given. Remember, a student-athlete who does not provide a specimen, regardless of the reason, must be suspended from all practice and competition until a specimen is provided.

8. Notify the student-athlete and his/her parents of the results of the test. If the test is positive, the school administration must immediately suspend the student-athlete from all practice and competition in all sports. The school administration also must schedule a meeting with the student-athlete and his/her parents to explain the penalties and the procedures for challenging the finding or appealing the suspension.

9. File a challenge of a positive finding or an appeal of the suspension at the request of the student-athlete.

10. Do not include in the student-athlete's permanent school record any documentation relative to the test.

11. Keep all information pertaining to the test confidential.

WHO DO I CONTACT IF I HAVE QUESTIONS REGARDING THE TESTING PROGRAM?

Contact Assistant Director of Eligibility Sedeirdra Smith in the FHSAA Office by email at ssmith@fhsaa.org or by phone at (352) 372-9551 ext. 380.

Consent of Student-Athlete and Parents to Participate in Random Testing for Use of Anabolic Steroids

For:	Each student in grades 9-12 who participates in the sports of baseball, flag football, tackle football, softball, girls weightlifting or boys weightlifting, as well as the student's parent.
Action:	Must be completed, signed by you and your parents, and returned to your athletic director before you can participate in any one of these sports during the 2007-08 school year.
Due date:	Prior to participation in in any of the six sports.
Required by:	Florida Law 2007-193.
Purpose:	Consent of student and parents to participate in random testing program.

TO: STUDENT-ATHLETE AND PARENTS

The State of Florida has directed the FHSAA to test student-athletes in grades 9-12 for the use of anabolic steroids. Student-athletes who are participating in the sports of boys baseball, girls flag football, boys tackle football, girls softball, and girls & boys weightlifting will be randomly selected to undergo testing. Florida Law 2007-193 states that a student-athlete who participates in any one of these six target sports and the student-athlete's parents must consent for the student-athlete to provide a specimen if the student-athlete is selected for testing. Failure to give this consent in writing will cause the student-athlete to be ineligible to participate in any one of the three sports.

You must consent to you/your child's testing by completing, signing and returning the attached form to your school before you can participate in practice or competition in any one of the six target sports. If you do not consent to you/your child's testing by signing the attached form, you/your child will not be eligible to participate in practice or competition in any one of the six target sports during the 2007-08 school year.

Please read the information preceding the attached form carefully. It includes a brief description of the testing program; the penalties for a positive finding, the procedure for challenging a positive finding, and the procedure for appealing the penalties imposed as a result of a positive finding.

BRIEF DESCRIPTION OF THE TESTING PROGRAM

The FHSAA has contracted with the National Center for Drug Free Sport™ to administer the testing program. Drug Free Sport, in turn, contracts with UCLA's Olympic laboratory, which is certified by the World Anti-Doping Agency, to analyze the specimens that are collected.

Each high school that sponsors a program in one of the six target sports must provide the FHSAA Office with a roster containing the names of the student-athletes in grades 9-12 who will be participating in the sport. The FHSAA Office will forward these rosters to Drug Free Sport. Drug Free Sport will randomly select for testing approximately 1 percent of the schools that participate in one of the six sports. Drug Free Sport then will randomly select 1 percent of the student-athletes on the rosters submitted by those schools.

A student-athlete who is selected will not know about the test until the certified specimen collector shows up at the student-athlete's school. The student-athlete will be called to the office and directed to a private room to provide a specimen (urine sample). If the student-athlete fails to provide a specimen for any reason, even an absence from school on that day, the student-athlete will be suspended from practice and competition until the specimen is provided.

The specimen collector will send the specimen to the lab where it will be analyzed for anabolic steroids, as well as substances that mask the use of anabolic steroids. The student-athlete will not be tested for the use of recreational drugs. Drug Free Sport will notify the school administration, which in turn will notify the student-athlete and parents, of the test results within 10 business days.

PENALTIES FOR TESTING POSITIVE

A student-athlete who tests positive will be immediately suspended from practice and competition in all sports for a period of 90 school days, and must attend and complete a drug education program conducted by the student-athlete's school, the school district or a third-party organization contracted to provide such a program. The student-athlete will be required to undergo an exit test no sooner than the 60th school day of the suspension. If the student-athlete tests negative on the exit test, the student-athlete will be reinstated. If the student-athlete tests positive on the exit test, the student-athlete will remain suspended until he/she tests negative on a subsequent exit test.

PROCEDURE FOR CHALLENGING A POSITIVE FINDING

A student-athlete who tests positive may ask the school administration to challenge the finding. The school administration, which must honor the student-athlete's request, will file the challenge with the FHSAA Office. A sample of the student-athlete's original specimen, which has been retained by the lab, will undergo a second analysis. The student-athlete's family or school will have to pay the cost of this second analysis. If the challenge is successful (the second analysis is negative), the student-athlete will be immediately reinstated and the FHSAA Office will refund the cost of the analysis. If the challenge is not successful (the second analysis also is positive), the student-athlete will remain suspended.

PROCEDURE FOR APPEALING THE PENALTIES FOR A POSITIVE FINDING

A student-athlete who chooses not to challenge a positive finding but wishes to seek a waiver of or reduction in the penalties for the positive finding may ask the school administration to appeal the penalties. The school administration, which again must honor the student-athlete's request, will file the appeal with the FHSAA Office. The Commissioner may uphold the suspension, reduce the length of the suspension by one-half or reinstate the student-athlete. If the student-athlete is not satisfied with the decision of the Commissioner, the student-athlete may then appeal that decision to the Board of Directors, which has the same three options. Regardless of the outcome of the appeal, however, the student-athlete cannot be reinstated until he/she tests negative on an exit test.

PAYING FOR THE TESTS

The FHSAA Office will pay the costs of the initial test and one exit test if needed. If subsequent exit tests are needed, the student-athlete's family or school must pay for those tests. The FHSAA Office also will reimburse the cost of a challenge if the challenge is successful.

CONFIDENTIALITY OF TEST RESULTS

Test results are confidential and will not be disclosed to anyone other than the FHSAA Office, Drug Free Sport, the testing facility contracted by Drug Free Sport, the school administration, the student-athlete and parents, and the administration of any school to which the student-athlete transfers if the test results are positive. These individuals must ensure the confidentiality of the test results is maintained. Test results will not become a part of the student-athlete's permanent school record and cannot be used in any criminal proceeding. Any hearing before the Board of Directors during which penalties for a positive test are being appealed will be closed to the public.

Consent of Student-Athlete and Parents to Participate in Random Testing for Use of Anabolic Steroids

Must be completed and signed by a student-athlete in grades 9-12 participating in the the sports of baseball, flag football, tackle football, softball, and girls & boys weightlifting, as well as the student-athlete's parents, and submitted to the school before the student can participate in practice or competition in any of these sports.

Name of your school ____

You must sign this form before you/your child can participate in interscholastic practice or competition in the sports of baseball, flag football, tackle football, softball, and girls & boys weightlifting during the 2007-08 school year. Florida Law 2007-193 requires that you sign this form. See your principal or athletic director with any questions you have.

Anabolic Steroid Testing Consent

By signing this form, I affirm that I am aware of the State of Florida/FHSAA Anabolic Steroid Testing Program, which provides:

> A student-athlete who is found to have used an anabolic agent will be suspended from all interscholastic practice and competition for a period of 90 school days from the date the school administration is made aware of the positive finding. The student-athlete also will be required to attend and complete a drug education program conducted by the school, the school district or a third-party organization contracted by the school or school district to provide the program. The student-athlete must undergo an exit test for reinstatement of eligibility no sooner than the 60th school day of the suspension. If the exit test is negative, the student-athlete will be reinstated. If the exit test is positive, the student-athlete will remain suspended until such time as he/she tests negative on a subsequent exit test.

I agree that I was provided an opportunity to review the procedures for the testing program that accompanied this form and understand the test procedures, penalties for a positive finding and my/my child's rights to challenge a positive finding or appeal the penalties imposed as a result of a positive finding.

I agree to allow the Center for Drug Free Sport to test me/my child in relation to participation in the sports of baseball, flag football, tackle football, softball, and girls & boys weightlifting. I agree that I/my child will provide a urine sample to a certified specimen collector upon request. I understand that if I/my child fails to do so, I/my child will be immediately suspended from interscholastic practice and competition until such time as a specimen is provided.

I understand that this consent form and the results of steroid tests are confidential and will be shared only with the FHSAA Office, Drug Free Sport, the testing facility contracted by Drug Free sport, the school administration and me/my child, as well as the administration of any other school I/my child may transfer to during any period of suspension resulting from a positive test. I further understand that the test results will not be made a part of my/my child's permanent school record and cannot be used as evidence in any criminal proceeding.

I affirm that I understand that if I/my child sign this statement falsely or erroneously, I am violate FHSAA Bylaws that prohibit providing false information to gain eligibility, and I will further jeopardize my/my child's eligibility.

Date ____________________ Signature of student ______________________________

Name of student ______________________________

Date ____________________ Signature of parent ______________________________

Name of parent ______________________________

Date ____________________ Signature of parent ______________________________

Name of parent ______________________________

Home address ______________________ City ______________ Zip Code __________

Sport(s): [__ Baseball] [__ Flag Football] [__ Tackle Football] [__ Softball] [__ Girls Weightlifting] [__ Boys Weightlifting]

What to do with this form: Complete, sign and return to your principal or athletic director before the first day you intend to participate in practice in any of the sports you check above. This form is to be kept on file in the school for **four years**.

NEW JERSEY PROGRAM – MANDATED BY STATUTE

NJSIAA STEROID TESTING POLICY

FREQUENTLY ASKED QUESTIONS

On June 7, 2006, New Jersey became the first state in the nation to require steroid testing for high school athletes. The testing policy was developed by the New Jersey State Interscholastic Athletic Association (NJSIAA), a private, nonprofit association of public, parochial and private high schools that organizes high school sports in New Jersey. These frequently asked questions address common questions and concerns about the policy.

1. *How did the NJSIAA's steroid testing policy come about?*

   In 2005, then-Governor Richard Cody convened a Governor's Task Force on Steroid Use and Prevention. The task force was chaired by Monsignor Michael E. Kelly, Headmaster of Seton Hall Preparatory School, and included physicians, attorneys, school administrators, coaches and athletic trainers. The task force reported the following: "According to the National Institute on Drug Abuse, 3.4% of high school seniors have used anabolic steroids at least once, and 1.9% of eighth graders admitted to trying steroids. Numerous studies have shown the use of steroids and steroid precursors to be on the upswing. Unfortunately, the compulsions to achieve a desirable body image, to succeed in athletics, or to obtain a college scholarship are strong motivators and influences. These influences cause some young people to risk their long-term health by using performance-enhancing substances as a short cut to meeting their goals." (Task Force Report, page 26.) Based on the task force's recommendations, on December 20, 2005, Governor Cody signed Executive Order 72, which directed the New Jersey Department of Education to work in conjunction with the NJSIAA to develop and implement a program of random testing for steroids.

2. *Why test for steroids?*

   First, using steroids without a prescription can cause serious, adverse health effects. **Second**, using steroids and other performance-enhancing drugs can give athletes an unfair advantage over their competition, and is cheating. **Third,** testing for steroids can help deter their use among high school students. **Finally**, steroids are drugs that should be used to treat medical conditions. Possession or use of most steroids without a prescription is illegal. The NJSIAA recognizes that it will take a community-wide effort by parents, coaches, athletes, teachers and physicians to attack this growing challenge. Random steroid testing is one tool that can be used to help discourage athletes from taking steroids.

3. *What are some of the specific health problems associated with steroid abuse?*

   The Governor's Task Force found that steroid abuse can result in a host of serious health problems. The following is a partial list of health problems associated with steroid abuse: severe acne, excessive hairiness in both sexes, male pattern baldness, deepening of the voice, abnormal permanent enlargement of the clitoris, loss of female body contour, altered menstrual cycling, increased libido in women, testicular atrophy, elevated blood pressure and other adverse cardio-vascular effects, thickening of the blood, liver disease, increased aggressiveness, obstructive sleep apnea, enlarged breasts in men and women, impotence, blood clots, diabetes, elevated fats in the blood, premature closure of the growth plates resulting in reduction of height, migraine headaches, premature puberty and infertility.

4. *How did the NJSIAA develop its steroid testing policy?*

   In early 2006, the NJSIAA staff worked with a specially-appointed "Steroid Committee" and with its Medical Advisory Committee to develop a list of banned substances and a policy for testing student athletes. The policy was formally adopted by the NJSIAA Executive Committee on June 7, 2006.

5. *What does the steroid testing policy say?*

   The NJSIAA steroid testing policy states, "It shall be considered a violation of the NJSIAA sportsmanship rule for any student athlete to possess, ingest or otherwise use any substance on the list of banned substances, without written prescription by a fully-licensed physician as recognized by the American Medical Association, to treat a medical condition." **In short, use of performance-enhancing drugs by student athletes in New Jersey is considered to be cheating and will be penalized.**

6. *What is the penalty for violating the steroid testing policy?*

   Any person who tests positive in an NJSIAA-administered test, or any person who refuses to provide a testing sample, or any person who reports his or her own violation, will immediately forfeit his or her eligibility to participate in NJSIAA competition for a period of one year from the date of the test. Any such person will also forfeit any individual honor earned while in violation. No person who tests positive, refuses to provide a test sample, or who reports his or her own violation will resume eligibility until he or she has undergone counseling and produced a negative test result.

7. *What is the consent form?*

   Before participating in interscholastic sports, all student athletes and their parents or guardians must consent, in writing, to the random testing. Failure to sign the consent form renders the student athlete ineligible to participate in interscholastic sports until the form is signed.

8. *Who will be tested?*

   Under the policy, any athlete who qualifies for a state championship tournament can be tested. This means that if a team qualifies for a state tournament, any athlete on the team can be tested, or if an athlete qualifies for a state championship in an individual sport like track and field or wrestling, that individual can be tested.

9. *When will the testing take place?*

   Testing begins with the Fall, 2006 sports season. Athletes may be tested before, during or after any phase of state championship competition.

10. *How many tests will be done?*

    The NJSIAA will test 500 student athletes during the 2006-2007 school year.

11. *What sports will be tested?*

    Sixty percent of the tests will be from football, wrestling, track and field, swimming, lacrosse and baseball. The remaining 40% of the tests will be from any of the other NJSIAA sports.

12. *Who will administer the testing program?*

    The NJSIAA has contracted with The National Center for Drug Free Sport, Inc. to administer the testing program. The National Center for Drug Free Sport is the official administrator of the NCAA drug testing program and the Minor League Baseball drug prevention program.

13. *What laboratory will test the samples?*

    The NJSIAA will utilize the UCLA Olympic Analytical Laboratory to test samples from student athletes in New Jersey. The UCLA laboratory is the only laboratory in the United States that is fully accredited by the World Anti-Doping Agency.

14. *What type of test will be used?*

    The test will analyze a urine sample. The NJSIAA policy does not allow for blood tests.

15. *How will athletes be selected for testing?*

    Selection of the individuals to be tested will be done by the program's administrator, The National Center for Drug-Free Sport, by computer-generated random numbers.

16. *What drugs will the NJSIAA test for?*

    The NJSIAA has adopted a list that includes four banned-drug classes and 87 examples of banned substances. This list is patterned after the NCAA's list of banned substances, and contains the same types of substances that are banned by the International Olympic Committee and the World Anti-Doping Agency (WADA). During the 2006-2007 school year, the NJSIAA will test for steroids, diuretics, urine manipulators, and HCG (in males). **Using any substance belonging to a banned class violates the rules of sportsmanship, can be detrimental to the student's health, and is considered cheating**.

17. *Why is caffeine on the list of banned substances?*

    Caffeine is a stimulant. It is banned by the NCAA. The amount of caffeine needed to result in a positive drug test is the equivalent of drinking 12 cups of coffee over a two-hour period.

18. *Are nutritional and dietary supplements on the list of banned substances?*

    No, they are not on the list of banned substances; however, all athletes must be aware that many nutritional and dietary supplements contain NJSIAA banned substances. In addition, the U.S. Food and Drug Administration does not strictly regulate the supplement industry, and therefore purity and safety of nutritional dietary supplements cannot be guaranteed. Impure supplements may lead to a positive NJSIAA test. **The use of supplements is at the student athlete's own risk.** Student athletes should contact their physician or athletic trainer for further information.

19. *How can I find more information about dietary supplements and banned substances?*

    The NJSIAA has contracted with The National Center for Drug Free Sport to offer a subscription service called the "Resource Exchange Center," or "REC," to principals and athletic directors of NJSIAA member schools. The REC provides accurate and confidential information about dietary supplements and dangerous or banned substances.

20. *What assurances are there that the results of the steroid test will be accurate?*

The NJSIAA has hired experienced professionals to collect the samples, and will utilize the top laboratory in the country to perform the tests. In addition, every urine sample will be split into an “A” and a “B” sample. If the A sample is positive, the athlete and the athlete’s parents or guardian will be notified. They then have the right to have the B sample tested. No result is considered positive unless both the A and the B samples are positive.

21. *What if a student has a health condition that requires the student to take a drug that appears on the list of banned substances?*

If a test result is positive for a banned substance, the testing company will notify the NJSIAA’s Medical Review Officer, who is a medical doctor with experience in the field. The Medical Review Officer will contact the student and the student’s family, and, if necessary, review the student’s medical records to determine whether there is any medical reason for the positive result. If the Medical Review Officer determines that there is a medical reason for the positive result, no further action will be taken and the NJSIAA will not consider the test to be a positive result.

22. *Will the results of the tests be confidential?*

Yes. Results of all tests will be considered confidential, and will only be disclosed to the individual, his or her parents, and his or her school.

23. *Can a positive result be challenged?*

Yes. If the laboratory reports that the student’s sample has tested positive, and the Medical Review Officer confirms that there is no medical reason for a positive result, the student can still challenge the result by proving that he or she bears no fault or negligence for the violation. Appeals will be heard by an NJSIAA committee consisting of two members of the Executive Committee, the Executive Director or his designee, an athletic trainer and a physician. Further appeal of the committee’s decision would be to the Commissioner of Education (for public school athletes) or to the Superior Court (for non-public school athletes).

24. *What happens if an athlete tests positive under a school's testing program?*

Many schools have their own drug testing programs. Some of those schools test for steroids and other performance-enhancing drugs. NJSIAA violations found as a result of a school test will be penalized in accordance with the school's policy, and will not be reported to the NJSIAA.

25. *Will a team be penalized if an individual tests positive for steroids?*

No, a team will not be penalized if an individual tests positive for steroids. The NJSIAA has decided that only the individual user will forfeit his or her eligibility.

SPG/vgk
C:njsiaa-steroid testing FAQs

NJSIAA

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NJSIAA'S STEROID TESTING POLICY

In accordance with Executive Order 72, issued by the Governor of the State of New Jersey, Richard J. Codey, on December 20, 2005, the NJSIAA will test a random selection of student athletes, who have qualified, as individuals or as members of a team, for state championship competition.

1. **General prohibition against performance enhancing drugs:**

   A. It shall be considered a violation of the NJSIAA's sportsmanship rule for any student-athlete to possess, ingest, or otherwise use any substance on the list of banned substances, without written prescription by a fully licensed physician, as recognized by the American Medical Association, to treat a medical condition.

   B. Violations found as a result of NJSIAA's testing shall be penalized in accordance with this policy.

   C. Violations found as a result of member school testing shall be penalized in accordance with the school's policy.

2. **List of banned substances:**

   A list of banned substances shall be prepared annually by the Medical Advisory Committee, and approved by the Executive Committee. (See list)

3. **Consent form:**

   Before participating in interscholastic sports, the student-athlete and the student-athlete's parent or guardian shall consent, in writing, to random testing in accordance with this policy. Failure to sign the consent form renders the student-athlete ineligible.

4. **Selection of athletes to be tested:**

   A. Tested athletes will be selected randomly from all of those athletes participating in championship competition.

   B. Sixty percent of all tests shall be from football, wrestling, track & field, swimming, lacrosse and baseball. The remaining forty percent of all tests shall be from all other NJSIAA sports.

5. **Administration of tests:**

   Tests shall be administered by a certified laboratory, selected by the Executive Director and approved by the Executive Committee.

6. **Testing methodology:**

   The methodology for taking and handling samples shall be in accordance with current legal standards.

7. **Sufficiency of results:**

No test shall be considered a positive result unless the approved laboratory reports a positive result, and the NJSIAA's medical review officer confirms that there was no medical reason for the positive result. A "B" sample shall be available in the event of an appeal.

8. **Appeal process:**

If the certified laboratory reports that a student-athlete's sample has tested positive, and the medical review officer confirms that there is no medical reason for a positive result, a penalty shall be imposed unless the student-athlete proves, by a preponderance of the evidence, that he or she bears no fault or negligence for the violation. Appeals shall be heard by a NJSIAA committee consisting of two members of the Executive Committee, the Executive Director/designee, a trainer and a physician. Appeal of a decision of the Committee shall be to the Commissioner of Education, for public school athletes, and to the superior court, for non-public athletes. Hearings shall be held in accordance with NJSIAA By-Laws, Article XIII, "Hearing Procedure."

9. **Penalties**

Any person who tests positively in an NJSIAA administered test, or any person who refuses to provide a testing sample, or any person who reports his or her own violation, shall immediately forfeit his or her eligibility to participate in NJSIAA competition for a period of one year from the date of the test. Any such person shall also forfeit any individual honor earned while in violation. No person who tests positive, refuses to provide a test sample, or who reports his or her own violation shall resume eligibility until he or she has undergone counseling and produced a negative test result.

10. **Confidentiality:**

Results of all tests shall be considered confidential and shall only be disclosed to the individual, his or her parents and his or her school.

11. **Compilation of results:**

The Executive Committee shall annually compile and report the results of the testing program.

12. **Yearly renewal of the steroid policy:**

The Executive Committee shall annually determine whether this policy shall be renewed or discontinued.

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NJSIAA STEROID TESTING POLICY

CONSENT TO RANDOM TESTING

In Executive Order 72, issued December 20, 2005, Governor Richard Codey directed the New Jersey Department of Education to work in conjunction with the New Jersey State Interscholastic Athletic Association (NJSIAA) to develop and implement a program of random testing for steroids, of teams and individuals qualifying for championship games.

Beginning in the Fall, 2006 sports season, any student-athlete who possesses, distributes, ingests or otherwise uses any of the banned substances on the attached page, without written prescription by a fully-licensed physician, as recognized by the American Medical Association, to treat a medical condition, violates the NJSIAA's sportsmanship rule, and is subject to NJSIAA penalties, including ineligibility from competition. The NJSIAA will test certain randomly selected individuals and teams that qualify for a state championship tournament or state championship competition for banned substances. The results of all tests shall be considered confidential and shall only be disclosed to the student, his or her parents and his or her school. No student may participate in NJSIAA competition unless the student and the student's parent/guardian consent to random testing.

By signing below, we consent to random testing in accordance with the NJSIAA steroid testing policy. We understand that, if the student or the student's team qualifies for a state championship tournament or state championship competition, the student may be subject to testing for banned substances.

______________________	______________________	__________
Signature of Student-Athlete	Print Student-Athlete's Name	Date
______________________	______________________	__________
Signature of Parent/Guardian	Print Parent/Guardian's Name	Date

NJSIAA Banned-Drug Classes
2009 - 2010

The term "related compounds" comprises substances that are included in the class by their pharmacological action and/or chemical structure. No substance belonging to the prohibited class may be used, regardless of whether it is specifically listed as an example.

Many nutritional/dietary supplements contain NJSIAA banned substances. In addition, the U. S. Food and Drug Administration (FDA) does not strictly regulate the supplement industry; therefore purity and safety of nutritional dietary supplements cannot be guaranteed. Impure supplements may lead to a positive NJSIAA drug test. **The use of supplements is at the student-athlete's own risk.** Student-athletes should contact their physician or athletic trainer for further information.

The following is a list of banned-drug classes, with examples of banned substances under each class:

(a) Stimulants
amiphenazole
amphetamine
bemigride
benzphetamine
bromantan
caffine[1] (guorana)
chlorphentermine
cocaine
cropropamide
crothetamide
diethylpropion
dimethylamphetamine
doxapram
ephedrine
(ephedra, ma huang)
ethamivan
ethylamphetamine
fencamfamine
meclofenoxate
methamphetamine
methylenedioxymethamphetamine
(MDMA, ecstasy)
methylphenidate
nikethamide
pemoline
pentetrazol
phendimetrazine
phenmetrazine
phentermine
phenylpropanolamine (ppa)
picrotoxine
pipradol
prolintane
strychnine
synephrine
(citrus aurantium, zhi shi, bitter orange)
and related compounds

(b) Anabolic Agents
<u>anabolic steroids</u>
androstenediol
androstenedione
boldenone
clostebol
dehydrochlormethyl-testosterone
dehydroepiandro-sterone (DHEA)
dihydrotestosterone (DHT)
dromostanolone
epitrenbolone
fluoxymesterone
gestrinone
mesterolone
methandienone
methenolone
methyltestosterone
nandrolone
norandrostenediol
norandrostenedione
norethandrolone
oxandrolone
oxymesterone
oxymetholone
pregnelone
stanozolol
testosterone[2]
tetrahydrogestrinone (THG)
trenbolone
and related compounds
<u>other anabolic agents</u>
clenbuterol

(c) Diuretics
acetazolamide
bendroflumethiazide
benzhiazide
bumetanide
chlorothiazide
chlorthalidone
ethacrynic acid
flumethiazide
furosemide
hydrochlorothiazide
hydroflumenthiazide
methyclothiazide
metolazone
polythiazide
quinethazone
spironolactone
triamterene
trichlormethiazide
and related compounds

(d) Peptide Hormones & Analogues:
corticotrophin (ACTH)
human chorionic gonadotrophin (hCG)
leutenizing hormone (LH)
growth hormone (HGH, somatotrophin)
insulin like growth hormone (IGF-1)

All the respective releasing factors of the above-mentioned substances also are banned:
erythropoietin (EPO)
darbypoetin
sermorelin

(e) Definitions of positive depends on the following:

[1] for caffine – if the concentration in urine exceeds 15 micrograms/ml

[2] for testosterone – if administration of testosterone or use of any other manipulation has the result of increasing the ratio of the total concentration of testosterone to that of epitestosterone in the urine of greater than 6:1, unless there is evidence that this ratio is due to a physiological or pathological condition.

TEXAS PROGRAM – BEING CONSIDERED FOR SUSPENSION DUE TO PERCEIVED LACK OF SUCCESS

The University Interscholastic League (UIL)
Anabolic Steroid Testing Program Protocol
2008-2009

For purposes of this protocol and the UIL Anabolic Steroid Testing Program, the terms listed below have the following definitions:

Alkaline Specimen: Specimen that does not meet the pH requirements set forth in this protocol.

Anabolic Steroid(s): Any steroid as described in section 481.104 of the Texas Health and Safety Code.

Beaker Bar Code: Uniquely numbered stickers selected by the student-athlete from a supply of such and placed on the specimen collection beaker by the student-athlete. This number links the student-athletes identity to the specimen collection beaker.

Client: The School at which an Anabolic Steroid testing event is occurring.

Collection Beaker: Container with a cap utilized for the collection of the urine Specimen.

Collection Station: The entire facility used to collect the urine Specimen, including the restroom, toilet stall, and the area used by the Collector to process the Specimen.

Collector: Individual member of Testing Crew who works with the Crew Chief and assists in the testing Specimen collection process.

Complete Specimen: A Specimen that meets the volume, temperature, specific gravity and pH measurements contained in this protocol.

Contractor: The entity selected by the UIL to administer the Anabolic Steroid testing program.

Crew Chief: Individual in charge of the Testing Crew who is responsible for working with the School to schedule location and start time of the test as well as the general administration of the testing Specimen collection process.

Digital pH Meter: Instrument used by the Processing Collector to measure the pH of the Specimen for validity.

Documented Medical History: Medical records provided by a licensed practitioner with prescriptive authority documenting that an Anabolic Steroid was dispensed, prescribed, delivered and administered for a valid medical purpose in the course of professional practice.

Excused Absence: Has the meaning as defined in §25.087 of the Texas Education Code, or as delineated in local school district policy as approved, prior to the beginning of the current school year, by the board of trustees of the ISD the Student-athlete attends.

Exit Test: Anabolic Steroid test conducted by the Contractor as a condition of eligibility restoration for a Student-athlete who has been subjected to a penalty for a positive Anabolic Steroid test result.

Laboratory: Anabolic Steroid testing entity with a current certification from the Substance Abuse and Mental Health Services Administration of the United States Department of Health and Human Services, the World Anti-Doping Agency, or another appropriate national or international certifying organization contracted by the Contractor to analyze Complete Specimens provided in conjunction with this testing program.

Medical Review Officer (MRO): A physician holding a current, valid and unrestricted license to practice medicine, provided by the Contractor, who is responsible for reviewing requests for medical exception; reviewing the data of Anabolic Steroid tests; and reviewing documents submitted on behalf of a Student-athlete with a positive Specimen A result to determine whether there is a Documented Medical History which would qualify for a medical exception.

Member School Representative (MSR): A representative of the selected School, who is the primary liaison between the testing company and the School and is responsible for assisting the Testing Crew with notification and identification of the Student-athletes selected for testing.

Monitor: Member of the Testing Crew that accompanies a Student-athlete of the same gender into the restroom and supervises the voiding of a Specimen.

Parent: A biological or adoptive parent, a guardian or other person standing in parental relation to the Student-athlete.

Processing Collector: Member of the Testing Crew responsible for verifying the validity of the Specimen, according to Contractor specifications included in this protocol, working with **SCAN**®, and packaging the Specimen for shipment to the Laboratory.

Reagent Strip: Instrument used by the Processing Collector to measure the pH of the Specimen for validity.

Refractometer: Instrument used by the Processing Collector to measure the specific gravity of the Specimen for validity.

SCAN® (Secure Collection Automated Network): Computerized paperless system utilizing handheld mobile computers, barcode scanners, modems, data servers, and the Internet to provide automated drug-testing collections that is provided by the Contractor and used to document all information pertinent to the collection and testing of a Complete Specimen.

School: A school, which is a member of the University Interscholastic League, that is a unit of a school district and offers instruction in the ninth, tenth, eleventh or twelfth grades, or any combination thereof, whether all of the grades are offered instruction in the same building.

A school also fits this definition if it has: (1) only one ninth grade, one tenth grade, one eleventh grade, and one twelfth grade; (2) with one principal in charge of all four grades; and (3) if all grades have the same school colors, the same school song, and the same school paper. That school would be eligible for League membership as one four-year (grades nine through twelve) high school unit, even though all grades are not on the same campus or in the same building.

School Personnel: An individual, who is an employee of the School or school district where Anabolic Steroid testing is occurring, and who may assist in identifying the Student-athletes selected for testing who do not have photo identification. This could include the MSR or TSC.

Shipping Kit: Box or bag used to package sealed Specimens for the purpose of shipping to the Laboratory.

Specimen Collection Kit: Supplies consisting of two vials (A and B), Specimen shipping bag, and shipping box.

Specimen: Urine provided by Student-athlete for Laboratory analysis for the presence of Anabolic Steroids.

Specimen Bar Code: Uniquely numbered set of bar codes selected by the student-athlete from a supply of such and after laboratory analysis is completed is used by the contractor to identify the Student-athlete who provided the specimen.

Split Specimen Packaging: Process of pouring a single urine Specimen into two vials, an A and a B.

Student-athlete: An individual enrolled as a student in a School who participates, through practices or contests before, during or after school, in any athletic activity listed in section 380 of the UIL Constitution and Contest Rules.

Surrogate: A person provided by the Laboratory who has no relationship with the Contractor or any known bias concerning the test outcome, who, in lieu of the Student-Athlete and his/her Parent or their designated representative, will attend the testing of a Specimen B as described in 8.16-19 below.

Testing Crew (Crew Member): Individual(s) who perform the role(s) of Monitor, Collector, and Processing Collector and work under the direction of the Crew Chief to assist in the testing Specimen collection process. Members of the Testing Crew may perform multiple roles in the collection process.

Testing Site Coordinator (TSC): A representative of the School, who is responsible for assisting the Testing Crew by providing a Collection Station in which to administer Anabolic Steroid testing.

1.0. Standards.

1.1. The presence in a Student-athlete's urine of an Anabolic Steroid is cause for the loss of athletic eligibility, unless a medical exception has been granted.

1.2. Presence of an Anabolic Steroid will be determined from analysis of the Student-athlete's urine and confirmation by an Anabolic Steroid testing laboratory with a current certification from the Substance Abuse and Mental Health Services Administration of the United States Department of Health and Human Services, the World Anti-Doping Agency, or another appropriate national or international certifying organization through mass spectrometry in combination with gas chromatography, liquid chromatography or isotope mass spectrometry.

1.3 Only Anabolic Steroid tests conducted by the Contractor will be considered for the purposes of this program.

1.4. The current UIL Anabolic Steroid List is available from the UIL and can be found at www.uil.utexas.edu. The UIL Anabolic Steroid List includes the substances listed below which meet the description of Anabolic Steroid contained in section 481.104 of the Texas Health and Safety Code. The 2008-2009 Anabolic Steroid List will be posted prior to August 1, 2008.

UIL Anabolic Steroid List

androstenediol	methandrostenolone
androstenedione	methenolone
boldenone	methyltestosterone
chlorotestosterone (4-chlortestosterone)	mibolerone
clostebol	methandriol
dehydrochlormethyltestosterone	nandrolone
dehydroepiandrosterone (DHEA)	norandrostenediol
dihydrotestosterone (DHT)	norandrostenedione
dromostanolone	norethandrolone
drostanolone	oxandrolone
epitrenbolone	oxymesterone
ethylestrenol	oxymetholone
fluoxymesterone	stanolone
formebulone	stanozolol
gestrinone	testolactone
mesterolone	testosterone*
methandienone	tetrahydrogestrinone (THG)
methandranone	trenbolone
	and any substance, such as a compound or metabolite, that is chemically or pharmacologically related to testosterone, other than an estrogen, progestin, or corticosteroid, and promotes muscle growth

* For testosterone the definition of positive depends on an adverse analytical finding (positive result) based on the methods listed in section 1.2 which shows that the testosterone is of exogenous origin, or if the ratio of the total concentration of testosterone to that of epitestosterone in the urine is greater than 6:1, unless there is evidence that this ratio is due to a physiological or pathological condition.

1.5. The UIL Anabolic Steroid Testing program shall be limited to testing to determine the presence or use of Anabolic Steroids. Recreational drugs are not included in the testing program.

1.6. Results of an Anabolic Steroid test conducted under this program are confidential and, unless required by court order, may be disclosed only to the Student-athlete and the Student-athlete's Parent and the activity directors, principal, and assistant principals of the School attended by the

Student-athlete. If a Student-athlete who is under penalty imposed by this protocol enrolls in another School within Texas, the sending School MSR is required to notify the receiving School MSR that the Student-athlete in question has tested positive for an Anabolic Steroid and inform the receiving School of the length of the applicable penalty for that Student-athlete.

2.0. Organization.

2.1. The UIL has final authority over the procedures and implementation of the UIL Anabolic Steroid testing program.

2.2. The Contractor will be responsible for the general administration of the Anabolic Steroid testing program under the supervision of the Director of the UIL.

2.3. Contractor is responsible for selection, certification and training of the Crew Chiefs and the Testing Crews.

2.4. Contractor may utilize the services of outside collection agencies to conduct Anabolic Steroid testing Specimen collections.

2.5. Crew Chief assignments and the random selection of Schools and Student-athletes for testing are the responsibility of Contractor.

2.6. No member of an Anabolic Steroid Testing Crew may participate in Anabolic Steroid testing at a School at which they are employed, or at which they would have any other conflict of interest as determined by the UIL.

2.7. At the beginning of each school year, Schools shall identify one (1) Member School Representative (MSR) and two (2) individuals (one male and one female) to serve as Testing Site Coordinators (TSC) to assist the Crew Chief assigned to that testing event. The identities of these individuals shall be reported to the UIL at the beginning of each school year.

2.8. All testing for Anabolic Steroids within this program will be performed only by an Anabolic Steroid testing laboratory with a current certification from the Substance Abuse and Mental Health Services Administration of the United States Department of Health and Human Services, the World Anti-Doping Agency, or another appropriate national or international certifying organization.

3.0. Causes for Loss of Eligibility.

3.1. Acknowledgement and Consent Required

A Student-athlete is prohibited from participating in an athletic competition sponsored or sanctioned by the UIL unless:

1) the Student-athlete agrees not to use Anabolic Steroids; and,
2) if enrolled in high school, the Student-athlete submits to random testing for the presence of Anabolic Steroids in the Student-athlete's body; and

3) the UIL obtains from the Student-athlete's Parent, a UIL-approved acknowledgement and consent form signed by the Parent and acknowledging that:
   a) the Parent's child, if enrolled in high school, may be subject to random Anabolic Steroid testing; and
   b) the Parent or guardian consents to such testing; and
   c) state law prohibits possessing, dispensing, delivering, or administering a steroid in a manner not allowed by state law;
   d) state law provides that bodybuilding, muscle enhancement, or the increase of muscle bulk or strength through the use of a steroid by a person who is in good health is not a valid medical purpose;
   e) only a licensed practitioner with prescriptive authority may prescribe a steroid for a person; and
   f) a violation of state law concerning steroids is a criminal offense punishable by confinement in jail or imprisonment in the Texas Department of Criminal Justice.

3.2. Positive Anabolic Steroid Test Results

3.2.1. <u>First Positive Test Result.</u> Upon a report of confirmation of a first positive Specimen B Anabolic Steroid test result during his/her high school participation, or upon a refusal to submit to testing after random selection, a Student-athlete shall be suspended for thirty (30) school days of competition in all UIL athletic activities. Prior to eligibility restoration, a Student-athlete must undergo an Exit Test and receive a negative result.

3.2.2. <u>Second Positive Test Result.</u> Upon a report of confirmation of a second positive Specimen B Anabolic Steroid test result during his/her high school participation, or upon a refusal to submit to testing after random selection of a Student-athlete who has previously been subjected to the first positive test penalty, a Student-athlete shall be suspended from all UIL athletic contests for one (1) calendar year. Prior to eligibility restoration, a Student-athlete must undergo an Exit Test and receive a negative result.

3.2.3. <u>Third Positive Test Result.</u> Upon a report of confirmation of a third positive Specimen B Anabolic Steroid test result during his/her high school participation, or upon a refusal to submit to testing after random selection of a Student-athlete who has previously been subjected to the first and second positive test penalties, a Student-athlete shall be suspended from all UIL athletic contests for the remainder of his/her high school career at any UIL member school.

The UIL will cover the cost for the first Exit Test for purposes of eligibility restoration for the penalties outlined in 3.2.1 and 3.2.2 above. Any subsequent Exit Test(s) for purposes of eligibility restoration are conducted at the expense of the School, Student-athlete or the family of the Student-athlete. Only Anabolic Steroid tests conducted by the Contractor will be considered for the purposes of this program.

3.3. Any violation by the Student-athlete of this protocol as determined by the Crew Chief, will be treated as if there was a positive Specimen B result for an Anabolic Steroid and subject the Student-athlete to applicable penalties as described in 3.2.1. through 3.2.3. These violations will be noted on the Crew Chief's report that is filed with the Contractor after a testing event. The Contractor will report such violations to the Student-athlete, his/her parent and the MSR in the same manner as positive specimen B results are reported under this protocol. Subsequent to serving the penalty for a first positive test, a violation by the Student-athlete of this protocol in relation to a later test, will subject the Student-athlete to penalties as described in 3.2.2 and 3.2.3, as applicable.

4.0. School and Student-athlete Selection.

4.1. The method for randomly selecting Schools or Student-athletes to be tested for Anabolic Steroids will be approved by the UIL in advance of Anabolic Steroid testing, administered by Contractor and implemented by the assigned Anabolic Steroid testing Crew Chief.

4.2. Student-athletes in the 9th, 10th, 11th and 12th grades at Schools are subject to random selection for Anabolic Steroid testing.

4.3. Selection of Student-athletes will be based upon a random selection process approved by the UIL and conducted by the Contractor.

4.4. Student-athletes will be randomly selected from the current UIL Anabolic Steroid Testing Student-athlete Listing Form. The UIL Anabolic Steroid Testing Student-athlete Form shall be the official list of all Student-athletes in grades 9-12 participating in UIL athletic activities. The School is required to utilize the UIL Anabolic Steroid Testing Student-athlete Listing Form, which is available for download on the UIL web site.

4.5. A substitution, who will also have been randomly selected, shall be made for a Student-athlete who is selected for Anabolic Steroid testing but is absent on the day of Anabolic Steroid testing. Randomly selected Student-athletes who do not appear for testing for reasons other than an Excused Absence will be treated as if there was a positive test result for an Anabolic Steroid and subject to applicable penalties as described in 3.2.

5.0. School and Student-athlete Notification of Testing.

5.1. The MSR and TSCs at a selected School will be officially notified of the Anabolic Steroid testing a minimum of twenty-four (24) hours (1 business day) but no more than forty-eight (48) hours (2 business days) before the day of testing by the Contractor.

5.2. The MSR, TSCs and/or any other School Personnel notified of an Anabolic Steroid testing event are required to keep such notification confidential. Failure of a MSR, TSC(s) and/or any other School Personnel so notified to keep such notification information confidential will be considered a violation of UIL rules and appropriate sanctions from the range of penalties in section 27 of the UIL Constitution and Contest Rules will be applied.

5.3. Upon notification of testing, the MSR will be required to provide an accurate and current list of all Student-athletes in grades 9-12 participating in UIL athletic activities at the School to Contractor for Student-athlete random selection. The MSR will be required to submit the list within the time frame specified by the Contractor in their notification. The School is required to utilize the UIL Anabolic Steroid Testing Student-athlete Listing Form, which will be available for download on the UIL web site.

5.4. Upon arrival at the School, the Anabolic Steroid testing Crew Chief will provide the MSR with a list of the randomly selected Student-athletes for Anabolic Steroid testing. The randomly selected Student-athletes will be notified of Anabolic Steroid testing by the MSR. The MSR will notify the Student-athlete in person to report immediately to the Collection Station.

5.5. Upon notification the MSR will have the Student-athlete read and sign the UIL Student-athlete Notification Form. The time of notification will be recorded on the form. The Student-athlete will report for Anabolic Steroid testing immediately upon notification. Failure of the Student-athlete to report immediately may be found by the Crew Chief to be a violation of this protocol.

5.6. School Personnel will be available in the Collection Station at all times to certify the identity of Student-athletes who cannot provide photo identification and will be responsible for security of the Collection Station at all times.

6.0. Specimen Collection Procedures.

<u>Management of the Collection Station</u>

6.1. Only those persons authorized by the Crew Chief or the TSCs will be allowed in the Collection Station. Should there be disagreement over who is allowed in the Collection Station, the decision of the Crew Chief will prevail.

6.2. Upon entering the Collection Station, the Student-athlete will provide photo identification or, in the absence of photo identification, the School Personnel present shall identify the Student-athlete and the Student-athlete will be officially signed into the Collection Station. Time of sign-in to the Collection Station will be noted in the Secure Collection Automated Network (SCAN®) Device.

6.3. The use of a cell phone, camera, and any video or audio recording device or any other recording or electronic communication device in the Collection Station is prohibited.

6.4. Only the Crew Chief may release a sick or injured Student-athlete from the Collection Station or may release a Student-athlete to meet academic obligations. Such release shall only be made after appropriate arrangements for having the Student-athlete tested have been made and documented by the Crew Chief.

6.5. The Student-athlete will select a Collection Beaker and a Beaker Bar Code bearing a unique identifier at the direction of a Testing Crew member.

6.6. Student-athletes may not carry any item other than his/her Collection Beaker into the restroom when providing a Specimen. The Student-athlete must remove all outer clothing, such as a jacket, sweater, or sweatshirt, prior to entering the restroom. Failure to follow the direction of a crew member to remove outer clothing may be found by the Crew Chief to be a violation of this protocol.

<u>Specimen Collection Process</u>

6.7. A crew member will serve as a Monitor to assure the integrity of the Specimen until the designated volume (approximately 90 mL) of urine has been collected and will stay with the Student-athlete in the restroom. The crew member serving as a Monitor must secure the room being used for the collection so that no one except the Student-athlete, and the crew member serving as a Monitor can enter it until after the collection has been completed. The crew member serving as a Monitor will add dying agents to toilet bowls, as needed to keep the water in the toilet dyed, to prevent Specimen substitution. No unsupervised access to water will be permitted during the collection process.

6.8. Any crew member serving as a Monitor must be a member of the official Anabolic Steroid Testing Crew and of the same gender as the Student-athlete providing the Specimen. After entering the restroom but prior to entering an individual restroom stall, the Student-athlete is required to empty contents of all pockets and place those contents in a container to be placed in a location where the Student-athlete and a crew member serving as a Monitor can observe. The Student-athlete is required to raise his/her shirt/clothing high enough to observe the midsection area in an effort to rule out attempts to manipulate or substitute a Specimen.

6.9. The crew member serving as a Monitor will instruct the Student-athlete to rinse their hands with water only.

6.10. The crew member serving as a Monitor will allow the Student-athlete to enter the stall and close the door for privacy during the voiding process.

6.11. Fluids given to Student-athletes who have difficulty voiding must be from sealed containers, approved by the Crew Chief, which are opened and consumed in the Collection Station.

6.12. If the Specimen is not complete, the Student-athlete must remain in the Collection Station until a Complete Specimen is provided. An initial temperature reading from the Collection Beaker containing the incomplete Specimen will be recorded. During this period, the Student-athlete is responsible for keeping the Collection Beaker closed and controlled.

a) If the Student-athlete with a Specimen that is not complete must leave the Collection Station for a reason approved by the Crew Chief, the Specimen may be discarded at the discretion of the Crew Chief.

b) Upon return to the Collection Station, this Student-athlete will begin the collection procedure again.

6.13. Once a Specimen of adequate volume is provided (approximately 90 mL), the Student-athlete is responsible for keeping the Collection Beaker closed and controlled. After collection, the crew member serving as a Monitor will escort the Student-athlete to the collection processing area.

6.14. Following collection of the Specimen, the Processing Collector will take an initial temperature reading, which must be between 90.5 and 99.8 degrees Fahrenheit, from the Collection Beaker and it will be recorded. If the Specimen has a temperature outside the limits mentioned above, the Specimen will be discarded by the Student-athlete. The Student-athlete must remain in the Collection Station until another Specimen is provided in compliance with this protocol.

6.15. Once a Specimen is provided that meets the temperature requirements, the Processing Collector will pour off a small volume of the Specimen into a separate container to perform Specimen validity checks, including specific gravity and pH measurements. Specific gravity will be measured first with a Refractometer, followed by pH measurement with a Reagent Strip. The following parameters will be used for processing the Specimen:

a) If the specific gravity is greater than or equal to 1.005, the Collector will then measure the pH of the urine in the presence of the Student-athlete.

b) If the specific gravity is below 1.005, the Specimen will be discarded by the Student-athlete. The Student-athlete must remain in the Collection Station until another Specimen is provided in compliance with this protocol.

c) If the Specimen has a pH greater than 7.5 or less than 4.5 as measured with a Reagent Strip or Digital pH Meter, the Specimen will be discarded by the Student-athlete. The Student-athlete must remain in the Collection Station until another Specimen is provided. No more than three Alkaline Specimens will be collected. The third Alkaline Specimen will be packaged and sent to the Laboratory.

d) If the Specimen has a specific gravity of greater than or equal to 1.005 as measured with a Refractometer and the urine has a pH between 4.5 and 7.5 inclusive, as measured with a Reagent Strip or Digital pH Meter, the Specimen will be processed and sent to the Laboratory.

6.16. If the Student-athlete is having difficulty providing a Complete Specimen, the Crew Chief immediately will notify the Contractor to determine how to proceed.

Packaging the Specimen

6.17. Once a Complete Specimen has been provided, the Student-athlete will select a Specimen Collection Kit and a uniquely numbered set of Specimen Bar Code seals.

6.18. A Collector will record the temperature, specific gravity and pH values for the Complete Specimen

6.19. The UIL Anabolic Steroid Testing Program will utilize Split Specimen Packaging. For split Specimen testing, the Collector will pour a minimum of 60 mL (90 mL maximum) of the Specimen into the A vial and the remaining amount (approximately 25 mL) into the B vial in the presence of the Student-athlete.

6.20. The Collector will place the cap on each vial and will then seal each vial with the Specimen Bar Code seal, in the presence of the Student-athlete.

6.21. The Student-athlete, crew member serving as Processing Collector and Monitor will sign confirming that all procedures were followed as described in the protocol. Any deviation from the procedures contained in this protocol, by anyone other than the Student-athlete being tested, must be documented. Such occurrences will be documented in the Crew Chief's report that is filed with the Contractor following a testing event.

If deviations from the procedures contained in this document, by anyone other than the Student-athlete being tested, are alleged, the Student-athlete will be required to provide another Specimen following this protocol, during that testing event. Both Complete Specimens will be packaged and forwarded to the Laboratory for analysis.

6.22. After the collection has been completed, all sealed vials will be secured in a Shipping Kit. The Collector will prepare the kit for forwarding to an Anabolic Steroid testing laboratory with a current certification from the Substance Abuse and Mental Health Services Administration of the United States Department of Health and Human Services, the World Anti-Doping Agency, or another appropriate national or international certifying organization. All copies of all forms, if any, will be forwarded to the designated persons.

6.23. Vials and any paperwork sent to the Laboratory shall not contain the name of the Student-athlete.

6.24. The Specimens are the property of the UIL.

7.0. Chain of Custody.

7.1. The Crew Chief will deliver the Shipping Kit(s) to a common carrier for transport to the Laboratory. The Crew Chief shall forward all shipping documents, such as bills of lading and tracking numbers, to the Contractor.

7.2. Upon arrival at the Laboratory, the receipt of the Shipping Kit(s) from the carrier will be recorded by a Laboratory employee. The Laboratory shall retain as part of its records all shipping related documents.

7.3. The Laboratory will record whether the Specimen Bar Code seal on each vial arrived intact.

7.4. If a Specimen arrives at the Laboratory with any Specimen Bar Code seal not intact, the UIL may require that Contractor collect another Specimen from the Student-athlete. Any Specimen that arrives at the Laboratory with any Specimen Bar Code seal not intact will not be tested and will be discarded by the Laboratory.

8.0. Laboratory Procedures, Notification of Results, and Medical Exceptions.

Laboratory Procedures

8.1. The Laboratory will make the final determination of Specimen adequacy.

8.2. If the Laboratory determines that a Student-athlete's Specimen is inadequate for analysis, the UIL may require that Contractor collect another Specimen from the Student-athlete.

8.3 Once the Laboratory determines that a Student-athlete's Specimen is adequate for analysis, the Laboratory will use a portion of Specimen A for its initial analysis.

8.4. Analysis will consist of Specimen preparation, instrument analysis and data interpretation.

8.5. The Laboratory director or designated certifying scientist will review all results showing a positive finding for an Anabolic Steroid in Specimen A.

8.6. The Laboratory will inform Contractor of the results by each respective Specimen Bar Code.

Notification of Results

8.7. Upon receipt of the results, the Contractor will reconcile the Specimen Bar Code with the information contained in **SCAN®** to identify individuals with positive and negative findings. The Contractor will inform the MSR of all negative results. The MSR shall notify the Student-athlete and their Parent of the negative result. Test results are confidential as described in section 1.6 of this protocol.

8.8. When Specimen A of a Student-athlete is found to be positive for an Anabolic Steroid by the Laboratory, the Contractor will contact the designated MRO by telephone as soon as possible. The MRO will provide the final review of Specimen A results.

Contractor will provide the Student-athlete's contact information to the MRO. The telephone contact notifying the MRO of positive findings on Specimen A will be followed by a letter (marked "confidential"), which will be provided to the MRO.

8.9. The MRO will contact the Parent of the Student-athlete with a positive finding on Specimen A to tell the Parent of the test result and to inform the Parent how to request a medical exception. Initial contact by the MRO will be attempted by telephone to be followed by letter to the Parent. The letter will include information and forms applicable to seeking a medical exception. The MRO will attempt to contact the Parent of the Student-athlete for 48 hours (2 business days). If the MRO is unable to make contact with the Parent of the Student-athlete within 48 hours (2 business days), the time period for submission of materials mentioned in 8.10 will begin.

Medical Exceptions

8.10. A Student-athlete or his/her Parent may request a medical exception for use of an Anabolic Steroid either (1) prior to being selected for Anabolic Steroid testing, or (2) after being informed of a positive result for Specimen A.

8.10.1. A Student-athlete or his/her Parent may request a medical exception prior to being selected for Anabolic Steroid testing by (1) providing the Contractor with the Request For Medical Exception Form, and (2) requesting the Student-athlete's physician to provide a Documented Medical History of the need for the use of an Anabolic Steroid to the Contractor. The Documented Medical History is to be sent directly from the physician to the Contractor. Upon receipt, the Contractor will forward the Student-athlete's Request For Medical Exception Form and the Documented Medical History from the Student-athlete's physician to the Contractor-approved MRO for review. Only the Contractor-approved MRO may grant a medical exception. The MRO will make a decision regarding a medical exception within five (5) business days of receiving the Request for Medical Exception Form and Documented Medical History, and forward that decision to the Contractor. Contractor will inform the Student-athlete and his/her Parent regarding the outcome of the exception request by telephone. The telephone contact will be followed by a letter from the Contractor (marked "confidential") to the Student-athlete and his/her Parent documenting the MRO's decision.

The decision of the MRO is final and is not subject to appeal. The Contractor will keep the MRO's decision on file for the remainder of that school year for use if the Student-athlete is selected for Anabolic Steroid testing.

8.10.2. A Student-athlete or his/her Parent may request a medical exception within 48 hours (2 business days) of the first notification of a positive test result for Specimen A by (1) providing the MRO with the Request For Medical Exception Form, and (2) requesting the Student-athlete's physician to provide a Documented Medical History of the need for the use of an Anabolic Steroid to the MRO. A Student-athlete's Request For Medical Exception Form and Documented Medical History must be received by the MRO within 48 hours (2 business days) after the first notification or it will not be reviewed. Only the

Contractor-approved MRO may grant a medical exception under this program. The MRO will make a decision regarding a medical exception within five (5) business days of receiving the Request for Medical Exception Form and Documented Medical History, and forward that decision to the Contractor. Contractor will inform the Student-athlete and his/her Parent regarding the outcome of the exception request by telephone. The telephone contact will be followed by a letter (marked "confidential") from the Contractor to the Student-athlete and his/her Parent documenting the MRO's decision.

The decision of the MRO is final and is not subject to appeal.

8.11. If a medical exception is already on file with or granted by the MRO for a Student-athlete with a positive finding on Specimen A, no further action will be taken. The Contractor will report the Student-athlete's result as 'medical exception granted' to the MSR.

8.12. If a medical exception is not granted by the MRO for a Student-athlete with a positive finding on Specimen A, Specimen B will automatically be tested. The Contractor will notify the MSR by telephone as soon as possible of the initial positive finding on Specimen A. The telephone contact will be followed by a letter (marked "confidential"), which will be mailed to the MSR. Contractor will, during the telephone conversation, advise the MSR that Specimen B will be tested.

Specimen B

8.13. For Student-athlete's not granted a medical exception and with a positive finding on Specimen A, there is no penalty imposed until completion of analysis of Specimen B.

8.14. Contractor will contact the Parent by telephone as soon as possible and notify them of the positive finding in reference to Specimen A and that Specimen B will be tested. The telephone contact will be followed by a letter (marked "confidential"), which will be mailed to the Parent. A UIL Positive Anabolic Steroid Test Appeal Form (see section 9.0 below) will be included with this mailing.

8.15. Contractor will, during the telephone conversation, advise the Parent that Specimen B will be tested. Contractor also will inform the Parent that the Student-athlete may have representation at the Laboratory for the testing of Specimen B and that the Student-athlete in question is not subject to penalty until completion of analysis of Specimen B.

8.16. Notification by the Parent of the intent to have representation at the Laboratory must be given to Contractor within 48 hours (2 business days) of being advised that Specimen B will be tested. Notification of the desire to have a representation at the Laboratory can be accomplished via telephone, fax, e-mail or in writing to the Contractor.

8.17. If the Parent desires representation for the Student-athlete at the Laboratory, they must present themselves, or, upon appropriate permissions for confidentiality being granted, their representative, at the Laboratory, at an appointed date and time, within 2 business days of the notification of intent to have representation. Any expenses associated with travel to the Laboratory for this purpose are the responsibility of the Student-athlete or their Parent. If the

Parent of the Student-athlete cannot arrange for such representation, the Laboratory will arrange for a Surrogate to attend the testing of Specimen B.

8.18. The Surrogate will not otherwise be involved with the analysis of the Specimen.

8.19. At the testing for Specimen B, the Student-athlete, the Parent, their representative or the Surrogate will verify by signature as to the Specimen Bar Code on Specimen B, that the Specimen Bar Code seal is intact, and that there is no evidence of tampering. If the Specimen Bar Code seal on Specimen B does not match, is not intact or there is evidence of tampering, Specimen B will not be tested and will be discarded by the Laboratory. The result for that Specimen Bar Code will be reported to the Contractor as negative and the Student-athlete will not be subject to penalty. In this scenario, the UIL may require that the Contractor collect another Specimen from the Student-athlete.

8.20. Specimen preparation, analysis and interpretation for Specimen B analysis will be conducted by a Laboratory staff member other than the individual who prepared, analyzed and interpreted the Student-athlete's Specimen A.

8.21. Specimen B findings will be final. The Laboratory will inform Contractor of the results.

8.22. For Student-athletes who have a Specimen B negative finding, no further action will be taken and the Student-athlete will not be subject to penalty. Negative results for Specimen B will be communicated in the same manner that negative results for Specimen A are communicated. For Student-athletes who have a Specimen B positive finding, Contractor will contact the Parent and the MSR by telephone as soon as possible and notify each of the Specimen B positive finding and of the ability to appeal the finding, the process for filing the appeal and refer them to the Appeal Form previously mailed.

8.23. Upon notification of the Specimen B positive finding, the School shall be required to immediately enforce the applicable penalty to the Student-athlete as referenced in section 3.2.

8.24. A positive finding may be appealed by the Student-athlete or by the Parent on the Student-athlete's behalf to the UIL.

8.25. Specimens with negative results are kept for five (5) business days and then discarded by the Laboratory. Specimens with positive results are kept by the Laboratory for a minimum of one (1) year.

9.0. UIL Anabolic Steroid Testing Appeals Process.

General Provisions

9.1. After notice that a Student-athlete's Specimen B has been found to be positive for Anabolic Steroids, the Student-athlete and his/her Parent or the School (all of whom are referred to elsewhere in this section as Appellants) may file an appeal. The student athlete and his/her Parent must waive their right of confidentiality to allow the UIL and any other persons necessary to the appeals process to review and make use of the test results as well as other relevant documents and information. However, the School may only appeal if the student athlete or his/her Parent waives their right to confidentiality and the Student-athlete and his/her Parent do not object to the appeal.

The filing of an appeal does not suspend imposition of the penalty. Upon notice of a positive Specimen B test, the School must enforce the penalty applicable to the Student-athlete who is the subject of the appeal as referenced in section 3.2. The penalty may only be lifted upon exhaustion of the appeals process and a finding in favor of the Student-athlete.

All appeals will be considered and ruled upon by a hearing officer chosen by UIL from a pool of hearing officers appointed by the UIL State Executive Committee. Any challenge to the hearing officer appointed to preside over the appeal must be based on evidence of actual bias. The hearing officer's decision in any appeal is final.

Scope of Appeal and Method of Consideration

9.2. Appeals may only be based upon alleged errors in the collecting, testing and analysis of the Specimen that, if true, would materially affect the test result. The alleged errors that form the basis of the appeal must be clearly stated in the Appeal Form. No other allegations or issues will be considered on appeal. There is no appeal concerning a medical exception.

As provided below in 9.4, an Appellant may choose for the appeal to be considered by the hearing officer in one of two ways: either by written submission or by telephonic hearing. Generally, the two methods are conducted as follows:

Written Submission- All matters are submitted in writing to the hearing officer. There is no hearing of any sort and the hearing officer only considers the written submissions of the student athlete and his/her Parent and/or the School along with any written submission from the UIL and other relevant entities or persons.

Telephonic Hearing- After being given a reasonable time to submit any written documentation to the hearing officer, a telephonic hearing is conducted during which Student-athlete and his/her Parent and/or School and UIL staff present their respective cases to the hearing officer in a conference call.

The choice of whether to proceed by written submission or telephonic hearing must be clearly shown on the Appeal Form at the time of its submission to UIL. Failure to clearly indicate a choice will result in the appeal being considered by written submission.

Initiating an Appeal

9.3. An appeal of a positive Anabolic Steroid test result must be initiated by the filing of a properly completed UIL Anabolic Steroid Testing Program Appeal Form (Appeal Form). The completed Appeal Form must be received by the UIL office not later than three (3) business days after notification by telephone to the Parent of the Student-athlete and the MSR of the Specimen B positive finding. (Telephone notification to the Student-athlete and his/her Parent and the MSR, will be confirmed subsequently by confidential letter.) As part of the Appeal Form, the Student-athlete and his/her Parents must agree to waive confidentiality of the test results and any other documents and information relevant to the appeal in favor of UIL and persons such as employees of the testing program Contractor, members of the Testing Crew, the Laboratory and other persons that UIL determines are necessary to conduct the appeal.

The Student-athlete and his/her Parent or School may be represented by legal counsel at any point in the process. However, if not previously provided as part of the Appeal Form, the hearing officer and the UIL must be provided the counsel's name and contact information at least twenty-four (24) hours prior to any deadline for written submission or telephonic hearing.

Additionally, representatives of the Contractor, the Laboratory and/or Testing Crew, in addition to UIL staff members, may participate in either the written submissions or telephonic hearing and provide relevant testimony, evidence, information and/or documentation.

Hearing Officer, Scheduling and Process

9.4. As soon a practical after the receipt of the completed Appeal Form from a Student-athlete and his/her Parent or the School, a hearing officer shall be appointed to hear the appeal. Appellants are to be given notice of the name of the hearing officer appointed to hear the appeal as soon as practical. Any objection along with any relevant evidence showing actual bias by the hearing officer must be submitted to the hearing officer within seven (7) days from the date of an Appellant being notified of the hearing officer's identity. The hearing officer will make the determination whether or not he or she can continue forward and preside over the appeal.

If the appeal is one where a telephonic hearing has been requested, as soon as practical after his or her appointment, the hearing officer shall set a conference call with the parties, or their respective counsel, to set a date for the telephonic hearing.

A written schedule for either the written submission or telephonic hearing appeal process shall be issued by the hearing officer within seven (7) calendar days of his or her appointment. If the hearing officer has not been able to conference with the parties to set a date for a telephonic hearing, he or she may set a hearing date in the scheduling order.

No ex-parte communications with the hearing officer are permitted. Each party must copy the other side on all written communications with the hearing officer and allow participation in any phone calls to the hearing officer.

9.5. Every appeal will be scheduled and conducted substantially as follows:

a) The appeal schedule will require that within fourteen (14) calendar days of the issuance of the schedule, each party to the appeal to submit to the hearing officer, and exchange with each other, written statements of their respective positions and any written evidence, such as documents or sworn affidavits, that support or refute the allegations of errors put forth by the Appellants in the Appeals Form. When a telephonic hearing is to be held, the parties shall also exchange a list of witnesses and a summary of their expected testimony. No written statements by witnesses will be considered unless they are in the form of a sworn affidavit.

b) The hearing officer may grant extensions of time regarding the submission and exchange of documents or concerning any other scheduling deadline in the appeals process at his or her discretion as circumstances warrant. Agreed motions by the parties for extensions of time will be given particular consideration. However, unless an extension of time has been previously granted by the hearing officer, the failure to comply with the schedule may result in the hearing officer imposing sanctions on the offending party, including the exclusion of evidence or witnesses.

c) The schedule shall include all relevant contact information of the parties. If it is reasonably believed that confidentiality can be maintained, the contact information shall include fax numbers and email addresses. Fax numbers and email addresses that are so identified may be used as a method for communication between the parties and the hearing officer.

d) Members of the UIL Medical Advisory Committee or other experts in the field of Anabolic Steroid testing may be utilized as consultants by the hearing officer. Any documents or opinions from such advisory experts that are considered by the hearing officer will be promptly made available to each party to the appeal.

e) If the appeal is by written submission, each side shall be given seven (7) calendar days after the receipt of the other party's initial submission and exchange of documents to submit to the hearing officer a rebuttal statement along with any additional relevant documents. Each side may submit one such rebuttal, after which the evidence will be closed and no further argument or evidence will be considered.

f) If the appeal is by telephonic hearing, the parties shall take turns presenting their respective cases to the hearing officer with the Appellants going first. Witnesses may be called to testify provided that the other party has been given timely prior notice of the name of the witness and the summary of their expected testimony. Witnesses may be questioned by the hearing officer. No cross-examination of witnesses by the parties will be allowed. A court reporter shall make a record of the telephonic hearing in its entirety and place any witnesses under oath. A transcript of the telephonic hearing may be purchased from the court reporter by either party. The conclusion of the hearing will close the evidence and no further argument or evidence will be considered.

g) The hearing officer may set page limits on written submissions and time limits on all or any part of a telephonic hearing and otherwise oversee and manage the appeals process in order to achieve a fair and just result.

h) Within seven (7) business days after the evidence is closed in either the written submission or telephonic hearing appeals process, the hearing officer will issue a written finding as to whether or not the Appellant has met the burden of proving by the greater weight of the credible evidence that errors in the collecting, testing and analysis of the Specimen materially affected the test result.

If the hearing officer finds that the Appellant has met the burden of proof, the Appeal will be sustained and the Student-athlete regains eligibility for participation immediately.

If the hearing office finds that the Appellant has not met the burden of proof, the Appeal will be denied and the Student-athlete remains subject to the applicable sanction as contained in 3.2. Upon completion of the applicable sanction period, the Student-athlete is required to follow the restoration of eligibility procedures outlined in section 10.

10.0. Restoration of Eligibility.

10.1. Any Student-athlete found to be positive for an Anabolic Steroid, or who refuses to submit to testing after random selection, shall be subject to penalties as outlined in section 3.2. Student-athletes who are ineligible for athletic contests as a result of a UIL positive Anabolic Steroid test finding must be tested by the Contractor and receive a negative result to qualify for eligibility restoration. Only Anabolic Steroid tests conducted by the Contractor will be considered for the purposes of this program.

10.2. Student-athletes who are ineligible for athletic contests as a result of a first positive Anabolic Steroid test finding may request the mandatory Exit Test no earlier than the 20^{th} school day of the 30 school day suspension for a first positive Specimen B Anabolic Steroid test result or refusal to submit to testing after random selection of a Student-athlete.

Student-athletes who are ineligible as a result of a second positive test finding may request the mandatory exit Anabolic Steroid test no earlier than the eleventh month of the 12 month suspension for a second positive Specimen B test result or refusal to submit to testing after random selection of a Student-athlete who has previously been subjected to the first positive test penalty.

10.3. The MSR shall submit a request for an Exit Test to the Contractor upon the request of the suspended Student-athlete. The Student-athlete is not required to make such request until they choose to do so, regardless of whether this is a first or second positive test.

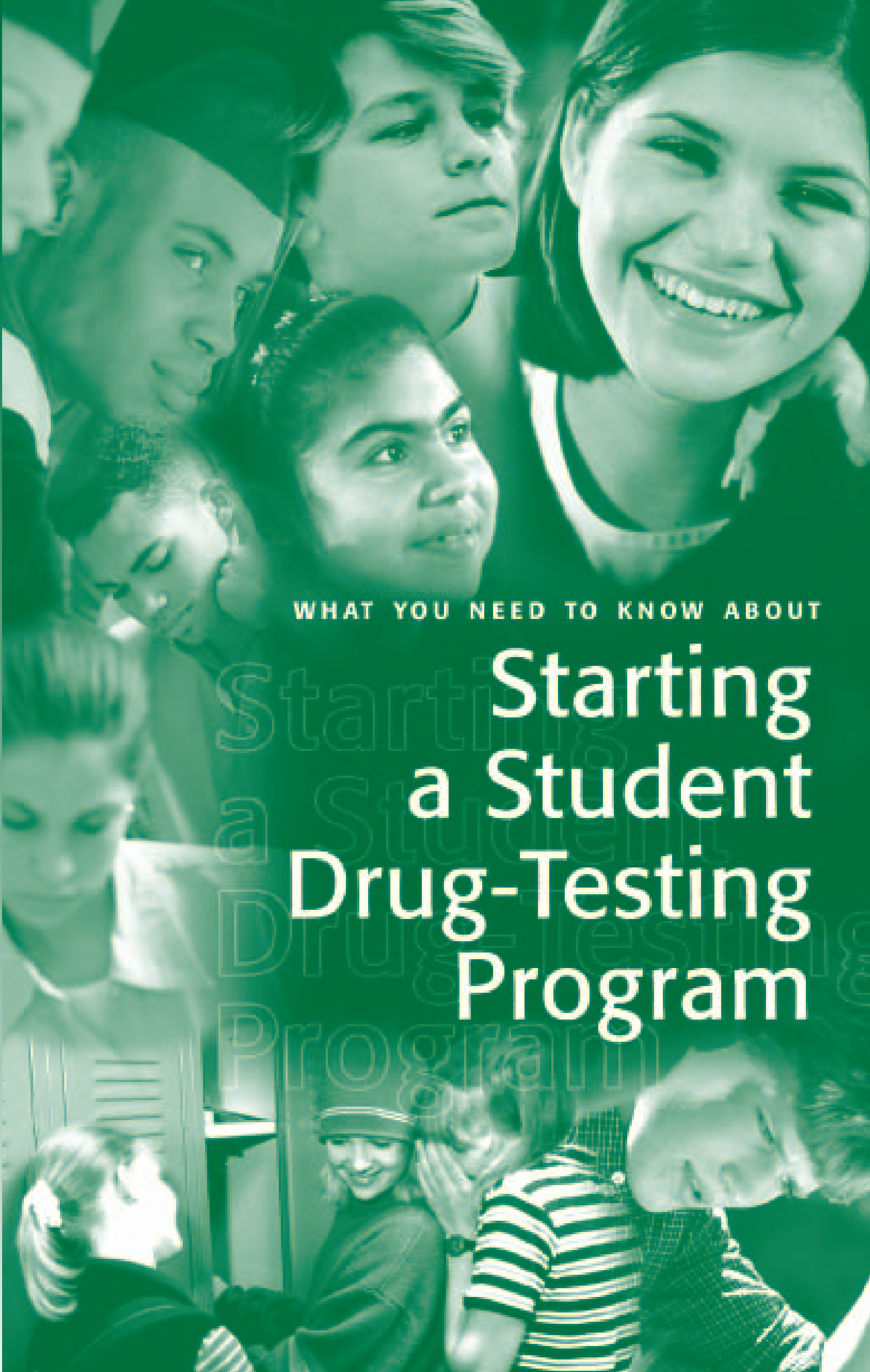
Upon receiving the request for the Exit Test, the Contractor shall determine the date that the Student-athlete will be tested. This date shall be no later than ten (10) school days following the receipt of the request for the Exit Test.

10.4. Exit Tests will be conducted according to the UIL Anabolic Steroid Testing Program Protocol.

10.5. Restoration of eligibility shall not occur until after the Student-athlete serves the applicable penalty in section 3.2, tests negative on the Exit Test and the MSR has received the negative results from the Contractor.

10.6. Should an exit Anabolic Steroid test show 'new use' of an Anabolic Steroid, including, but not limited to, a different Anabolic Steroid from the previous positive test or an increased level of the same Anabolic Steroid from the previous positive test, the Student-athlete in question is subject to the next highest penalty as outlined in section 3.2 of this document. The UIL Anabolic Steroid Testing Program Protocol applies.

10.7. The UIL will cover the cost for the first Exit Test for purposes of eligibility restoration for the penalties outlined in 3.2.1 and 3.2.2. Any subsequent Exit Test(s) for purposes of eligibility restoration are conducted at the expense of the School, Student-athlete or the family of the Student-athlete.



WHAT YOU NEED TO KNOW ABOUT

Starting a Student Drug-Testing Program

OFFICE OF NATIONAL DRUG CONTROL POLICY

“In my budget, I proposed new funding to continue our aggressive, community-based strategy to reduce demand for illegal drugs. Drug testing in our schools has proven to be an effective part of this effort. …The aim here is not to punish children, but to send them this message: We love you, and we don’t want to lose you.”

President George W. Bush

STATE OF THE UNION ADDRESS

JANUARY 20, 2004

WHAT YOU NEED TO KNOW ABOUT

Starting a Student Drug-Testing Program

OFFICE OF NATIONAL DRUG CONTROL POLICY

Acknowledgements

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Foreword

In his 2004 State of the Union speech, President George W. Bush reminded Congress and the Nation of our responsibility to help children make the right choices. "One of the worst decisions children can make," he said, "is to gamble their lives and futures on drugs."

JOHN P. WALTERS

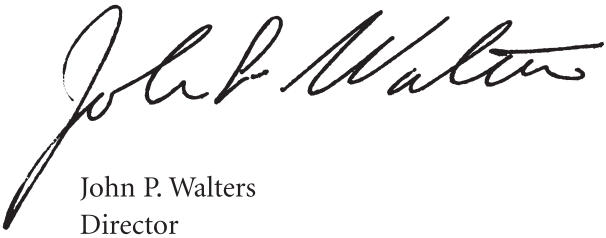
The President directed our attention to recent good news: survey results showing that drug use among American teenagers has dropped 11 percent in the past two years. This achievement not only marked improvement not seen in a decade, it also met the national goal the President set in February 2002 to reduce drug use among 12- to 17-year-olds by 10 percent within two years.

Our progress demonstrated that, when we push back against drug use, it will recede. And now that effort has been given an added boost. In his speech, the President pledged $23 million in additional funding to support one of the most powerful tools for preventing youth substance abuse: school-based drug testing.

In June 2002, the U.S. Supreme Court broadened the authority of public schools to test students for illegal drugs, thereby making this powerful tool available to any school battling drug problems. Since that historic ruling, a number of schools across the country have seized this opportunity to implement drug-testing programs of their own.

Parents and educators have a responsibility to keep children and teens safe from drug use. We have made important progress. Our task is now to move further. We must identify and use the best tools at our disposal to protect kids from a behavior that destroys bodies and minds, impedes academic performance, and creates barriers to success and happiness. Drug testing is just such a tool—powerful, safe, and effective. It is available to any school, public or private, that understands the devastation of drug use and is determined to confront it. Many schools urgently need effective ways to reinforce their anti-drug efforts. Drug testing can help them.

I hope that schools considering adding a testing program to their current prevention efforts will find reassurance in knowing that drug testing can be done effectively and compassionately. Testing, after all, cannot be used to punish kids who use drugs. Its purpose is to prevent use in the first place, and to make sure users get the help they need to stop placing themselves and their friends at risk. Random drug testing is not a substitute for all our other efforts to reduce drug use by young people, but it does make all those efforts much stronger and more effective.



John P. Walters
Director
Office of National Drug Control Policy
October 2004

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Introduction

School administrators faced with the task of keeping their students drug-free have used a variety of prevention and education programs. A precipitating event—a tragic drug-overdose death or an alarming escalation in the level of drug use, for example—will often spur a school to seek additional means of reducing the drug problem. Now, as a result of a 2002 Supreme Court decision *(Board of Education of Independent School District No. 92 of Pottawatomie County vs. Earls)*, public middle and high schools are free to use a powerful new tool for deterring and detecting drug use: random drug tests. Drug testing previously was available only for students involved in sports. In the 2002 ruling, however, the Court broadened the scope of testing to include all students who take part in after-school activities—teams, clubs, and other organizations—in which the participants compete against students at other schools.

Student drug testing is but one part of a comprehensive drug and alcohol prevention, intervention, and treatment program. Prevention messages will keep many students from using drugs, and they may also prompt some who experiment with drugs to stop. There are others, however, who have begun using alcohol or drugs and who are not responsive to prevention messages. Many of these users have not yet experienced adverse health effects of their drug use, nor have they faced criminal or social sanctions. It is through this group of users that a serious community drug problem spreads.

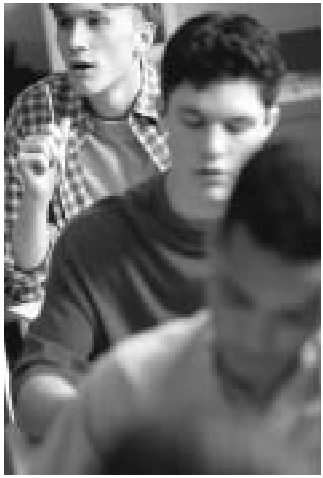
Early intervention

One of the best ways to block the spread of drug use is through an approach called early intervention, which encourages friends, family, care-givers, and others to get actively involved in the lives of drug users—and the sooner the better. The idea is to identify nondependent users, through drug testing and other means, then steer them from drugs and into counseling, if necessary, before they become addicted or entice others to use drugs. Kids whose drug use has already progressed to abuse and dependence may require more intense or clinical intervention, such as specialty treatment. Drug testing not only helps identify students who use drugs, it also creates a deterrent to use. It helps young people cope with peer pressure, giving them a convenient reason to say "no" to drugs, and it underscores the message that drugs are a barrier to achieving one's full potential.

Student drug testing has proven to be effective in schools that have tried it. For example, Hunterdon Central Regional High School in Flemington, New Jersey, experienced an overall decrease in student drug use between 1997 and 2000. The only change in the school's substance-abuse program during that three-year period was the implementation of random drug tests for student athletes. In September 2000, Hunterdon suspended all random drug testing after the American Civil Liberties Union filed a lawsuit in New Jersey state court on behalf of students who claimed their 4th Amendment rights were violated. Over the next two years, during which the school made no other changes in its substance-abuse program, the level of drug use at Hunterdon increased.

In a similar scenario, 85 percent of schools in Indiana that suspended their drug-testing programs during a court challenge by the Indiana Civil Liberties Union found that drug use increased during the suspension, then decreased when testing resumed.

Results such as this show the power and the promise of student drug testing. It is important to note, however, that drug testing may not be appropriate for every school. An earlier ONDCP publication, *What You Need to Know About Drug Testing in Schools*, provided an overview of the complex issues involved in student drug testing, and it raised some important issues that parents and administrators must consider before starting such a program. For example: Will your school and community support such a program? What are the legal requirements? Which students should be tested? What kinds of tests are available, and which are best suited for your school?



As that booklet cautions, random drug testing should never be used to punish students. Rather, it should be used to deter young people from using drugs, or to identify current drug users so they may be referred to counseling or treatment. And because no two communities face exactly the same drug problem, each school must develop its own unique drug-testing program, carefully tailored to its particular needs and circumstances.

What You Need to Know About Starting a Student Drug-Testing Program is meant to complement and build on the information provided in the earlier publication. This booklet assumes that you, as a school administrator, staff member, or parent involved in the decision, have considered all the issues, weighed the pros and cons, collected data, and are now ready to put together a plan for starting a drug-testing program in your school. It reviews the steps you need to take before implementing a testing program, such as conducting a needs assessment, consulting legal counsel, enlisting the support of both the school and the local community, developing a written policy, and providing access to student assistance. It offers guidance on how to find funding for your program, and it also includes a discussion of how some schools select students for testing and what types of tests they use. A list of resources includes Web sites and contact information for agencies and other organizations that can answer any further questions you may have about student drug testing.

The benefits of drug testing

Drug use can turn to dependence and addiction, trapping users in a vicious cycle that destroys families and ruins lives. Students who use drugs are statistically more likely to drop out of school than their peers who don't.

Drugs and alcohol not only interfere with a student's ability to learn, they also disrupt the orderly environment necessary for all students to succeed. Studies show that students who use drugs are more likely to bring guns and knives to school, and that the more marijuana a student smokes, the greater the chances he or she will be involved in physical attacks, property destruction, stealing, and cutting classes. Parents and students expect schools to offer protection from violence, racism, and other forms of abuse. It is likewise their right to expect a learning environment free from the influence of illegal drugs.

As a parent or school administrator, you have a responsibility to ensure that student drug use does not become a barrier to learning. *What You Need to Know About Starting a Student Drug-Testing Program* can help you meet that responsibility. If you conclude that drug testing would be an effective method of detecting, confirming, and deterring drug use among the young people under your care, this booklet offers valuable advice and information that can guide you in the development of a program that is effective, confidential, and compassionate.

Before You Begin

A great deal of preparation goes into developing a successful drug-testing program. Before you begin testing, it is important that you cover all the bases and take these necessary first steps:

- Collect data to determine the scope and nature of your school's drug problem
- Consult legal counsel
- Enlist support within the school and local community
- Develop a clear, written policy
- Obtain the approval of an Institutional Review Board, if necessary
- Provide access to student assistance

Collect data

Would your school really benefit from a drug-testing program? For some schools, prevention and education programs may be sufficient responses to the drug threat. For others, more powerful tools are needed to help reduce student drug use.

A school might begin a drug-testing program to confront an escalating drug problem, for example, or when overdose deaths among the student body prompt action to avert more tragedy. The Capistrano Unified School District in California launched a student drug-testing program after requests from the community for a program that would help students say "no" to drugs. The voluntary program, which started in 2002 at San Clemente High School with the support of the school board, principal, and parents, now has a participation rate of more than 50 percent.

The needs assessment should be done in the early stages, when you are considering whether your school's drug problem warrants a drug-testing program. Collecting data is important to help you determine the scope and characteristics of your drug problem and to establish a baseline from which to measure the effectiveness of your testing program later on. Some schools find it helpful to establish an advisory committee or task force. Such a group could be comprised of school administrators, students, teachers, parents, student assistance counselors, coaches, club advisors, and representatives from local treatment programs and police departments.

The advisory committee can be helpful in many ways, including the collection and assessment of data. Reports by teachers, staff, and parents can yield useful information about the nature and extent of your school's drug problem. Keep data about drug paraphernalia or residue found in or around the school. Look at indirect evidence, such as local police reports and overdose data in the aggregate, to help fill out the picture. Local treatment programs can also provide useful information about drug use by students without breaching the confidentiality of their individual patients.

Government-funded surveys such as the National Survey on Drug Use and Health, Monitoring the Future, and The Youth Risk Behavior Survey all have questions regarding drug use that can be adapted for a school survey. A number of states, as well as several private, non-profit organizations, can also provide support and survey materials designed to reflect student drug and alcohol use. Student surveys can pinpoint which drugs your students are using and, in turn, can help you decide which drugs to target in your test panel.

Consult legal counsel

In June 2002, the U.S. Supreme Court upheld a drug-testing program for students involved in competitive extracurricular activities, thereby expanding the authority of public schools to test students for drugs. Although the ruling allows schools to drug-test greater numbers of students, it is not a blanket endorsement of drug testing for all students. Schools therefore should engage legal counsel familiar with Federal, State, and local law regarding drug testing before implementing a testing program. It is important to obtain a full legal review of your drug-testing policy and program before you begin testing.

Enlist community support

A key part of the development of an effective testing program is building partnerships and trust with those in the community who would be affected: parents, students, the Board of Education, the Superintendent, local health care agencies, local businesses, legal counsel, community coalitions, and others.

For some, student drug testing is an emotional and controversial issue—all the more reason to keep everyone informed and listen to every point of view, including the voices of opposition. Addressing concerns whenever possible will strengthen your program. Holding focus-group or town-hall meetings gives you an opportunity to share the information that led to your decision to implement a drug-testing program. You may find that some who were in denial about the drug problem will become convinced when they see the results of the data you have collected.

There's no guarantee that everyone will agree with the concept of random drug testing, of course. But with careful preparation—educating parents and students, and by assuring them that the program will not be punitive, that confidentiality will be closely maintained, and that they may freely voice their opinions—you can greatly improve your chances of success. For those who will not be swayed, point out that no student will be forced to submit to a drug test. Although children whose parents refuse to give their consent may lose the privilege of taking part in extracurricular activities, parents must always have the ability to opt out of the drug-testing program.

Once your school's leadership has understood and agreed to implement a drug-testing program, and once parents, students, teachers, and other school personnel have been fully informed, widen the circle of influence by including local officials, merchants, and owners of area businesses. In some areas, companies give incentives, such as discounts or preferential employment status, to students who take part in student drug-testing programs.

Develop a clear, written policy

The committee or task force you have formed can help you decide whether the tests will be administered by school staff or by someone hired from outside the school. Many schools use the staff nurse to administer the tests. Others, including those in Polk County, Florida, hire staff from the local drug court who are trained in collection procedures and chain-of-custody issues. Your advisory committee can weigh the pros and cons of the various types of tests—urine, hair, sweat, and saliva—and also offer advice, based on the data you collected, on which drugs to include in your test panel. A test normally targets a standard group, or "panel," of drugs—marijuana, cocaine, opiates, amphetamines, and PCP. If steroids or other drugs outside the standard panel are a problem in your school, you can decide to include them in your list of target drugs. Once such decisions are made, the committee can help you develop your school's drug-testing policy.

There is no single model policy that will fit every school's particular needs. However, effective policies do share a number of common elements that you should incorporate in yours. First of all, it should be a written policy, rendered in clear, concise language that allows no ambiguity in what you are proposing.

There are four primary areas of concern that should be addressed in a school drug-testing policy: First, the policy should contain a statement about the need for a drug-free school. Second, it should have an introduction/position statement on substance use and student health, safety, confidentiality, and implementation of your student drug-testing program. Third, the policy should address the key components of the drug-testing program, such as which categories of students will be tested, how they will be selected for a drug test, what drugs will be tested for, specimen collection and chain-of-custody issues, how consent for testing will be obtained, how confidentiality of student information will be maintained, how drug-test results will be protected, and what consequences will follow a positive test result or refusal to take the test. Finally, the policy should provide a list of student rights, as well as an explanation of the school's responsibilities to the students.

Those who read your policy should be able to understand the testing procedure, and that positive test results will undergo further review by qualified medical personnel to determine the likelihood of legitimate medications causing the positive reading. Make sure your policy indicates whether the school or the parents will pay for the confirmation test.

The policy should explain what recourses are available to a student if he or she believes a positive result was an error, and it must articulate the consequences of a true positive test. If students who test positive are suspended from extracurricular activities until they provide a negative test, the policy should make this clear, as well as whether graduated sanctions will be imposed with repeated positive tests.

By the same token, the policy should state clearly that no academic consequences will follow as a result of a positive drug test. Your drug-testing policy should clearly state the permissible use of test results, indicating precisely who may (and may not) see them, and it should underscore, above all, that school administrators will maintain strict confidentiality.

Working with your advisory committee, develop consent forms for parents and students to sign indicating they have read your policy, understand it, and agree to take part in the drug-testing program. Announce the policy at least 90 days before testing begins. When collecting information from students on drug use, be mindful of the

U.S. Department of Education's regulations on confidentiality and release of information. The two primary regulations are the Family Educational Rights and Privacy Act (FERPA) and the Protection of Pupil Rights Amendment (PPRA). See the Resources section for more information. Also listed among the Resources are links to Internet sites offering samples of student drug-testing policies, as well as contact information for non-profit organizations that can provide technical assistance on developing a policy.

Obtain the approval of an Institutional Review Board, if necessary

If your school district receives Federal funds to develop, enhance, or implement a student drug-testing program, the project may be subject to the approval of an Institutional Review Board (IRB), a special panel charged with protecting the rights and welfare of human research subjects. Projects that are designed to test or demonstrate the effectiveness of drug testing are considered "research" by some agencies under a Federal policy governing human subjects. Not all student drug-testing programs fall within the scope of this policy. But it is essential that you determine early in the process, before you begin drug-testing students, whether your project requires IRB review. Check with your funding agency to see if it has adopted the Federal policy for the protection of human subjects. Some agencies, including the U.S. Department of Education, offer guidance to grant recipients on finding an IRB and obtaining the necessary approval. (See the Resources section for more information, including lists of IRBs and a complete list of agencies that have adopted the Federal policy regarding the protection of human subjects.)

Provide access to student assistance

Some schools may be reluctant to initiate a testing program for lack of understanding what to do with those students who test positive for drugs. Indeed, it is essential for any school contemplating a student drug-testing program to have some sort of mechanism in place for working with students whose test results are positive. For those who have just started using drugs or use them only occasionally, a few words from a counselor and/or parents—coupled with the prospect of future drug tests—may be enough to discourage further use. The counselor may refer the student for recovery support services, which can be an intermediary step for those not requiring clinical treatment services. Frequent users or those in danger of becoming chemically dependent will likely need clinical treatment.

One good way to assure these young people receive the appropriate level of counseling or treatment is to provide access to a student assistance program. Operating in much the same way as employee assistance programs in the workplace, student assistance programs have a long history of helping schools remove barriers to learning. Some schools use a core team of trained staff to provide student assistance services. Others designate a single counselor as the student assistance counselor, while still others contract with outside non-profit mental health or substance abuse agencies to provide student assistance services. Whatever the arrangement, student assistance programs help young people improve their success in school by connecting them with the most appropriate resources for the many issues that interfere with learning, such as family problems, peer conflicts, depression, isolation, illness, and substance abuse.

Student assistance services typically include linking students and their families to appropriate community resources and school-based support services. A positive drug test may result in referral to ongoing drug testing, educational classes, attendance in a chemical awareness group, or treatment for chemical dependency. Some students with positive test results are referred through the student assistance program to a behavioral health assessor, a professional counselor who specializes in working with chemically dependent youth. Maintaining strict confidentiality throughout the process, the assessor can determine whether the student's alcohol or drug use requires recovery support or clinical treatment services, or can be dealt with in less intrusive ways. For students who have completed treatment and who are in recovery striving to stay "clean," returning to the school environment can be a difficult experience. Student assistance eases the re-entry process by offering aftercare and other support services, then stays in touch with the students to monitor their progress over time.

Studies have found that students who were referred through a student assistance program to behavioral health specialists show improved attendance, fewer discipline problems, and better performance in school. For more information, call the National Student Assistance Association at 800-257-6310 or visit the group's Web site at www.nsaa.us.

Conducting the Test

Just as the drug problem differs from one school to another, so do the mechanisms by which various schools conduct drug tests. You should work closely with your advisory committee and legal counsel to map out a strategy and set clear guidelines for the nuts-and-bolts operation of the testing program. Your plan should cover, in detail, every step from beginning to end, including procedures for choosing which students can be tested, when and how they are summoned to the collection area, how the tests are performed and analyzed, and what happens in the event of a positive test.

Although there is no "one size fits all" approach to drug testing, there are strategies and techniques that have proven to be effective. Understanding these, and knowing how other schools have tackled some of the same issues you are facing, can be immensely valuable in helping you develop a plan for your school. Key issues, questions, and topic areas include:

- Whom to test, and when
- The procedure
    - Specimen collection
    - Certified labs
    - Point-of-collection urine tests
    - The confirmation test
    - Medical review officer
- Alternative testing methods
- Consequences of a positive test

Whom to test, and when

Methods and procedures vary widely, but on average, schools with drug-testing programs submit approximately 10-25 percent of their eligible students to drug tests each month. Typically, a school will test some students weekly, but there are those that test bi-weekly or even monthly. Most schools use a computerized system to select students randomly for drug testing. Others rely on a lottery system and pull names out of a "pool" of eligible students. On test days, schools often select a few alternate candidates to account for absences.

The procedure

For years, urine has been the only specimen collected for many federally regulated and most private-sector drug-testing programs. Today, the majority of schools with drug-testing programs continue to use urine tests because of the proven reliability, accuracy, and fairness of this method. However, schools are increasingly using tests of hair and oral fluids because both are easier to collect and more resistant to cheating.

Specimen collection. For urine tests, a school staff member usually escorts those chosen from the testing pool to the collection site. Here, students typically are given a specimen cup and sent to the lavatory unobserved. Blue dye has been placed in the toilets, and the water to the sink has been shut off or the faucets taped shut to lessen the risk of having the specimen adulterated. The person overseeing the collection procedure also checks the temperature of the specimen to make sure it is valid and that no substitution has occurred.

Once the specimen is determined to be valid, the cup is sealed and then initialed by the student, and the proper chain of custody is applied. To preserve confidentiality, an identification number rather than the student's name or initials may be used for marking the specimens and test results. Many schools send the specimens to a laboratory, where they are analyzed by sensitive and carefully calibrated instruments. Laboratory analysis gives the most accurate reading, but the test results may not be known for 24 to 48 hours from the time the lab receives the specimen.

At the laboratory, technicians check every specimen for possible substitution or adulteration by substances that the student may have ingested or put in the specimen afterward to "cleanse" it. (Specimen tampering or adulteration is less of a concern in hair or saliva testing.) Even if it turns out that an adulterated specimen does not reveal the presence of drugs or drug metabolites, the fact that it has been tampered with should bring on the same consequences as positive drug test.

Certified labs. Drug testing is mandated for Federal employees in safety- or security-sensitive positions. Because a positive drug test could cost someone in such a position his or her job, every possible precaution is in place to assure test accuracy. All specimens, for example, must be sent to laboratories certified by the Substance Abuse and Mental Health

Services Administration (SAMHSA). Although school drug-testing programs are not bound by the same strict procedures, many schools use SAMHSA-certified labs to ensure a high level of accuracy. (For more information about the Federal drug-testing program, as well as a list of certified labs, see http://workplace.samhsa.gov/ResourceCenter/lablist.htm.) This certification procedure is currently only for urine testing, but Federal guidelines under development will extend the process to hair, oral fluids, and sweat-patch testing.

Point-of-collection urine tests. Some schools perform a screening test of the collected specimens on-site, in a procedure known as point-of-collection testing. For urine testing, the collection procedure is the same as that for specimens being sent to a laboratory. The difference is that, in point-of-collection screening, the specimen is read by the test administrator, not by laboratory instruments. A variety of testing devices are available that allow the tester to "dip and read," "tilt and read," or "drop and read" the test results. This on-site collection test yields immediate results, most of which will be negative. However, because of the human involvement in reading the tests, it is imperative that the tester be properly trained. If a point-of-collection specimen tests positive, it is then sent to a laboratory, using proper chain-of-custody procedures, for a confirmation test.

Parents should be notified each time their child is tested, and the results—positive or negative—should be shared with them. It is up to each school to determine which staff members, if any, are permitted to see the test results. High schools generally allow at least one staff member access to the results. A middle school, on the other hand, might send the results to the parents only, along with literature on what to do if the test is positive.

The confirmation test. If the results of the screening test are negative, no further action is necessary. However, if the specimen tests positive, regardless of the testing method, a confirmation test should be done. In the case of urine testing, the confirmation test involves an analytical process known as gas chromatography/mass spectrometry (GC/MS). Technicians use gas chromatography to separate the various substances in the specimen, and then make a positive identification through mass spectrometry. Some schools automatically authorize a confirmation test in the event of a positive screening; others do so only at a parent's request. If the confirmation test also comes up positive, a qualified "medical review officer" should determine whether the positive reading was caused by illicit drugs or by proper prescription medication.

Medical review officer. A medical review officer is a licensed physician who is also an expert in drug and alcohol testing and the Federal regulations governing such testing. It is the job of a medical review officer to ensure the integrity of the drug test. If a test is positive, the medical review officer consults with the student and/or the student's family and gives them an opportunity to supply evidence that there was a justifiable reason for the positive test, such as a properly prescribed drug. If the medical review officer determines that the positive test was not the result of illegal drug use, the test is reported as negative. Having a medical review officer on board helps protect the rights of students and can have the added benefit of strengthening the school's position if the test results are ever challenged.

Most laboratories can provide a list of available medical review officers. To verify the certification status of medical review officers, see the American Society of Addiction Medicine (ASAM) Web site at http://www.asam.org/search/search4.html. For more information about certified labs, visit the Web site for SAMHSA's Division of Workplace Programs at http://workplace.samhsa.gov/DrugTesting/MedicalReviewOfficers

Alternative testing methods

Drugs or drug metabolites can be detected in hair, oral fluids, and sweat. Several factors, including the stigma of wearing a sweat patch, make sweat testing more suited for use in the criminal justice system and for follow-up testing after drug treatment.

Hair testing is less intrusive and has a longer detection window than urine testing, but it may present some special problems. If, for example, a student athlete shaves his head, where would you take a sample? (In this case, a urine test could be used as an alternative.) Moreover, hair specimens can be analyzed only in a laboratory.

Another less-intrusive alternative involves the testing of oral fluids, the generic term for saliva and other material collected from the mouth. Due to the sensitivity of testing devices required to detect marijuana and cocaine in oral fluids, specimens should be sent to a laboratory to ensure the most accurate readings. Although drugs and drug metabolites do not remain in oral fluids as long as they do in urine, oral-fluids testing offers a number of advantages. For example, specimens can be collected relatively easily—a swab of the inner cheek is the most common way—and in virtually any environment. Oral fluids are also harder to adulterate or substitute, and collection is less invasive than in urine or hair testing.

Consequences of a positive test

Depending on the school's policy, students who test positive for drug use may be suspended from their extracurricular activities for a period of time. They may also be required to attend drug education classes, undergo counseling, or seek treatment for clinical dependency. These students usually must submit to follow-up drug tests as well. What's most important, once users have been identified through drug testing, is for those involved in their lives—family, friends, counselors, treatment providers—to practice early intervention and do all they can to dissuade these students from using drugs. Recovery support services can be especially helpful at this time.

If subsequent tests also yield positive results, students might face graduated sanctions, such as a longer suspension from an extracurricular activity. On the other hand, when a student admits drug use and shows a willingness to come to grips with the problem, this is usually seen as a positive step toward stopping the use, in which case sanctions may be much lighter or lifted altogether. Whatever the consequences, it is essential that students who test positive for drugs, particularly those who are in recovery after treatment for chemical dependency, get all the help and support they need, whether through student assistance or other services.

Drug testing in schools will let students be accountable

By Kyle Brown

Reprinted here, in part, is an opinion piece published June 23, 2004, in the Fort Wayne, Indiana, Journal Gazette. *Its author, then a rising senior at Homestead High School, wrote the article in response to an editorial in the newspaper urging Southwest Allen County Schools to reject drug testing.*

I applaud Southwest Allen County Schools for taking the initiative to stop drug and alcohol use in my school. The party atmosphere at Homestead continues to grow every year, and the present methods of education and prevention are proving to be ineffective. A new way of thinking has to be developed to curb the trend, and that's what Superintendent Brian Smith and his administration have put together: a well-thought-out program designed to help students rather than punish them.

Monday's editorial stated that random drug tests are too expensive, of questionable deterrent value and a violation of privacy rights. Let me dispense with those objections quickly. My school is considering drug tests that cost $15 each. The first three years of this program will be financed entirely from private donations, local foundations and government grants. If drug testing works during its three-year trial, then the tests would cost my school and the two middle schools $54,000 annually. That's just $18,000 per school per year. When you consider the costs of students missing school because of drugs and alcohol and the lost revenue to the school system resulting from their absences, this is a no-brainer.

Monday's editorial said drug testing violates my privacy rights. This assumes that my fellow students and I value our privacy over the lives of our friends. I would assert that it is just the opposite: We want accountability. It seems the only reason to deny drug testing in the schools is to protect underage drinking and drug use. And, frankly, I give up my privacy every time I change clothes in the locker room.

Let me give you three reasons why I support drug testing in my school. First, the program will encourage students to make constructive decisions rather than destructive ones. Second, it gives teeth to the drug-free promise that athletes and other students participating in extracurricular activities currently sign. (Currently, most of my peers just consider that promise a joke; there's simply no means to keep students accountable to it.) Finally, the new drug testing program will give students a reason to say no to drugs and alcohol. It will give students an opportunity to say "no" to drugs and alcohol and "yes" to athletics, band, show choir, journalism and all the activities that make school a complete experience.

The program Dr. Smith and other members of the community have developed will make the schools safer and stronger. Students will knowingly or even unknowingly help themselves by participating. Grades will increase, athletes will perform better and students will be able to learn in a safer environment.

Furthermore, the program will keep students and athletes accountable for their actions. The contractual promise every athlete and extracurricular participant signs will no longer be worthless. By establishing this program, we may never know all the good that will come from it because of all the bad that is stopped before it gets started.

As a member of a new generation who embraces accountability rather than the gross indulgences of personal freedoms that previous generations have embraced, I would urge you as a reader of this paper to lend your support for a safer and stronger school community by becoming a vocal advocate for random drug testing.

Assessing your program's effectiveness

One important measure of success for a student drug-testing program is whether drug use at your school declines over time. Launching the program is only part of the process. It is essential that you also monitor the program closely and regularly by conducting surveys, watching for signs of progress, and making any necessary fine-tuning adjustments along the way, such as modifying the list of drugs in your test panel. On a continuing basis, you should collect as much information as you can about the amount and extent of drug use at your school.

Anecdotal evidence of the sort collected before starting the program, together with signs of changes in overall student productivity and incidents of disruption and detention, will give you a fairly good idea of how the program is working. However, quantitative data—including the results of student surveys compared to your baseline data and the percentage of positive test results found each year during the course of your program—will allow you to more definitively gauge your program's success. In some cases, schools have hired outside evaluators to review the progress of their programs.

A recent survey of student athletes underscores the preventative power of drug testing. As part of the Student Athlete Testing Using Random Notification (SATURN) study, researchers compared rates of drug use among student athletes at one Oregon high school with those at another Oregon school that did not have a testing policy. At the start of the year, 7 percent of student athletes at both schools reported past-month use of illicit drugs. By the end of the school year, however, drug use by student athletes in the school with a testing program had decreased to 5 percent, while use among athletes at the non-testing school had jumped to 19 percent. (This increase was due in part to the fact that the school did not have a drug-testing program that would have provided students the opportunity to say “no” to drugs.)

Funding your program

In a survey conducted recently by the Office of National Drug Control Policy, more than 37 percent of respondents said they did not consider implementing a drug-testing program in their public school because of concern it would be too expensive.

While cost is certainly an important factor when weighing the pros and cons of drug testing, it should not be viewed as an insurmountable hurdle for schools eager to start a program. Depending on the type of test used and the range of target drugs, individual tests can cost between $10 and $50. Funds for drug-testing programs can come from any number of Federal, State, local, or private sources, including those listed below.

Safe and Drug-Free Schools and Communities Program. The *No Child Left Behind Act* states that funds from the Safe and Drug-Free Schools Program can be used for student drug testing as part of a comprehensive program. It is important that schools follow the procedures set forth in *No Child Left Behind* for using state formula money. To view or download the *No Child Left Behind Act*, visit http://www.ed.gov/policy/elsec/leg/esea02/index.html

Grants for Student Drug Testing. Each year, Congress provides funds through the Department of Education’s Office of Safe and Drug-Free Schools, National Programs, for a variety of activities related to alcohol, drug, and violence prevention. In FY 2003, $2 million was provided to eight grantees nationally for student drug testing. The grants were available to local education agencies and to other public and private entities for implementing, enhancing, or evaluating school-based drug-testing programs.

Faith-based organizations are eligible to apply for these grants. Confidentiality of student identities must be preserved, and the grant must contain a comprehensive plan for referral to treatment or counseling of those students who have been identified in the student drug-testing program. More information can be found at http://www.ed.gov/about/offices/list/osdfs/programs.html#national

Asset Forfeiture Funds. In some jurisdictions, asset-forfeiture statues require that a percentage of funds forfeited be used for drug-prevention programs. Because the primary purpose of student drug testing is to deter drug use, some jurisdictions have used forfeiture funds for their school drug-testing programs.

Community Foundations. Tax-exempt, non-profit organizations called community foundations are the fastest growing sector of American philanthropy. Usually found in areas with a population of over 100,000, these foundations are autonomous and publicly supported, operating from an endowed permanent asset base that has been created by local residents over a period of years. For more information, see the Web site for the Council on Foundations at http://www.cof.org

Local Businesses. Many businesses today have drug-testing programs of their own. Companies in your community can provide expertise in conducting drug tests and devising strategies for assessment and referral. Local businesses may also provide financial and other kinds of support for your school's drug-testing program.

Activity Fees. Some schools add the cost of drug testing to the student activity fees charged to parents or allocate a portion of athletic booster-club funds to pay for drug tests.

Existing Contracts. Some schools have reduced the cost of drug tests by linking up with city or state agencies that already have contracts with drug-testing companies. Small schools, in particular, can make testing more affordable by "piggybacking" on existing contracts.

Conclusion

Drugs are a significant barrier to learning, and the use of drugs by even a small number of students can affect the entire atmosphere of a school. Recognizing this, many administrators, parents, and students appreciate having a tool as powerful as student drug testing available as an additional component in their school's comprehensive drug-and-alcohol prevention and early intervention program.

Drug testing may not always be the solution to drug use by young people, nor is it right for every school. But for those schools that have determined that drug use is a significant problem and that testing is an appropriate response, it is important to keep in mind that the purpose is not to punish students who use drugs. The goals are to deter non-using students from ever using drugs, to encourage non-dependent users to stop before they get into more serious trouble with drugs or encourage others to follow suit, and to identify those who need early intervention, recovery support, and/or clinical treatment services.

Drug testing reinforces all other drug-prevention strategies and is a vital part of a comprehensive approach to preventing adolescent drug use. Because drug testing detects use at every level, it can identify not only those users who are dependent on drugs, but also those who have just begun using or who have not yet experienced the negative effects of their use. Knowing which students are using drugs makes it much easier for parents, counselors, and others to step in with early intervention, provide the care these kids need, and put them on the road to better health.

Student drug testing should not be used just on a hunch or the assumption that drug use is a problem. Rather, it should be implemented only when a specific threat has been identified, and when the evidence, carefully collected over time, reveals a genuine need. A successful testing program involves extensive pre-planning, which must include every effort to enlist the support of school officials, parents, students, and anyone else who would be affected by it. Before testing begins, some sort of student assistance program should be in place to provide help to students who test positive for drugs. Every step of the program should be designed to ensure fairness, accuracy, and respect for confidentiality.

For schools with successful drug-testing programs, the rewards can be abundant. With declining drug use comes less disruption in the classroom and in the community, fewer health problems, higher productivity, better academic performance, and, for students, the promise of a healthier, brighter future.

Resources

Government Agencies and Services

Substance Abuse and Mental Health Services Administration (SAMHSA)

U.S. Department of Health and Human Services
www.samhsa.gov
SAMHSA offers information on prevention, treatment, and mental health services, as well as free literature, topical searches, and identification of model programs and approaches for preventing and treating substance abuse.

National Clearinghouse for Alcohol and Drug Information

U.S. Department of Human Services/SAMHSA
Phone: 1-800-729-6686
TDD (Hearing Impaired): 1-800-487-4889
Fax: 301-468-6433
Spanish Line: 1-877-767-8432
E-mail: info@health.org
http://ncadi.samhsa.gov
The clearinghouse is a one-stop resource for the most current and comprehensive information about substance abuse prevention and treatment.

Substance Abuse Treatment Facility Locator

www.findtreatment.samhsa.gov

Division of Workplace Programs

SAMHSA offers information about testing technologies, products, and services.
www.drugfreeworkplace.gov

State list of certified labs

SAMHSA's list of certified laboratories is updated every month.
http://workplace.samhsa.gov/ResourceCenter/lablist.htm

Office of Safe and Drug-Free Schools

U.S. Department of Education
http://www.ed.gov/about/offices/list/osdfs/index.html

Family Educational Rights and Privacy Act (FERPA)

www.ed.gov/offices/OM/fpco/ferpa

Protection of Pupil Rights Amendment (PPRA)

www.ed.gov/offices/OM/fpco/ppra

The Drug-Free Communities Program

A program of the Office of National Drug Control Policy and the Substance Abuse and Mental Health Services Administration, Drug-Free Communities is designed to strengthen community-based coalition efforts to reduce youth substance abuse. The site provides a database of funded coalitions nationwide.
www.drugfreecommunities.samhsa.gov

Office of National Drug Control Policy

www.whitehousedrugpolicy.gov

The Anti-Drug.com

www.theantidrug.com

Freevibe.com

www.freevibe.com

National Youth Anti-Drug Media Campaign

mediacampaign.org
druganswer.com (Asian languages)

National Institute on Drug Abuse

www.nida.nih.gov

Medical Review Officers

American Society of Addiction Medicine (ASAM)
http://www.asam.org/search/search4.html

Division of Workplace Programs (SAMHSA)
http://workplace.samhsa.gov/DrugTesting/MedicalReviewOfficers

Institutional Review Boards

Institutional Review Board Registry
Office for Human Research Protections
U.S. Department of Health and Human Services
http://ohrp.cit.nih.gov/search/asearch.asp#ASUR

Agencies that have adopted the Federal policy for the protection of human subjects

Department of Agriculture
Department of Energy
National Aeronautics and Space Administration
Department of Commerce
Consumer Product Safety Commission
Agency for International Development
Department of Housing and Urban Development
Department of Justice
Department of Defense
Department of Education
Department of Veterans Affairs
Environmental Protection Agency
Department of Health and Human Services
National Science Foundation
Department of Transportation

Grant Information

U.S. Department of Education

http://www.ed.gov/fund/landing.jhtml

Office of Safe and Drug-Free Schools

Programs/Initiatives
U.S. Department of Education
http://www.ed.gov/about/offices/list/osdfs/programs.html#national

What Should I Know about ED Grants?

U.S. Department of Education
http://www.ed.gov/fund/grant/about/knowabtgrants/index.html

Developing Competitive SAMHSA Grant Applications: Participants Manual

Substance Abuse and Mental Health Services Administration (SAMHSA)
http://alt.samhsa.gov/grants/TAManual/toc.htm

Student Surveys

2005 State and Local Youth Risk Behavior Survey

Department of Health and Human Services
Centers for Disease Control and Prevention
http://www.cdc.gov/HealthyYouth/yrbs/pdfs/2005highschoolquestionaire.pdf

2005 Youth Risk Behavior Survey: Middle School Questionnaire

Department of Health and Human Services
Centers for Disease Control and Prevention
http://www.cdc.gov/HealthyYouth/yrbs/pdfs/2005middleschoolquestionaire.pdf

Drug-Testing Guidelines

National Student Drug-Testing Coalition

www.studentdrugtesting.org
The booklet “Model Legislation For Student Drug-Testing Programs: State Bill and Insertion Language” is available online at http://www.studentdrugtesting.org/model%20state%20bill%20web%20file.PDF

Guidelines Concerning Student Drug Testing in Virginia Public Schools

http://www.pen.k12.va.us/VDOE/PC/DrugTestingGuidelines.pdf

Other Organizations

Community Anti-Drug Coalitions of America

Phone: 1-800-54-CADCA (1-800-542-2322) or 703-706-0560
Fax: 703-706-0565
E-mail: webmaster@cadca.org, or info@cadca.org
www.cadca.org

Drug-Free Schools Coalition, Inc.

Phone: 908-284-5080
Fax: 908-284-5081
E-mail: drugfreesc@aol.com

National Student Assistance Association

Phone: 800-257-6310
www.nsaa.us

Recovery Network

For information about substance abuse, addiction, and mental health problems.
www.recoverynetwork.org

Monitoring the Future
www.isr.umich.edu/src/mtf

American Medical Association
www.ama-assn.org

American Society of Addiction Medicine
www.asam.org

American Public Health Association
www.apha.org

HOW TO ORDER

This document is available online at www.whitehousedrugpolicy.gov. Additional copies may be obtained from the ONDCP Drug Policy Information Clearinghouse by calling 1-800-666-3332, or by sending an e-mail to ondcp@ncjrs.org.

EXECUTIVE OFFICE OF THE PRESIDENT OF THE UNITED STATES

OFFICE OF NATIONAL DRUG CONTROL POLICY

NCJ 206126

ILLINOIS PROGRAM – UNDER REVIEW

FAQ's (continued)

A (con't:): year from the date of their notification of the violation. Students may petition for reinstatement of their athletic eligibility after 90 provided they meet the requirements set forth by the Board of Directors. Additionally, member schools will be subject to penalties for a violation of the testing program as determined by the Executive Director on a case by case basis.

Q: What other resources are available for students, coaches, or parents regarding the dangers of steroids and dietary supplements?

A: The IHSA has a dedicated page for Sports Medicine Special Topics and can be accessed by going to www.ihsa.org. Over the past three school years, the IHSA has attempted to raise awareness on the use of performance-enhancing drugs by high school student-athletes through a number of educational units and other media. A number of resources are available through the associations SMAC page noted above, including specific information on the performance-enhancing drug testing program. The IHSA has also developed a video detailing the drug testing program that schools can access through the Schools Center on the IHSA website.

Conclusion

The IHSA's Sports Medicine Advisory Committee has studied the issues surrounding anabolic steroid and dietary supplement use and drug testing of student-athletes for a number of years. The committee has taken efforts to raise awareness on these issues and is committed to continuing efforts to provide resources to schools.

Studies have shown that high school students across the nation, including Illinois, are using anabolic steroids and dietary supplements to increase athletic performance at great risk to themselves. And it is because of this concern for the health of student-athletes that the IHSA is considering developing a drug testing program.

During the 2007-08 school term, additional information regarding drug testing, including all testing protocols that would be utilized, will be made available to member schools and the public through the IHSA website.

Illinois High School Association

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Bloomington, IL 61702-2715

Phone: 309-663-6377
Fax: 309-663-7479
E-mail: general@ihsa.org

Performance-Enhancing Drug Testing

FAQ's

Illinois High School Association

Tel: 309.663.6377

Background

This brochure is designed to answer some of the most frequent questions asked of the IHSA regarding anabolic steroids, dietary supplements, and drug-testing. Its aim is to provide interested individuals with the necessary and correct information in order to ensure the safety of student-athletes. Individuals with further questions can contact the IHSA electronically at general@ihsa.org.

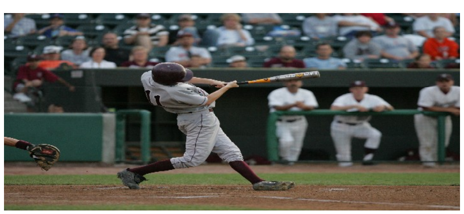
FAQ's

Q: What exactly does IHSA By-Law 2.170 address?

A: Approved overwhelmingly by the membership in 2006, By-Law 2.170 prohibits individuals associated with member schools from distributing anabolic steroids or performance-enhancing dietary supplements to student-athletes. It further details what things school personnel can distribute although the ultimate responsibility for taking any kind of substance is the student-athlete. The by-law also establishes "banned drug classes" that student-athletes should be aware of when they consider taking anything aimed at improving their performance.

Q: How will the association's testing program be effected by the "Banned Drug Classes"?

A: All tests conducted as a part of the association's testing program will be for the established banned drug classes.



FAQ's (continued)

Q: Can I take creatine?

A: Creatine is a dietary supplement that is sold in many forms by a number of manufacturers. Dietary supplements that are sold over the counter and through the internet are under-regulated by the U.S. FDA. Athletes are advised that the use of dietary supplements is at the user's own risk.

The list of ingredients and claims made by a manufacturer are not necessarily backed up by reliable, scientific research.

Q: Speaking of supplements, how do I know if one is okay or not?

A: As mentioned earlier, passage of IHSA By-Law 2.170 created a "banned drug classes" that are prohibited from being distributed to student-athletes. That list also provides direction to the association and its performance-enhancing drug-testing program in terms of what substances for which students will be tested. As mentioned earlier, ultimately the use of supplements is at the student's own risk.

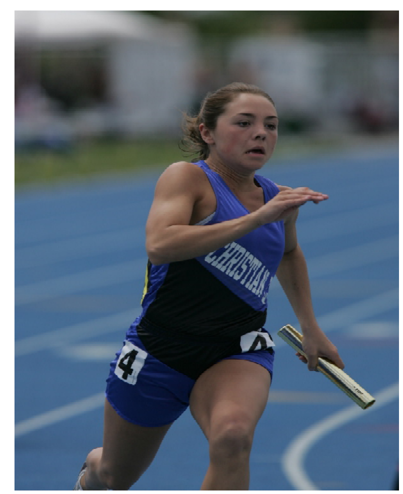
FAQ's (continued)

Q: What is the penalty then for taking a substance that is on the IHSA's banned list?

A: The IHSA's performance-enhancing drug testing program will randomly select students who represent their school in any IHSA athletic state series contest. At this time, the testing program will not extend into the summer months or the regular season. In the event a member school discovers that one of it student-athletes has taken a substance from the association's banned drug classes will be subject to the penalties called for in his/her school's Athletic Policy/ Code of Conduct. The penalties associated with the IHSA's performance-enhancing drug testing program pertain to those violations found as a result of the association's post-season testing.

Q: What will the penalties be for a student who tests positive for a banned substance?

A: The IHSA Board of Directors have determined that student-athletes who have been found to have violated the association's performance-enhancing drug testing program will be suspended from interscholastic participation for a period of one



Warning Signs and Symptoms of Steroid Use

Possible Signs of Steroid Use:

"Puffy", swollen look to the face; acne, especially on shoulders, back, or chest; excessive time spent working out; frequent nosebleeds; frequent muscle cramps; increased aggression and violence; increased irritability; periods of depression; quick strength and weight gain; wide mood swings

Possible Adverse Effects in Both Males and Females

Acne, especially on chest, shoulders, and back; addiction; blood cots; breast enlargement and pain (males); deepening of the voice (females); deformed sperm/possible birth defects (males); frequent nosebleeds; growth of permanent facial and chest hair (females); hardening of the arteries, higher cholesterol levels; increased risk of heart attack, increased blood pressure; increased violence and aggression ("roid rages"); increased risk of injury and slower healing time; insomnia, restlessness, depression; liver damage, including cancer; loss of hair and partial baldness; lowered sperm count/temporary sterility (males); menstrual irregularities (females); muscle tendon damage; pain when urinating (males); reduction of breast size (females); shrinking of the testicles/sterility (males); stunted growth; suicidal thoughts; swelling of feet and lower legs; unpleasant breath odor

Evaluating Ergogenic Aid Claims

The following are considerations coaches, students, and/or parents should make when examining ergogenic aids.

1. What is the source of the information?
- Peer-reviewed journal
- Magazine, newspaper or book
- Company selling a product

2. Who wrote the article?
- A professor or someone with a degree (Is the degree in a field related to sports medicine, nutrition, or biochemistry?)
- Someone with credentials
- Unsure, article doesn't state

3. Critical Analysis
- Does the product sound too good to be true?
- If a research study is cited, is it done on a healthy population or a diseased population, well-trained subjects or sedentary subjects, animals, or humans?

Evaluating Ergogenic Aid Claims (con't.)

- Does the dosage seem large or unsafe?
- Does the article make conclusive statements suggesting that a particular supplement will make you lose weight?
- Does the product promise quick improvements in healthy or physical performance?
- Does the item contain some secret ingredient or formula?
- Are currently popular personalities or star athletes used in its advertisements?

4. Is the product effective?

If it is still unclear whether the supplement is effective, seek other sources of information such as more articles on the topic or opinions of professionals in the field of nutrition and exercise.

5. Is the product safe at the recommended dosages?

6. Does the product cause long-term health problems?

7. Are possible side-effects identified?

8. Is taking the supplement ethical?

This is often a hard question to answer. The thrill of competition is to strive to be the very best, but does being the very best mean enhancing your performance through external substances. The ancient Greek ideal and that of the International Olympic Committee is that an athlete should succeed through their own unaided effort. Every individual must assess his/her ethical standards. In doing so, he/she should consider the policies of his/her team or the governing body for a sport, the possibility a substance is banned, and the understanding that taking such a supplement is considered cheating.

Provided by the IHSA

The IHSA would like to thank the following for providing information and/or resources in making this brochure possible:

NCAA Banned Drug List

Wisconsin Interscholastic Athletic Association

Iowa High School Athletic Association

By-Law 2.170:

Distribution of Steroids and Performance-Enhancing Dietary Supplements

(effective July 1, 2007)

Illinois High School Association

The future plays here.

Background

The value of high school interscholastic programs is found in the over-all physical, emotional, and intellectual development of student-athletes. In that pursuit, anabolic steroids and performance-enhancing dietary supplements offer no positive contribution. Rather, their use jeopardizes not only the health of student-athletes, but also impedes in their over-all development. And since this use runs counter to the purpose and value of interscholastic programs, coaches, administrators, school officials or employees, or booster club/support group members have an obligation and responsibility to provide only healthy, safe, and approved substances to student-athletes. IHSA By-Law 2.170, which will take effect on July 1, 2007, will strengthen the relationship between students and their schools by affirming the school's commitment to offering a safe environment in which their students can develop.

Over the past few years, the IHSA, through the work of its Sports Medicine Advisory Committee and in conjunction with the National Federation of State High School Associations, has attempted to increase awareness on steroid use by high school students and provided resources that schools, athletes, and parents could use to reinforce the dangers of anabolic steroids and performance-enhancing dietary supplements.

The purpose of this brochure is to provide schools, athletes, and parents with a description of those substances that are considered banned by the IHSA, and, therefore, substances student-athletes can not take and maintain their athletic eligibility.

This brochure presents the expected list of banned drug classes to be in effect for the 2007-08 school year. On July 1st, 2007, the official list shall be published on the IHSA website and will be distributed in hard copy to member schools in the August 2007 All-School Mailing.

Banned Drug Classes

The term "related compounds" comprises substances that are included in the class by their pharmacological action and/or chemical structure. No substance belonging to the prohibited class may be used, regardless of whether it is specifically listed as an example.

Many nutritional/dietary supplements contain banned substances. In addition, the U.S. Food and Drug Administration (FDA) does not strictly regulate the supplement industry; therefore purity and safety of nutritional dietary supplements cannot be guaranteed. Impure supplements may lead to a violation of IHSA by-laws. The use of supplements is at the student-athlete's own risk. Student-athletes should contact their physician or athletic trainer for further information.

The following is a list of banned-drug classes, with examples of banned substances under each class:

1. Stimulants

amiphenazole, amphetamine, bemigride, benzphetamine, bromantan, caffeine[1] (guarana), chlorphentermine, cocaine, cropropamide, crothetamide, diethylpropion, dimethylamphetamine, doxapram, ephedrine (ephedra, ma huang), ethamivan, ethylamphetamine, fencamfamine, meclofenoxate, methamphetamine(MDMA, ecstasy), methylphenidate, Nikethamide, Pemoline

pentretrazol, phendimetrazine, phenmetrazine, phentermine, phenylpropanolamine (PPA), picrotoxine, pipradol, prolintane, strychnine, synephrine (citrus aurantium, zhi shi, bitter orange)
and related compounds

2. Anabolic Agents: Anabolic Steroids

androstenediol, androstenedione, boldenone, clostebol, dehydrochlormethyltestosterone, dehydroepiandrosterone (DHEA), dihydrotestosterone (DHT), dromostanolone, epitrenbolone, fluoxymesterone, gestrinone, mesterolone, nethyltesosterone, nandrolone, norandrostenedione, norethandrolone, oxandrolone, oxymesterone, oxymetholone, stanozolol, testosterone[2], tetrahydrogestrinone (THG), trenbolone
and related compounds

Banned Drug Classes (con't.)

3. Diuretics

acetazolamide, bendroflumethiazide, benzhiazide, bumetanide, chlorothiazide, chlorthalidone, ethacrynic acid, furosemide, hydrochlorathiazide, methyclothiazide, metolazone, polythiazide, quinethazone, spironolactone (canrenone), triamterene, trichlormethiazide
and related compounds

4. Peptide Hormones and Analogues

Corticotrophin (ACTH), human chorionic gonadotrophin (hCG), luteinizing hormone (LH), growth hormone (HGH, somatotrophin), insulin like growth hormone (IGF-1)

All the respective releasing factors of the previously-mentioned substances also are banned:

erythropoietin (EPO), darbepoetin, sermorelin

Definitions of unacceptable levels depend on the following:

[1]for caffeine — if the concentration in urine exceeds 15 micrograms/ml

[2]for testosterone — if the administration of testosterone or use of any other manipulation has the result of increasing the ratio of the total concentration of testosterone to that of epitestosterone I the urine to greater than 6:1, unless there is evidence that this ratio is due to a physiological or pathological condition.

The Coach's Game Plan

Against Anabolic Steroids

Your Role in Prevention

HEALTH UNIT
Unité sanitaire
de Windsor comté d'Essex
WINDSOR • ESSEX • LEAMINGTON
www.wechealthunit.org

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Coaches of sports teams are in a unique position to influence players and discourage drug use.

Introduction

Why should I care if members of my team are taking anabolic steroids or dietary supplements?

Coaches of sports teams are in a unique position to influence players and discourage drug use. You are a role model, a mentor, and an educator, especially for young athletes. Coaches create the sports environment for the team and influence team morale, sportsmanship, and competition. Good sportsmanship and fair play are valuable qualities in athletics and are transferable to academics and personal relationships.

Both coaches and players are subjected to the pressure of winning at their sport. Athletes are overwhelmed by the pressure to win and perform well. There is also a general desire to achieve results more quickly. As one student put it: “Everyone is looking for the easy way out and that is what they are doing. Just trying to get there faster”, (Youth and Steroids Needs Assessment, 2006 p.13). The pressure to perform well and win may lead youth to use anabolic steroids or dietary supplements.

Team spirit and cohesiveness may be affected by unfair competition from students who use anabolic steroids or dietary supplements. The reputation of the school may also be negatively impacted. Because of the serious side effects of anabolic steroid use, students’ health is a major concern.

When young athletes use anabolic steroids or dietary supplements a win may be achieved but at the expense of team morale, cohesiveness, fair-play, school reputation, and student health!

The athlete’s health should <u>always</u> be the first concern of a coach.

Steroids 101 - The Basics

Steroids are:

- a man-made artificial form of the male hormone, testosterone
- taken by pill or injection
- sold illegally
- used to improve athletic performance and build muscles

Health Effects

Short Term:

- aggression ("roid rage"), extreme mood swings accompanied by suicidal thoughts
- acne, oily hair and skin, thinning scalp hair and baldness in both sexes
- stops bone growth, preventing the user from ever growing to full height

In men:

- impotence
- permanent breast development
- shrinking of testicles
- reduced sperm count

In women:

- reduced breast size
- coarsening of the skin
- deepening of the voice
- excessive growth of body hair
- changes in or cessation of the menstrual cycle

Long Term:

- liver tumours/cancer, jaundice, hepatitis, liver enlargement
- abnormalities of the heart, high blood pressure, blood clots, heart attack, stroke
- male pattern baldness
- reduced fertility in both women and men
- tendon ruptures, cessation of growth in adolescents
- infections such as HIV/AIDS and Hepatitis from used or dirty needles

Note:
Short term health effects can become permanent even when drug use is stopped.

Are Steroids Addictive?

Tolerance to the effects does not develop as it does with other drugs. However, users may experience withdrawal symptoms such as mood swings, fatigue, loss of appetite, restlessness, depression, insomnia, reduced sex drive, and the desire to take more steroids.

Dietary Supplements

- Dietary supplements (e.g., creatine) may also be used by athletes to enhance physical performance.
- Steroid supplements are converted into testosterone or a similar compound in the body and may produce the same effects as anabolic steroids.
- Prohormones are a supplement similar in chemical structure to steroids but are not considered illegal.
- Many supplements are sold as ergogenic aids in nutrition stores. Ergogenic aids are any external influence that may directly affect the physiological capacity of a particular body system, improving performance and increasing the speed of recovery from training and competition.
- The most common ergogenic aid is androstenedione or “Andro.”
- Many other dietary supplements are also available. These may be sold illegally in nutrition and health food stores. Refer to the Health Canada website for warnings about these substances.

Key "Plays"

Preventing Steroid Use

Whether the goal is to improve specific skills of young athletes or to win games, results can be achieved by using a plan. As a team coach, you realize that the best offense is a good defense!

Consider these 13 "Plays" in your defense against anabolic steroid use:

1. Encourage participation by making sports teams an important part of school life. Emphasize that education occurs both in and out of the classroom setting.

2. Advocate for clear policies on student athlete drug use. Educate students and parents on those policies.

3. Clearly state your expectation that players will not use performance-enhancing drugs. Set firm limits and enforce policies.

4. Educate players about the risks, especially those that affect their future. Discuss the short term effects and how steroids can impact long term goals. (e.g. loss of respect). Use "teachable opportunities" as they arise (i.e. current events).

5. Emphasize the benefits of participating in sports, especially those that matter to young people (i.e. respect of peers, self-worth and self-respect, personal growth).

Plays”

6. Encourage athletes to set personal goals and assist them in making progress. Refer only to reputable professionals for further skill development and training.

7. Be aware that negative comments have the ability to impact an athlete for life. Provide encouragement along with constructive concrete comments.

8. Help team members to develop decision-making skills so they are able to make appropriate choices. Emphasize that there are consequences to the decisions they make.

9. Let players know that they can talk to coaches about their fears and concerns.

10. Develop meaningful relationships with the athletes that you coach. You are in a special position to prevent the use of performance enhancing drugs.

11. Invite experts and positive role models to deliver positive messages and answer questions about nutrition, competition and performance.

12. Implement a Peer Mentoring program. Have older players who don’t use drugs meet with and mentor younger players as a group. Remind senior students that they are role models!

13. Have team members make a written commitment and pledge not to use anabolic steroids or supplements as a precondition to playing. Create awareness by conducting a contest with other teams within the school or with other schools to get the greatest percentage of team members with signed pledges.

How Do I Approach My Students?

When you suspect a student may be using performance enhancing drugs:

1. Always check policies that have been established by the school board and/or athletic association prior to taking any action.

2. In the absence of policies about the use of performance enhancing drugs, consult with the head coach, the principal, and/or the superintendent prior to confronting the student. Determine a course of action and who will be present when the student is confronted.

3. Make sure the athlete knows that you know. If you fail to act, the student may assume that his "bulked up" size and behaviour are okay or that you don't care.

4. Confront the athlete as soon as possible in a neutral, private area such as an office or a classroom. Always show concern for the student's health and participation as a team member.

Websites and Resources

Bodysense
www.bodysense.ca

Bodysense promotes positive body image in sport, targeted at female as well as male athletes, coaches, and parents. It also provides nutrition information for athletes.

Canadian Centre for Ethics In Sport
www.cces.ca

The Steroid and Body Image Project features lesson plans and posters with facts about steroids and information on body image. Ideal for students, mainly young men, ages 14 and over.

Coaches Association of Ontario
www.coachesontario.ca

Check here to find downloadable articles for coaches on sports psychology, coaching children, coaching science and sports parents.

Health Canada
www.hc.sc.gc.ca

Stay informed on up-to-date warnings about illegal supplements that may be available in Canada.

National Criminal Justice Reference Service
www.ojjdp.ncjrs.org/pubs/coachesplaybook

The “Coaches’ Playbook Against Drugs: Portable Guide” is a downloadable handbook with tips for keeping the team drug free.

(continued on next page)

Steroids 101 - The Basics

National Institute on Drug Abuse (NIDA)
www.steroidabuse.gov

NIDA's specialized website on anabolic steroids provides resources and links for students, educators, and parents.

Oregon Health and Science University
www.ohsu.edu/hpsm/index.html

Visit this link for ATLAS (Athletes Training and Learning to Avoid Steroids) and ATHENA (Athletes Targeting Healthy Exercise and Nutrition Alternatives) Programs. These school based prevention programs funded by NIDA give student athletes the knowledge and skills to resist steroid use and achieve their athletic goals in more effective, healthier ways. Each program is gender specific.

Positive Coaching Alliance
www.positivecoach.org

Look here for fact sheets on engaging parental cooperation and helpful information and fact sheets for coaches.

Public Broadcasting System
www.pbs.org/inthemix

"In The Mix" Reality Television is a weekly PBS Reality series for teens. The video clip of "Steroids: The Hard Truth" is viewable on the website with downloadable lesson plans and discussion guide with questions.

True Sport Foundation
www.truesportpur.ca

This site features discussion on topics such as fair play, doping, and parental conduct, as well as responses and related documents from ethics experts.

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The best offense is a good defense!

WINDSOR - ESSEX COUNTY
HEALTH UNIT
Unité sanitaire
de Windsor comté d'Essex
WINDSOR • ESSEX • LEAMINGTON
www.wechealthunit.org

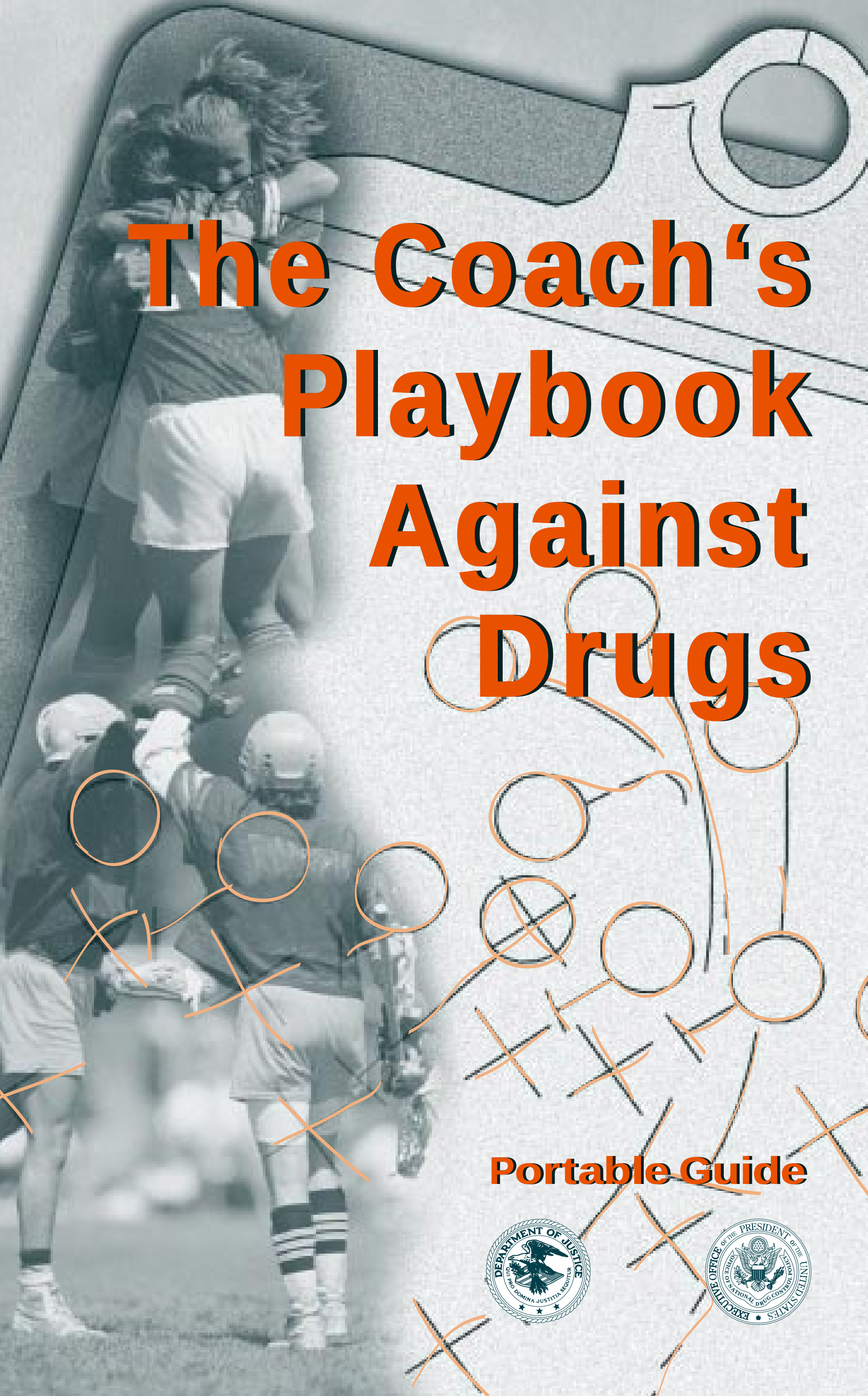
For more information contact the Windsor-Essex County Health Unit at:
519-258-2146 ext. 1260
www.wechealthunit.org

Other Resources Available to Help Educate and Promote Awareness to Your Students:

11"x17" Posters
For Locker Rooms, Washrooms, Gymnasiums, etc.

Youth Wallet Card (Unfolds to Three Panels)

U.S. Department of Justice
Office of Justice Programs
Office of Juvenile Justice and Delinquency Prevention



The Coach's Playbook Against Drugs

Portable Guide

DO YOU KNOW THE SCORE—

ON YOUR SPECIAL ROLE?

The purpose of this playbook is to help you as a coach educate your athletes about the dangers of drugs. Each year, 7 million boys and girls in this Nation are involved in sports at middle schools, junior high schools, or high schools. These students are the catalysts for a healthy chain reaction of involvement and school spirit that includes team captains, players, other students, school personnel, and the community. And it all begins with you—the coach—as the pivotal player.

Athletic coaches have a special relationship with athletes and other students but often underestimate their influence on these young people. You are a role model in the eyes of a young athlete, and you occupy this leadership role at a very significant and impressionable time in the athlete's life. When you talk to your players and students about the dangers of drugs, the message is more effective because "Coach" is behind those words.

What you tell your athletes about the use of alcohol and other drugs is very important. Don't take the subject lightly—the lives and future of the young people you coach are truly at stake. Equally important, the standards that you set by example will become the guide for students' behavior. If you want athletes to stay away from alcohol and other drugs, you must send that message clearly

"Coaching your students to remain drug free is a championship play. Join our team."

Larry Bird
Coach—Indiana Pacers
Former Boston Celtic
1998 Basketball Hall of Fame Inductee
12-Time All Star
3-Time NBA MVP
2-Time NBA Finals MVP

and forcefully, in words and in actions. If team members do not hear your opinion on this important subject, they may assume that you don't care. Many coaches may believe that their players are not the ones who are using alcohol and drugs, but they may be mistaken.

ON WHY PLAYERS USE DRUGS?

Coaches need to be aware of why athletes—perhaps even their own players—may be using alcohol and other drugs.

Athletes can be overwhelmed by pressure:

- Pressure to win.
- Pressure to perform well.
- Pressure to maintain a "cool" image.

Some athletes turn to drugs, including alcohol, to relieve stress and feel good. When athletes use alcohol or other drugs, they may achieve this goal by feeling an initial "high." Other times, players turn to drugs to sustain a good feeling. Coming off the field after a winning game, for example, athletes may try to prolong that winning feeling by turning to a mind-altering drug. On the other hand, if their team has lost the game, they may want to replace depressed feelings with a "high" from a mood-altering drug.

ON HOW DRUGS REALLY AFFECT ATHLETES?

As you know, using drugs will not relieve stress or allow a game high to last forever. By clearing up your players' misconceptions about the effects of drugs and explaining how drugs really affect our bodies, you may be able to keep your team drug free. In particular, explain that:

- Drugs may make players feel good initially, but that the good feelings are typically followed by unpleasant ones. Drugs don't solve problems; they create problems and make coping with them even harder. Drugs don't make stress go away; they create stress.

- Drugs will not enhance performance on the playing field. With the possible exception of one type of drug—anabolic steroids—it is simply not true that using drugs will enhance players' performance.
- Drugs actually interfere with an athlete's physical and mental ability. And, even though steroids may improve short-term performance, the physical side effects and emotional damage they cause far outweigh any gains.

YOU CAN KEEP YOUR TEAM DRUG FREE

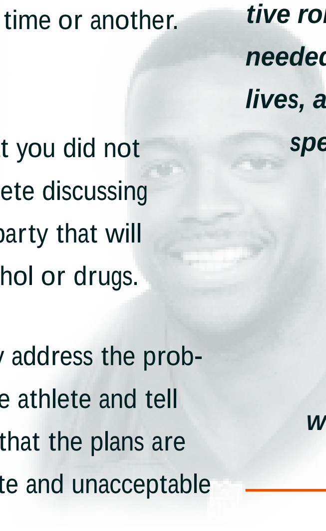
You are in a special position to prevent drug use. The "do's and don'ts" below are commonsense guidelines for handling situations that you or your fellow coaches are likely to encounter at one time or another.

Don't—

Pretend that you did not hear an athlete discussing plans for a party that will involve alcohol or drugs.

Do—

Immediately address the problem with the athlete and tell him or her that the plans are inappropriate and unacceptable



"It's important for coaches to take an active part in their players' lives—both on and off the field. Positive role models are needed in our children's lives, and coaches have a special opportunity to deliver a powerful and consistent message about the dangers of drugs."

Darrell Green
Defensive Back—
Washington Redskins #28
Six-Time Pro Bowler

for any member of your team. Tell the athlete that you are concerned and that you care. Ask if he or she needs any help. Tell him or her that drug use weakens an athlete's body and increases the risk of motor vehicle and other accidents.

Don't—

Choose to ignore the smell of marijuana.

Do—

Confront the athlete immediately. Make sure that he or she knows that you know. If you fail to act, the athlete may assume that this behavior is OK or that you don't care. Explain that marijuana is illegal and that the athlete can be arrested or suspended from school and sports for using it.

Don't—

Avoid enforcing rules—or enforce them selectively.

Do—

Be firm, set limits, and stick to them. Be sure that the rules you set are helpful in changing an athlete's behavior. Don't alienate or stigmatize athletes; engage them in the rulemaking.

Don't—

Ignore drug use because the team "needs" a particular athlete to play.

Do—

Set rules and enforce them consistently. Once you look away, team morale will suffer, as will your moral leadership. By opting to look the other way, you also fail in your responsibility to the athlete. If he or she gets hurt, how will you feel? Emphasize that the same rules apply to all team members and that you, as a coach, have a responsibility to enforce rules consistently.

Don't—

Ignore drug use by the coaching staff.

Do—

Ensure that everyone on your staff sets a good example. Your players will heed not just what you say, but what you do.

KEY PLAYS— HOW TO GET YOUR MESSAGE ACROSS

The best defense is a good offense. If you want to follow through and keep drugs and alcohol off the playing field and out of your players' lives, here are 10 key plays to help you get your message across.

1. **Encourage participation in athletics by making your team an integral and exciting part of school or community life.** Spending large amounts of time unsupervised after school and on weekends greatly increases the odds that teenagers will experiment with drugs. Therefore, you should make a special effort to involve youth in constructive after-school activities, such as athletics. Equally important, however, is for teenagers to find these activities fun and rewarding. Try to provide opportunities for kids of all abilities to participate and have fun.

"A soccer team needs players who are responsible and make good decisions. Taking drugs of any kind is not a good decision. As a coach, I have tremendous respect for those people who stand up to the pressure and won't tolerate drug use. We all need these kinds of people."

Bob Bradley
Head Coach—Chicago Five

2. **Clearly express your expectation that players will not use drugs.** Some adults, especially those who have used drugs themselves, find it difficult to talk to youth about drugs. Unless adults clearly state an expectation that youth should not use drugs, however, adolescents may not understand what standard, if any, they are being held to.

3. **Ensure that your players know the risks of drug use, especially those that affect athletic performance and their future.** Getting high has both long- and short-term consequences for an athlete—consequences that young people may not be aware of, but that you, the expert on performance, understand. For example, short-term risks of marijuana use include decreased stamina, weight gain, and reduced muscle strength. Steroids can lead to heart disease, infertility, and skin disease, and cause aggression in a person's daily life. Laziness, lack of motivation, loss of control, and poor decisionmaking are additional risks associated with drug use. Any of these can affect a player's long-term goals, like winning a championship or getting a college scholarship.

4. **Emphasize the benefits of participating in sports, particularly benefits that young people care about, including:**

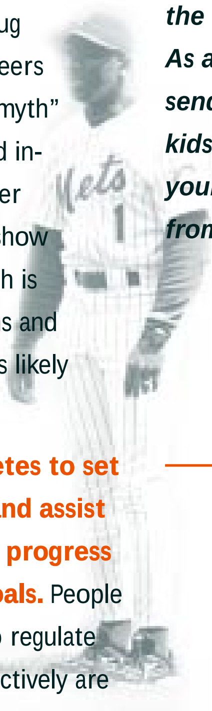
   - Gaining the respect of peers.
   - Sharing new and exciting experiences with close friends.
   - Earning the respect and trust of parents and siblings.
   - Setting a good example for others (especially younger siblings).
   - Having a strong sense of self-worth and self-respect.

- Increasing control over one's life and its direction.
- Achieving personal growth and progress toward one's goals.

The last three benefits are particularly important to high school students.

Psychologists have long made the case that the "carrot-and-stick" approach works far better than the "stick" alone. When you link the attainment of benefits that young people care most about to activities other than using drugs, you help them develop closely held reasons for staying drug free.

5. **Make sure your players know that drug use among preteens and early teens (ages 11 to 14) is a "fringe" behavior.** Eighty percent of eighth-grade students do not use drugs, yet most eighth graders believe drug use among their peers is common. This "myth" exerts a subtle and insidious form of peer pressure. Studies show that when the myth is debunked, preteens and early teens are less likely to try drugs.



"As a former player, I know the value of a good coach. As a coach, I know you can send the right message to kids about drugs. Coach your students away from drugs."

Mookie Wilson
First Base Coach—
New York Mets
Former Outfielder for the
1986 World Series
Champion New York Mets

6. **Encourage athletes to set personal goals and assist them in making progress toward those goals.** People who know how to regulate their behavior effectively are

more likely to set and achieve goals. Studies show that adolescents who learn self-regulation skills are far less likely to use drugs (presumably because they become more involved in setting and pursuing larger goals).

All athletes can set goals for what they want to achieve throughout the season. Help them to do so, and assist them in tracking their progress. Let them know that you have noticed their accomplishments, and praise them to other team members and peers. This gives young people specific, measurable ways to gauge the benefits of spending time on athletics.

Skills shown to be helpful to teens in setting goals and measuring progress toward them include identifying appropriate goals, not only for the short term but also for the long term; recognizing situations and people that are a threat to accomplishing the goals; and thinking through the consequences of one's actions.

7. **Have older players reinforce the idea that real "cool" kids don't use drugs—they disapprove of them.** The vast majority of preteens and early teens disapprove of drug use, and even a majority of older teens disapprove. Yet, preteens and early teens routinely underestimate this disapproval; most believe that the majority of their peers approve of drug use. Heightening the perception of disapproval by peers and older teens is one of the most powerful ways to prevent drug use.

   A simple way to do this is to select a number of your older players who don't use drugs (including some likely to be considered "cool" by younger players) and have them meet as a group with your younger players. Encourage the older players to speak openly about the negative consequences of using drugs that they have observed—including effects on physical abilities and school performance. Most importantly, have these players talk about how using drugs lets other people—parents, teachers, friends, teammates—down. Remind your older players that they are role models. Encourage them to speak out, and reach out, to younger kids.

8. **Help young people to develop appropriate decision-making skills.** Adolescence is a time of life when teens must make an increasing number of decisions. Many adolescents, however, have not been taught how to make good decisions.

   To help your players develop decisionmaking skills, let them share in decisions that affect the team as a whole. For example, let players help decide on the structure of a practice or the specific skills to work on during a practice session. Guide athletes through the decisionmaking process by teaching them to (1) identify/clarify the decision to be made; (2) consider all possible options and outcomes; (3) choose the best option; and (4) follow through.

9. **Let players know that they can talk to you about their fears and concerns regarding drug use.** Most adolescents yearn for a close relationship with a caring adult and for the ability to communicate honestly. They may find it easier to talk to a coach than to their parents about sensitive topics such as sex and drugs. By responding openly when such a topic is raised, you will help your players learn new ways to broach sensitive subjects and keep important lines of communication open. Tell players where they can find more information and steer those who need help toward it. One place to start is the Office of National Drug Control Policy

(ONDCP) Web site: www.whitehousedrugpolicy.gov. For additional information, refer to the Resources section at the end of your playbook.

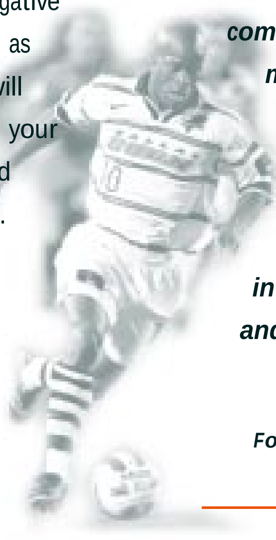
10. **Develop meaningful relationships with the young people you coach.** The most common reason young people give for not wanting to use drugs is a desire to please the caring adults in their lives. Be a caring adult—someone your athletes can count on for support and guidance.

EFFECTS OF USING DRUGS

Key Play #3 advises you to be sure that your players are aware of the risks of drug use. A simple description of the effects of using drugs is often more effective than a long lecture filled with drug horror stories. Using short, to-the-point descriptions of the negative effects of drugs—such as those listed below—will work well in capturing your students' attention and keeping them engaged.

"As a professional athlete, it is important to maintain a body that is healthy and physically fit. By maintaining a drug-free lifestyle, I am able to keep my mind sharp, uphold a winning attitude, and put forth my best performance—both on and off the field. I hope to communicate a positive message to young people by setting a drug-free example, as well as encourage them to do the same in their own schools and communities."

Dante Washington
Forward—Dallas Burn
Former U.S. Olympic Team Member



PERFORMANCE IN MANY AREAS IS HAMPERED

Drugs can have lasting effects on the brain and body. Using drugs often compromises judgment and physical abilities and makes a person unable to perform in a variety of contexts:

- Academics.
- Athletics.
- Music or dramatic arts.
- Decisionmaking in everyday situations.
- Driving any kind of vehicle.
- Operating equipment or tools.

Drug use also diminishes health, physical appearance, and motivation. It impairs judgment, leading to risky decisions and behaviors, and it directly reduces physical and intellectual performance in many areas.

THE RISK OF DRUG-RELATED PROBLEMS IS INCREASED

A young adult who uses drugs increases his or her risk of experiencing any (or all) of the following:

- Legal problems.
- Addiction.
- Involvement in a traffic accident.
- Involvement in a swimming, boating, or other type of accident.
- Engaging in risky sexual behaviors that may spread disease.
- Athletic injuries.

DEVELOPMENT OF LIFE SKILLS IS IMPAIRED

An adolescent's drug use will also mask problems and interfere with the normal development of such important life skills as:

- Stress management.
- Conflict resolution.
- Problem solving.
- Goal setting.

PHYSICAL, EMOTIONAL, SOCIAL, AND SPIRITUAL DEVELOPMENT IS DAMAGED

A young person's sense of independence, responsibility, and purpose is best achieved without the interference of drugs. The following types of development depend on a young person remaining drug free:

- Normal psychological development.
- Appropriate moral and spiritual development.
- Ability to solve daily problems and cope with stress.
- Ability to interact and get along with others.

THE GAME WILL BE AFFECTED

Sports were designed to be a fun and competitive way to gain exercise. They were not designed to include drug use. Communicate the serious effect of drugs on the game by asking your players to guess how their foul shots, field goals, or home runs would be affected by drugs. To put it simply, they won't happen. Scientific studies show that drugs impair coordination and abilities. How does this translate on the athletic field?

- A basketball player using drugs is more likely to miss a game-winning free throw.

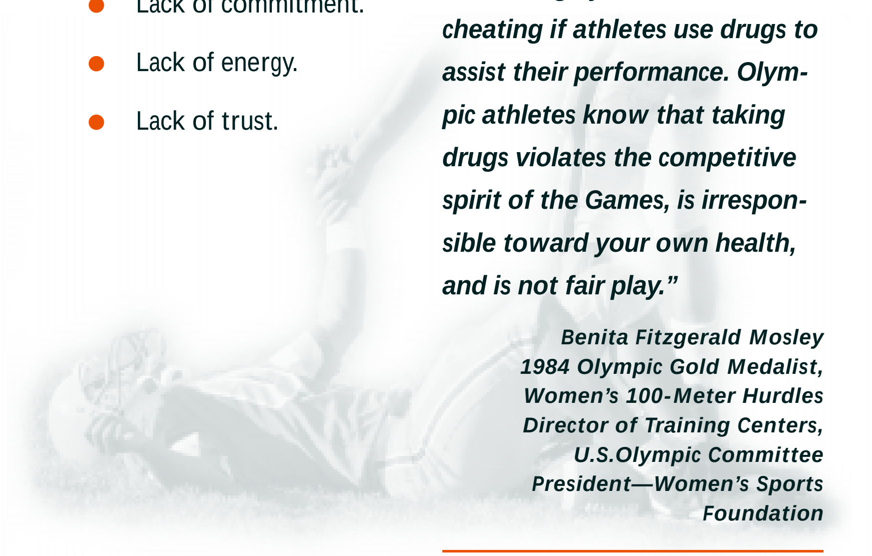
- A football receiver using marijuana is less likely to outrun a defender. Speed, lung capacity, muscle strength, and stamina all can drop with marijuana use.
- A skier using drugs likewise dramatically increases his or her chances of suffering a career-ending injury.

If a player's performance is weak because of drug use, the player will have to live knowing that he or she has disappointed the team, the coach, and others—all for a few minutes of a false high.

TEAM SPIRIT WILL SUFFER

Drugs negatively affect not only a team's performance, but its sense of team spirit and cohesiveness as well. In particular, drug use can cause the following effects on the morale of the team:

- Lack of togetherness.
- Lack of concentration.
- Lack of commitment.
- Lack of energy.
- Lack of trust.



"America's coaches need to let kids know it's critical to stay drug free for many reasons. Two big reasons are that drugs can damage your health and it's cheating if athletes use drugs to assist their performance. Olympic athletes know that taking drugs violates the competitive spirit of the Games, is irresponsible toward your own health, and is not fair play."

Benita Fitzgerald Mosley
1984 Olympic Gold Medalist,
Women's 100-Meter Hurdles
Director of Training Centers,
U.S.Olympic Committee
President—Women's Sports Foundation

PLEDGE TO BEAT DRUGS

Coaches and athletes all across the country can make a written commitment to take steps that will throw drugs and alcohol for a loss. The pledges below can be copied, modified, or used as samples to fit the needs of your team and school. Think creatively about how best to use these pledges. Signed pledges could be displayed in your school's main office or library. Teams and organizations could require the pledge as a precondition to playing or managing a sport. Neighboring schools might conduct a contest to see which could secure the greatest number of signed student, coach, or even parent, pledges. Talk to school administrators, parents, and community officials about how to monitor adherence to pledges and what consequences should result if players or coaches break their pledges. Generate interest in the pledges by placing an article in your school newspaper or PTA newsletter.

STUDENT'S PLEDGE

As an athlete, I agree to abide by all rules regarding the use of drugs. I understand that drug addiction is a disease and, even though it may be treatable, it has serious physical and emotional effects—effects that would hurt me, my family, my team, and my school. Given the serious dangers of drug use, I accept and pledge to follow all rules and laws established by my school, team, and community regarding the use of drugs. These include the rules listed in my school's student and athletic handbooks and any other rules established by my coach.

To demonstrate my support, I pledge to:

1. Support my fellow students by setting an example and abstaining from the use of illegal drugs.
2. Avoid enabling any of my fellow students or teammates who use these substances. I will not cover up or lie for them if any rules are broken. I will hold my fellow students and teammates fully responsible and accountable for their actions.
3. Seek information and assistance in dealing with my own or other students' problems relating to drugs.
4. Be honest and open with my parents or guardians about my feelings and problems.
5. Be honest and open with my coach and other school or community personnel.

Student ____

School Name ____

Date ____

*** PARENTS OR GUARDIANS: We ask that you co-sign this pledge to show your support.*

Parent or Guardian ______________________________________

Date ____

Parent or Guardian ______________________________________

Date ____

COACH'S PLEDGE

As a coach, I agree to abide by the training rules regarding the use of drugs and to support and enforce all training rules. Given the serious dangers of drug use, I pledge to assist my team members in playing and staying drug free.

To demonstrate my support, I pledge to:

1. Discuss thoroughly with my team the impact of drug use on athletes.
2. Ensure that my athletes understand their commitment to training rules and the consequences of violating any of those rules.
3. Encourage my players and their parents to sign the Student's Pledge and submit their pledges to the athletic director, who will have received a copy of my pledge.
4. Enforce rules consistently when I learn that training rules have been or are likely to be broken.
5. Avoid enabling athletes' drug use or other unhealthy habits by ignoring or refusing to deal with a player who has broken the rules.
6. Provide information and referrals to any student experiencing difficulty with or having concerns about the use of drugs.
7. Provide assistance to students who are re-entering school or rejoining my team after receiving treatment for drug or alcohol use.

Coach ____

School Name ____

Date ____

RESOURCES

Office of Juvenile Justice and Delinquency Prevention (OJJDP)
810 Seventh Street NW.
Washington, DC 20531
202–307–5911
Internet: www.ncjrs.org/ojjhome.htm

OJJDP provides Federal leadership on juvenile justice and delinquency prevention efforts, which include alcohol and other substance abuse. OJJDP also sponsors the Juvenile Justice Clearinghouse, which offers easy access to information on all topics relating to delinquency prevention and juvenile justice. The Clearinghouse can be reached at 800–638–8736.

Office of National Drug Control Policy (ONDCP)
Executive Office of the President
Washington, DC 20503
202–395–6700
Internet: www.whitehousedrugpolicy.gov/ or www.ondcpsports.org

ONDCP's Athletic Initiative provides coaches, parents, and young people with information about prevention programs focusing on sports. ONDCP also supports the Drug Policy Information Clearinghouse, a single source of statistics, data, research, and referrals useful for developing or implementing drug policy. The Clearinghouse can be reached at 800–666–3332.

FOR MORE INFORMATION

Center for Substance Abuse Prevention (CSAP)
Division of Community Education
5600 Fishers Lane
Rockwall II, Suite 800
Rockville, MD 20857
301–443–0373
Internet: www.samhsa.gov/csap/index.htm

The Center for Substance Abuse Prevention (CSAP) sponsors the National Clearinghouse for Drug and Alcohol Information (NCADI), one of the Federal Government's central clearinghouses for alcohol and drug information. NCADI can be reached at 800–729–6686, TDD 800–487–4889, or online at www.health.org.

Drug Enforcement Administration (DEA)

Prevention Branch
700 Army Navy Drive
Arlington, VA 22202
202–307–7936
Internet: www.usdoj.gov/dea/

DEA's Prevention Branch plays a leading role in developing antidrug training programs and materials for the athletic community, such as Team Up: A Drug Prevention Manual for High School Athletic Coaches, which was developed in conjunction with the National High School Athletic Coaches Association and provides coaches with information necessary to develop a prevention program for their teams, classes, and schools.

The Fellowship of Christian Athletes

8709 Leeds Road
Kansas City, MO 64129
816–921–0909
Internet: www.gospelcom.net/fca/

The Fellowship's "One Way to Play" (OW2P!) offers young people a comprehensive program aimed at positive opportunities and drug-free lifestyles.

Join Together

441 Stuart Street
Boston, MA 02166
617–437–1500
Internet: www.jointogether.org/

Join Together is a national resource center and meeting place for communities working to reduce substance abuse and gun violence.

National Federation of State High School Associations (NFHS)

11724 NW Plaza Circle
Kansas City, MO 64153
816–464–5400, ext. 3263
Internet: www.nfhs.org/

NFHS serves over 10 million young people who participate in school activities. NFHS, with the American Sports Education Program, has developed the National Federation Interscholastic Coaches Education Program (NFICEP). Specific examples include:

- NFICEP's Drugs and Sports Course provides coaches with training in preventing the use of tobacco, alcohol, and other drugs.
- Coaches Guide to Drugs and Sports is one of the foremost guides for coaches about drug use and prevention.

National High School Athletic Coaches Association (NHSACA)

P.O. Box 2569
Gig Harbor, WA 98335
253–853–6777
Internet: www.hscoaches.org

NHSACA provides training seminars for coaches in drug prevention and counseling.

National Institute on Drug Abuse (NIDA)
Division of Epidemiology and Prevention Research

5600 Fishers Lane, Room 9A–53
Rockville, MD 20857
301–443–1514
301–443–6504
Internet: www.nida.nih.gov/

NIDA's mission is to apply the science of public health epidemiology and to describe the nature and extent of drug abuse, the disease of addiction, and related consequences.

National Institute on Alcohol Abuse and Alcoholism (NIAAA)
Division of Clinical and Prevention Research
Prevention Research Branch
6000 Executive Boulevard
Rockville, MD 20892
301–443–1677
Internet: silk.nig.gov/niaaa1/grants/dcpr_ph.htm

NIAAA's Division of Clinical and Prevention Research (DCPR) has as its primary objective the fostering of state-of-the-art research in the treatment and prevention of alcohol abuse and alcoholism.

Safe and Drug-Free Schools
Office of Elementary and Secondary Education
U.S. Department of Education
600 Independence Avenue, S.W.
Washington, DC 20202–0498
800–624–0100
Internet: www.ed.gov/offices/OSES/

The Safe and Drug-Free Schools Program is the Federal Government's primary vehicle for reducing drug use and violence, through education and prevention activities in our Nation's schools.

NCJ 173393

National Federation of State High School Associations

Highlights from the 2008 Consensus Statement on Concussion in Sport

The NFHS Sports Medicine Advisory Committee (SMAC) regularly discusses and reviews the latest medical evidence regarding sports-related concussions in high school athletes. The past decade has witnessed significant changes in the management of sports-related concussions as new research findings have been published. Consequently, the NFHS SMAC has recently updated the "Concussion" section of the NFHS Sports Medicine Handbook (2008 Third Edition) and the 2009 NFHS brochure on "Suggested Guidelines for Management of Concussion in Sports."

In November of 2008, a panel of experts convened for the 3rd International Conference on Concussion in Sport in Zurich, Switzerland. The group has now published the Consensus Statement on Concussion in Sport. Previous consensus statements released in 2001 and 2004 have helped shape and define state of the art management of the concussed athlete during this decade.

After a thorough review of the newly released document, there are no substantial changes to report from the position the NFHS SMAC and the Centers for Disease Control and Prevention (CDC) articulated in 2005. However, the NFHS SMAC would like to emphasize three of their conclusions.

"A player with diagnosed concussion should not be allowed to return to play on the day of an injury."

While consistent with the recent recommendations of the NFHS SMAC, this statement represents a significant change from the previous statement released after the 2nd International Conference on Concussion in 2004. In the past, many medical experts stated that an athlete could return to play in an event if he or she no longer had any "symptoms" of a concussion 15 minutes after the time of the injury. The "15 minute rule" had come under increasing scrutiny by concussion experts as studies have found that most athletes are not fully recovered from a concussion within 48 hours of the injury, let alone 15 minutes. Therefore, over the past few years, the NFHS SMAC has maintained a policy of no same day return to play for high school athletes who have suffered a concussion.

"The cornerstone of concussion management is physical and cognitive rest until symptoms resolve and then a graded program of exertion prior to medical clearance and return to play."

Cognitive rest is a relatively recent concept which highlights the need for the concussed athlete to refrain from strenuous physical and mental activity while having concussion symptoms. Experts believe that allowing the brain to rest by limiting reading, studying and other forms of "mental exertion" will result in quicker recovery. Other activities to avoid include playing video games, text messaging, listening to loud music and using a computer. In some instances, individuals who have suffered a concussion may be told by their health care provider to take a few days off from school to allow symptoms to lessen.

Once all symptoms have resolved and the athlete has been cleared by a health care provider, the athlete may then begin a slow increase in physical activity over several days. If symptoms do not recur over this period of time, the athlete may then return to full activity. The NFHS SMAC and the CDC have advocated this approach to managing concussed athletes.

"There is no good clinical evidence that currently available protective equipment will prevent concussion."

The group of experts emphasized that there is currently no good evidence to support the notions that certain football helmets will eliminate the risk of concussion, or that soccer headgear or mouthguards will do so. Of course, well maintained and properly fitted equipment are always appropriate to reduce risk.

For further information regarding concussion in sports, please see:

McCrory P, Meeuwisse W, Johnston K, Dvorak J, Aubry M, Molloy M and Cantu R. Consensus Statement on Concussion in Sport: The 3rd International Conference on Concussion in Sport held in Zurich, November 2008.

NFHS. Suggested Guidelines for Management of Concussion in Sports. Brochure from the NFHS Sports Medicine Advisory Committee. 2009.

NFHS. Concussions. 2008 NFHS Sports Medicine Handbook (Third Edition). 2008: 77-82.

Applicable NFHS Sports Medicine Advisory Committee Position Statements, Guidelines and Recommendations on the NFHS web site under Sports Medicine at http://www.nfhs.org.

Consensus Statement on Concussion in Sport 3rd International Conference on Concussion in Sport Held in Zurich, November 2008

Paul McCrory, MBBS, PhD, Willem Meeuwisse, MD, PhD,† Karen Johnston, MD, PhD,‡ Jiri Dvorak, MD,§ Mark Aubry, MD,‖ Mick Molloy, MB,¶ and Robert Cantu, MA, MD#*

(*Clin J Sport Med* 2009;19:185–200)

Preamble

This paper is a revision and update of the recommendations developed following the 1st (Vienna) and 2nd (Prague) International Symposia on Concussion in Sport.[1,2] The Zurich Consensus statement is designed to build on the principles outlined in the original Vienna and Prague documents and to develop further conceptual understanding of this problem using a formal consensus-based approach. A detailed description of the consensus process is outlined at the end of this document under the "Background" section (see Section 11). This document is developed for use by physicians, therapists, certified athletic trainers, health professionals, coaches and other people involved in the care of injured athletes, whether at the recreational, elite or professional level.

While agreement exists pertaining to principal messages conveyed within this document, the authors acknowledge that the science of concussion is evolving and therefore management and return to play decisions remain in the realm of clinical judgment on an individualized basis. Readers are encouraged to copy and distribute freely the Zurich Consensus document and/or the Sport Concussion Assessment Tool (SCAT2) card, and neither is subject to any copyright restriction. The authors request, however, that the document and/or the SCAT2 card be distributed in their full and complete format.

The following focus questions formed the foundation for the Zurich concussion consensus statement:

Acute Simple Concussion

- Which symptom scale and which sideline assessment tool is best for diagnosis and/or follow up?
- How extensive should the cognitive assessment be in elite athletes?
- How extensive should clinical and neuropsychological (NP) testing be at non-elite level?
- Who should do/interpret the cognitive assessment?
- Is there a gender difference in concussion incidence and outcomes?

Return to Play (RTP) Issues

- Is provocative exercise testing useful in guiding RTP?
- What is the best RTP strategy for elite athletes?
- What is the best RTP strategy for non-elite athletes?
- Is protective equipment (eg, mouthguards and helmets) useful in reducing concussion incidence and/or severity?

Complex Concussion and Long-term Issues

- Is the Simple versus Complex classification a valid and useful differentiation?
- Are there specific patient populations at risk of long-term problems?
- Is there a role for additional tests (eg, structural and/or functional MR Imaging, balance testing, biomarkers)?
- Should athletes with persistent symptoms be screened for depression/anxiety?

Paediatric Concussion

- Which symptoms scale is appropriate for this age group?
- Which tests are useful and how often should baseline testing be performed in this age group?
- What is the most appropriate RTP guideline for elite and non-elite child and adolescent athletes?

Submitted for publication January 14, 2009; accepted March 11, 2009.
From the *Centre for Health, Exercise & Sports Medicine, University of Melbourne, Parkville, Australia; †Sport Medicine Centre, Faculty of Kinesiology, and Department of Community Health Sciences, Faculty of Medicine, University of Calgary, Calgary, Alberta, Canada; ‡Sport Concussion Clinic, Toronto Rehabilitation Institute, Toronto, Ontario, Canada; §FIFA Medical Assessment and Research Center (F-MARC) and Schulthess Clinic, Zurich, Switzerland; ‖International Ice Hockey Federation and Hockey Canada, and Ottawa Sport Medicine Centre, Ottawa, Ontario, Canada; ¶International Rugby Board, Dublin, Ireland; and #Department of Neurosurgery and Department of Sport Medicine, Emerson Hospital, Concord, Massachusetts.
Consensus panelists (listed in alphabetical order): In addition to the authors above, the consensus panelists were Steve Broglio, Gavin Davis, Randall Dick, Ruben Echemendia, Gerry Gioia, Kevin Guskiewicz, Stan Herring, Grant Iverson, Jim Kelly, Jamie Kissick, Michael Makdissi, Michael McCrea, Alain Ptito, Laura Purcell, and Margot Putukian. Also invited but not in attendance: Roald Bahr, Lars Engebretsen, Peter Hamlyn, Barry Jordan, and Patrick Schamasch.
Competing Interests: The authors have no competing interests to declare.
Reprints: not available.
Correspondence: Assoc. Prof. Paul McCrory, MBBS, PhD, Centre for Health, Exercise & Sports Medicine, University of Melbourne, Parkville, Australia 3010 (e-mail: paulmccr@bigpond.net.au).

Future Directions

- What is the best method of knowledge transfer and education?
- Is there evidence that new and novel injury prevention strategies work (eg, changes to rules of the game, fair play strategies, etc.)?

The Zurich document additionally examines the management issues raised in the previous Prague and Vienna documents and applies the consensus questions to these areas.

SPECIFIC RESEARCH QUESTIONS AND CONSENSUS DISCUSSION

1. CONCUSSION

1.1 Definition of Concussion

Panel discussion regarding the definition of concussion and its separation from mild traumatic brain injury (mTBI) was held. Although there was acknowledgement that the terms refer to different injury constructs and should not be used interchangeably, it was not felt that the panel would define mTBI for the purpose of this document. There was unanimous agreement, however, that concussion is defined as follows:

Concussion is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include:

1. *Concussion may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an "impulsive" force transmitted to the head.*
2. *Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.*
3. *Concussion may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.*
4. *Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course; however, it is important to note that, in a small percentage of cases, post-concussive symptoms may be prolonged.*
5. *No abnormality on standard structural neuroimaging studies is seen in concussion.*

1.2 Classification of Concussion

There was unanimous agreement to abandon the Simple vs. Complex terminology that had been proposed in the Prague agreement statement, as the panel felt that the terminology itself did not fully describe the entities. However, the panel unanimously retained the concept that the majority (80%-90%) of concussions resolve in a short (7-10 day) period, although the recovery time frame may be longer in children and adolescents.[2]

2. CONCUSSION EVALUATION

2.1 Symptoms and Signs of Acute Concussion

The panel agreed that the diagnosis of acute concussion usually involves the assessment of a range of domains including clinical symptoms, physical signs, behavior, balance, sleep and cognition. Furthermore, a detailed concussion history is an important part of the evaluation both in the injured athlete and when conducting a pre-participation examination. The detailed clinical assessment of concussion is outlined in the SCAT2 form, which is an appendix to this document.

The suspected diagnosis of concussion can include one or more of the following clinical domains:

(a) Symptoms: somatic (eg, headache), cognitive (eg, feeling like in a fog) and/or emotional symptoms (eg, lability)
(b) Physical signs (eg, loss of consciousness, amnesia)
(c) Behavioural changes (eg, irritablity)
(d) Cognitive impairment (eg, slowed reaction times)
(e) Sleep disturbance (eg, drowsiness)

If any one or more of these components is present, a concussion should be suspected and the appropriate management strategy instituted.

2.2 On-field or Sideline Evaluation of Acute Concussion

When a player shows **ANY** features of a concussion:

(a) The player should be medically evaluated onsite using standard emergency management principles, and particular attention should be given to excluding a cervical spine injury.
(b) The appropriate disposition of the player must be determined by the treating healthcare provider in a timely manner. If no healthcare provider is available, the player should be safely removed from practice or play and urgent referral to a physician arranged.
(c) Once the first aid issues are addressed, then an assessment of the concussive injury should be made using the SCAT2 or other similar tool.
(d) The player should not be left alone following the injury, and serial monitoring for deterioration is essential over the initial few hours following injury.
(e) A player with diagnosed concussion should not be allowed to return to play on the day of injury. Occasionally, in adult athletes, there may be return to play on the same day as the injury. (See section 4.2.)

It was unanimously agreed that sufficient time for assessment and adequate facilities should be provided for the appropriate medical assessment both on and off the field for all injured athletes. In some sports this may require rule change to allow an off-field medical assessment to occur without affecting the flow of the game or unduly penalizing the injured player's team.

Sideline evaluation of cognitive function is an essential component in the assessment of this injury. Brief neuropsychological test batteries that assess attention and memory function have been shown to be practical and effective. Such tests include the Maddocks questions[3,4] and the Standardized

Assessment of Concussion (SAC).[5–7] It is worth noting that standard orientation questions (eg, time, place, person) have been shown to be unreliable in the sporting situation when compared with memory assessment.[4,8] It is recognized, however, that abbreviated testing paradigms are designed for rapid concussion screening on the sidelines and are not meant to replace comprehensive neuropsychological testing which is sensitive to detect subtle deficits that may exist beyond the acute episode nor should they be used as a stand-alone tool for the ongoing management of sports concussions.

It should also be recognized that the appearance of symptoms might be delayed several hours following a concussive episode.

2.3 Evaluation in Emergency Room or Office by Medical Personnel

An athlete with concussion may be evaluated in the emergency room or doctor's office as a point of first contact following injury or may have been referred from another care provider. In addition to the points outlined above, the key features of this exam should encompass:

(a) A medical assessment including a comprehensive history and detailed neurological examination including a thorough assessment of mental status, cognitive functioning and gait and balance.
(b) A determination of the clinical status of the patient including whether there has been improvement or deterioration since the time of injury. This may involve seeking additional information from parents, coaches, teammates and eyewitness to the injury.
(c) A determination of the need for emergent neuroimaging in order to exclude a more severe brain injury involving a structural abnormality.

In large part, these points above are included in the SCAT2 assessment, which forms part of the Zurich consensus statement.

3. CONCUSSION INVESTIGATIONS

A range of additional investigations may be utilized to assist in the diagnosis and/or exclusion of injury. These include:

3.1 Neuroimaging

It was recognized by the panelists that conventional structural neuroimaging is normal in concussive injury. Given that caveat, the following suggestions are made: Brain CT (or, where available, MR brain scan) contributes little to concussion evaluation but should be employed whenever suspicion of an intra-cerebral structural lesion exists. Examples of such situations may include prolonged disturbance of conscious state, focal neurological deficit or worsening symptoms.

Newer structural MRI modalities including gradient echo, perfusion and diffusion imaging have greater sensitivity for structural abnormalities. However, the lack of published studies, as well as absent pre-injury neuroimaging data, limits the usefulness of this approach in clinical management at the present time. In addition, the predictive value of various MR abnormalities that may be incidentally discovered is not established at the present time.

Other imaging modalities such as fMRI demonstrate activation patterns that correlate with symptom severity and recovery in concussion.[9–13] Whilst not part of routine assessment at the present time, they nevertheless provide additional insight to pathophysiological mechanisms. Alternative imaging technologies (eg, positron emission tomography, diffusion tensor imaging, magnetic resonance spectroscopy, functional connectivity), while demonstrating some compelling findings, are still at early stages of development and cannot be recommended other than in a research setting.

3.2 Objective Balance Assessment

Published studies using both sophisticated force plate technology, as well as those using less sophisticated clinical balance tests (eg, Balance Error Scoring System (BESS)), have identified postural stability deficits lasting approximately 72 hours following sport-related concussion. It appears that postural stability testing provides a useful tool for objectively assessing the motor domain of neurologic functioning and should be considered a reliable and valid addition to the assessment of athletes suffering from concussion, particularly where symptoms or signs indicate a balance component.[14–20]

3.3 Neuropsychological Assessment

The application of neuropsychological (NP) testing in concussion has been shown to be of clinical value and continues to contribute significant information in concussion evaluation.[21–26] Although in most case cognitive recovery largely overlaps with the time course of symptom recovery, it has been demonstrated that cognitive recovery may occasionally precede or more commonly follow clinical symptom resolution suggesting that the assessment of cognitive function should be an important component in any return to play protocol.[27,28] It must be emphasized, however, that NP assessment should not be the sole basis of management decisions; rather, it should be seen as an aid to the clinical decision-making process in conjunction with a range of clinical domains and investigational results.

Neuropsychologists are in the best position to interpret NP tests by virtue of their background and training. However, there may be situations where neuropsychologists are not available and other medical professionals may perform or interpret NP screening tests. The ultimate return to play decision should remain a medical one in which a multidisciplinary approach, when possible, has been taken. In the absence of NP and other (eg, formal balance assessment) testing, a more conservative return to play approach may be appropriate.

In the majority of cases, NP testing will be used to assist return to play decisions and will not be done until the patient is symptom free.[29,30] There may be situations (eg, child and adolescent athletes) where testing may be performed early whilst the patient is still symptomatic to assist in determining management. This will normally be best determined in consultation with a trained neuropsychologist.[31,32]

3.4 Genetic Testing

The significance of Apolipoprotein (Apo) E4, ApoE promotor gene, Tau polymerase and other genetic markers in the management of sports concussion risk or injury outcome is unclear at this time.[33,34] Evidence from human and animal studies in more severe traumatic brain injury demonstrates induction of a variety of genetic and cytokine factors such as: insulin-like growth factor-1 (IGF-1), IGF binding protein-2, Fibroblast growth factor, Cu-Zn superoxide dismutase, superoxide dismutase-1 (SOD-1), nerve growth factor, glial fibrillary acidic protein (GFAP) and S-100. Whether such factors are affected in sporting concussion is not known at this stage.[35–42]

3.5 Experimental Concussion Assessment Modalities

Different electrophysiological recording techniques (eg, evoked response potential (ERP), cortical magnetic stimulation and electroencephalography) have demonstrated reproducible abnormalities in the post concussive state; however, not all studies reliably differentiated concussed athletes from controls.[43–49] The clinical significance of these changes remains to be established.

In addition, biochemical serum and cerebral spinal fluid markers of brain injury (including S-100, neuron specific enolase (NSE), myelin basic protein (MBP), GFAP, tau, etc.) have been proposed as means by which cellular damage may be detected if present.[50–56] There is currently insufficient evidence, however, to justify the routine use of these biomarkers clinically.

4. CONCUSSION MANAGEMENT

The cornerstone of concussion management is physical and cognitive rest until symptoms resolve and then a graded program of exertion prior to medical clearance and return to play. The recovery and outcome of this injury may be modified by a number of factors that may require more sophisticated management strategies. These are outlined in the section on modifiers below.

As described above, the majority of injuries will recover spontaneously over several days. In these situations, it is expected that an athlete will proceed progressively through a stepwise return to play strategy.[57] During this period of recovery, while symptomatically following an injury, it is important to emphasize to the athlete that physical AND cognitive rest is required. Activities that require concentration and attention (eg, scholastic work, videogames, text messaging, etc.) may exacerbate symptoms and possibly delay recovery. In such cases, apart from limiting relevant physical and cognitive activities (and other risk-taking opportunities for re-injury), while symptomatic, no further intervention is required during the period of recovery, and the athlete typically resumes sport without further problem.

4.1 Graduated Return to Play Protocol

Return to play protocol following a concussion follows a stepwise process as outlined in Table 1.

With this stepwise progression, the athlete should continue to proceed to the next level if asymptomatic at the current level. Generally, each step should take 24 hours so that an athlete would take approximately one week to proceed through the full rehabilitation protocol once they are asymptomatic at rest and with provocative exercise. If any post-concussion symptoms occur while in the stepwise program, then the patient should drop back to the previous asymptomatic level and try to progress again after a further 24-hour period of rest has passed.

4.2 Same Day RTP

With adult athletes, in some settings, where there are team physicians experienced in concussion management and sufficient resources (eg, access to neuropsychologists, consultants, neuroimaging, etc.), as well as access to immediate (ie, sideline) neuro-cognitive assessment, return to play management may be more rapid. The RTP strategy must still follow the same basic management principles, namely, full clinical and cognitive recovery before consideration of return to play. This approach is supported by published guidelines, such as the American Academy of Neurology, US Team Physician Consensus Statement, and US National Athletic Trainers' Association Position Statement.[58–60] This issue was extensively discussed by the consensus panelists, and it was acknowledged that there is evidence that some professional American football players are able to RTP more quickly, with even same day RTP supported by NFL studies without a risk of recurrence or sequelae.[61] There is data, however, demonstrating that, at the collegiate and high school level, athletes

TABLE 1. Graduated Return to Play Protocol

Rehabilitation Stage	Functional Exercise at Each Stage of Rehabilitation	Objective of Each Stage
1. No activity	Complete physical and cognitive rest	Recovery
2. Light aerobic exercise	Walking, swimming or stationary cycling keeping intensity <70% MPHR: no resistance training	Increase HR
3. Sport-specific exercise	Skating drills in ice hockey, running drills in soccer; no head impact activities	Add movement
4. Non-contact training drills	Progression to more complex training drills, eg, passing drills in football and ice hockey; may start progressive resistance training	Exercise, coordination, and cognitive load
5. Full contact practice	Following medical clearance, participate in normal training activities	Restore confidence and assess functional skills by coaching staff
6. Return to play	Normal game play	

allowed to RTP on the same day may demonstrate NP deficits post-injury that may not be evident on the sidelines and are more likely to have delayed onset of symptoms.[62–68] It should be emphasized, however, that the young (<18) elite athlete should be treated more conservatively even though the resources may be the same as an older professional athlete. (See section 6.1.)

4.3 Psychological Management and Mental Health Issues

In addition, psychological approaches may have potential application in this injury, particularly with the modifiers listed below.[69,70] Care givers are also encouraged to evaluate the concussed athlete for affective symptoms such as depression, as these symptoms may be common in concussed athletes.[57]

4.4 The Role of Pharmacological Therapy

Pharmacological therapy in sports concussion may be applied in two distinct situations. The first of these situations is the management of specific prolonged symptoms (eg, sleep disturbance, anxiety, etc.). The second situation is where drug therapy is used to modify the underlying pathophysiology of the condition with the aim of shortening the duration of the concussion symptoms.[71] In broad terms, this approach to management should be only considered by clinicians experienced in concussion management.

An important consideration in RTP is that concussed athletes should not only be symptom free but also should not be taking any pharmacological agents/medications that may mask or modify the symptoms of concussion. Where antidepressant therapy may be commenced during the management of a concussion, the decision to return to play while still on such medication must be considered carefully by the treating clinician.

4.5 The Role of Pre-participation Concussion Evaluation

Recognizing the importance of a concussion history, and appreciating the fact that many athletes will not recognize all the concussions they may have suffered in the past, a detailed concussion history is of value.[72–75] Such a history may pre-identify athletes that fit into a high risk category and provides an opportunity for the healthcare provider to educate the athlete in regard to the significance of concussive injury. A structured concussion history should include specific questions as to previous symptoms of a concussion, not just the perceived number of past concussions. It is also worth noting that dependence upon the recall of concussive injuries by teammates or coaches has been demonstrated to be unreliable.[72] The clinical history should also include information about all previous head, face or cervical spine injuries, as these may also have clinical relevance. It is worth emphasizing that, in the setting of maxillofacial and cervical spine injuries, co-existent concussive injuries may be missed unless specifically assessed. Questions pertaining to disproportionate impact versus symptom severity matching may alert the clinician to a progressively increasing vulnerability to injury. As part of the clinical history it is advised that details regarding protective equipment employed at time of injury be sought, both for recent and remote injuries. The benefit a comprehensive pre-participation concussion evaluation allows for modification and optimization of protective behavior and is an opportunity for education.

5. MODIFYING FACTORS IN CONCUSSION MANAGEMENT

The consensus panel agreed that a range of 'modifying' factors may influence the investigation and management of concussion and in some cases may predict the potential for prolonged or persistent symptoms. These modifiers would also be important to consider in a detailed concussion history and are outlined in Table 2.

In this setting, there may be additional management considerations beyond simple RTP advice. There may be a more important role for additional investigations including formal NP testing, balance assessment, and neuroimaging. It is envisioned that athletes with such modifying features would be managed in a multidisciplinary manner coordinated by a physician with specific expertise in the management of concussive injury.

The role of female gender as a possible modifier in the management of concussion was discussed at length by the panel. There was not unanimous agreement that the current published research evidence is conclusive that this should be included as a modifying factor, although it was accepted that gender may be a risk factor for injury and/or influence injury severity.[76–78]

5.1 The Significance of Loss of Consciousness (LOC)

In the overall management of moderate to severe traumatic brain injury, duration of LOC is an acknowledged

TABLE 2. Concussion Modifiers

Factors	Modifier
Symptoms	Number
	Duration (>10 days)
	Severity
Signs	Prolonged LOC (>1 min), amnesia
Sequelae	Concussive convulsions
Temporal	Frequency - repeated concussions over time
	Timing - injuries close together in time
	"Recency" - recent concussion or TBI
Threshold	Repeated concussions occurring with progressively less impact force or slower recovery after each successive concussion
Age	Child and adolescent (<18 years old)
Co- and Pre-morbidities	Migraine, depression or other mental health disorders, attention deficit hyperactivity disorder (ADHD), learning disabilities (LD), sleep disorders
Medication	Psychoactive drugs, anticoagulants
Behaviour	Dangerous style of play
Sport	High-risk activity, contact and collision sport, high sporting level

predictor of outcome.[79] Whilst published findings in concussion describe LOC associated with specific early cognitive deficits, it has not been noted as a measure of injury severity.[80,81] Consensus discussion determined that prolonged (>1 minute duration) LOC would be considered as a factor that may modify management.

5.2 The Significance of Amnesia and Other Symptoms

There is renewed interest in the role of post-traumatic amnesia and its role as a surrogate measure of injury severity.[67,82,83] Published evidence suggests that the nature, burden and duration of the clinical post-concussive symptoms may be more important than the presence or duration of amnesia alone.[80,84,85] Further, it must be noted that retrograde amnesia varies with the time of measurement post-injury and hence is poorly reflective of injury severity.[86,87]

5.3 Motor and Convulsive Phenomena

A variety of immediate motor phenomena (eg, tonic posturing) or convulsive movements may accompany a concussion. Although dramatic, these clinical features are generally benign and require no specific management beyond the standard treatment of the underlying concussive injury.[88,89]

5.4 Depression

Mental health issues (such as depression) have been reported as a long-term consequence of traumatic brain injury including sports related concussion. Neuroimaging studies using fMRI suggest that a depressed mood following concussion may reflect an underlying pathophysiological abnormality consistent with a limbic-frontal model of depression.[52,90–100]

6. SPECIAL POPULATIONS

6.1 The Child and Adolescent Athlete

There was unanimous agreement by the panel that the evaluation and management recommendations contained herein could be applied to children and adolescents down to the age of 10 years. Below that age children report concussion symptoms different from adults and would require age-appropriate symptom checklists as a component of assessment. An additional consideration in assessing the child or adolescent athlete with a concussion is that in the clinical evaluation by the healthcare professional there may be the need to include both patient and parent input, as well as teacher and school input when appropriate.[101–107]

The decision to use NP testing is broadly the same as the adult assessment paradigm. However, timing of testing may differ in order to assist planning in school and home management (and may be performed while the patient is still symptomatic). If cognitive testing is performed then it must be developmentally sensitive until late teen years due to the ongoing cognitive maturation that occurs during this period which, in turn, makes the utility of comparison to either the person's own baseline performance or to population norms limited.[20] In this age group it is more important to consider the use of trained neuropsychologists to interpret assessment data, particularly in children with learning disorders and/or ADHD who may need more sophisticated assessment strategies.[31,32,101]

The panel strongly endorsed the view that children should not be returned to practice or play until clinically completely symptom free, which may require a longer time frame than for adults. In addition, the concept of 'cognitive rest' was highlighted with special reference to a child's need to limit exertion with activities of daily living and to limit scholastic and other cognitive stressors (eg, text messaging, videogames, etc.) while symptomatic. School attendance and activities may also need to be modified to avoid provocation of symptoms.

Because of the different physiological responses and longer recovery after concussion and specific risks (eg, diffuse cerebral swelling) related to head impact during childhood and adolescence, a more conservative return to play approach is recommended. It is appropriate to extend the amount of time of asymptomatic rest and/or the length of the graded exertion in children and adolescents. It is not appropriate for a child or adolescent athlete with concussion to RTP on the same day as the injury regardless of the level of athletic performance. Concussion modifiers apply even more to this population than adults and may mandate more cautious RTP advice.

6.2 Elite vs. Non-Elite Athletes

The panel unanimously agreed that all athletes, regardless of level of participation, should be managed using the same treatment and return to play paradigm. A more useful construct was agreed whereby the available resources and expertise in concussion evaluation were of more importance in determining management than a separation between elite and non-elite athlete management. Although formal baseline NP screening may be beyond the resources of many sports or individuals, it is recommended that in all organized high-risk sports consideration be given to having this cognitive evaluation regardless of the age or level of performance.

6.3 Chronic Traumatic Brain Injury

Epidemiological studies have suggested an association between repeated sports concussions during a career and late life cognitive impairment. Similarly, case reports have noted anecdotal cases where neuro-pathological evidence of chronic traumatic encephalopathy was observed in retired football players.[108–112] Panel discussion was held, and no consensus was reached on the significance of such observations at this stage. Clinicians need to be mindful of the potential for long-term problems in the management of all athletes.

7. INJURY PREVENTION

7.1 Protective Equipment – Mouthguards and Helmets

There is no good clinical evidence that currently available protective equipment will prevent concussion, although mouthguards have a definite role in preventing dental and oro-facial injury. Biomechanical studies have shown a reduction in impact forces to the brain with the use of head gear and helmets, but these findings have not been translated to show a reduction in concussion incidence. For skiing and snowboarding, there are a number of studies to suggest that helmets provide protection against head and facial injury and hence should be recommended for participants in alpine sports.[113–116] In specific sports such as cycling, motor and equestrian sports, protective helmets may prevent other forms of head injury (eg, skull fracture) that are related to falling on hard road surfaces, and these may be an important injury prevention issue for those sports.[116–128]

7.2 Rule Change

Consideration of rule changes to reduce head injury incidence or severity may be appropriate where a clear-cut mechanism is implicated in a particular sport. An example of this is in football (soccer) where research studies demonstrated that upper limb to head contact in heading contests accounted for approximately 50% of concussions.[129] As noted earlier, rule changes also may be needed in some sports to allow an effective off-field medical assessment to occur without compromising the athlete's welfare, affecting the flow of the game or unduly penalizing the player's team. It is important to note that rule enforcement may be a critical aspect of modifying injury risk in these settings, and referees play an important role in this regard.

7.3 Risk Compensation

An important consideration in the use of protective equipment is the concept of risk compensation.[130] This is where the use of protective equipment results in behavioral change such as the adoption of more dangerous playing techniques, which can result in a paradoxical increase in injury rates. This may be a particular concern in child and adolescent athletes where head injury rates are often higher than in adult athletes.[131–133]

7.4 Aggression vs. Violence in Sport

The competitive/aggressive nature of sport which makes it fun to play and watch should not be discouraged. However, sporting organizations should be encouraged to address violence that may increase concussion risk.[134,135] Fair play and respect should be supported as key elements of sport.

8. KNOWLEDGE TRANSFER

As the ability to treat or reduce the effects of concussive injury after the event is minimal, education of athletes, colleagues and the general public is a mainstay of progress in this field. Athletes, referees, administrators, parents, coaches and health care providers must be educated regarding the detection of concussion, its clinical features, assessment techniques and principles of safe return to play. Methods to improve education including web-based resources, educational videos and international outreach programs are important in delivering the message. In addition, concussion working groups, plus the support and endorsement of enlightened sport groups such as Fédération Internationale de Football Association (FIFA), International Olympic Commission (IOC), International Rugby Board (IRB) and International Ice Hockey Federation (IIHF) who initiated this endeavor, have enormous value and must be pursued vigorously. Fair play and respect for opponents are ethical values that should be encouraged in all sports and sporting associations. Similarly, coaches, parents and managers play an important part in ensuring these values are implemented on the field of play.[57,136–148]

9. FUTURE DIRECTIONS

The consensus panelists recognize that research is needed across a range of areas in order to answer some critical research questions. The key areas for research identified include:

- Validation of the SCAT2
- Gender effects on injury risk, severity and outcome
- Paediatric injury and management paradigms
- Virtual reality tools in the assessment of injury
- Rehabilitation strategies (eg, exercise therapy)
- Novel imaging modalities and their role in clinical assessment
- Concussion surveillance using consistent definitions and outcome measures
- Clinical assessment where no baseline assessment has been performed
- 'Best-practice' neuropsychological testing
- Long-term outcomes
- On-field injury severity predictors

10. MEDICAL LEGAL CONSIDERATIONS

This consensus document reflects the current state of knowledge and will need to be modified according to the development of new knowledge. It provides an overview of issues that may be of importance to healthcare providers involved in the management of sports related concussion. It is not intended as a standard of care and should not be interpreted as such. This document is only a guide and is of a general nature consistent with the reasonable practice of a healthcare professional. Individual treatment will depend on the facts and circumstances specific to each individual case.

It is intended that this document will be formally reviewed and updated prior to 1 December 2012.

11. STATEMENT ON BACKGROUND TO CONSENSUS PROCESS

In November 2001, the 1st International Conference on Concussion in Sport was held in Vienna, Austria. This meeting was organized by the IIHF in partnership with FIFA and the Medical Commission of the IOC. As part of the resulting mandate for the future, the need for leadership and future updates were identified. The 2nd International Conference on Concussion in Sport was organized by the same group with the additional involvement of the IRB and was held in Prague, Czech Republic, in November 2004. The original aims of the symposia were to provide recommendations for the improvement of safety and health of athletes who suffer concussive injuries in ice hockey, rugby, football (soccer) as well as other sports. To this end, a range of experts were invited to both meetings to address specific issues of epidemiology, basic and clinical science, injury grading systems, cognitive assessment, new research methods, protective equipment, management, prevention and long-term outcome.[1,2]

The 3rd International Conference on Concussion in Sport was held in Zurich, Switzerland, on 29/30 October 2008 and was designed as a formal consensus meeting following the organizational guidelines set forth by the US National

Institutes of Health. (Details of the consensus methodology can be obtained at http://consensus.nih.gov/ABOUTCDP.htm.) The basic principles governing the conduct of a consensus development conference are summarized below:

1. A broad based non-government, non-advocacy panel was assembled to give balanced, objective and knowledgeable attention to the topic. Panel members excluded anyone with scientific or commercial conflicts of interest and included researchers in clinical medicine, sports medicine, neuroscience, neuroimaging, athletic training and sports science.
2. These experts presented data in a public session, followed by inquiry and discussion. The panel then met in an executive session to prepare the consensus statement.
3. A number of specific questions were prepared and posed in advance to define the scope and guide the direction of the conference. The principle task of the panel was to elucidate responses to these questions. These questions are outlined above.
4. A systematic literature review was prepared and circulated in advance for use by the panel in addressing the conference questions.
5. The consensus statement is intended to serve as the scientific record of the conference.
6. The consensus statement will be widely disseminated to achieve maximum impact on both current health care practice and future medical research.

The panel chairperson (WM) did not identify with any advocacy position. The chairperson was responsible for directing the consensus session and guiding the panel's deliberations. Panelists were drawn from clinical practice, academic and research in the field of sports related concussion. They do not represent organisations per se but were selected for their expertise, experience and understanding of this field.

APPENDICES

Sport Concussion Assessment Tool 2 (SCAT2)
Pocket SCAT2

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Sport Concussion Assessment Tool 2 (SCAT2)

SCAT2

Sport Concussion Assessment Tool 2

Name

Sport/team

Date/time of injury

Date/time of assessment

Age Gender M F

Years of education completed

Examiner

What is the SCAT2?[1]

This tool represents a standardized method of evaluating injured athletes for concussion and can be used in athletes aged from 10 years and older. It supersedes the original SCAT published in 2005[2]. This tool also enables the calculation of the Standardized Assessment of Concussion (SAC)[3,4] score and the Maddocks questions[5] for sideline concussion assessment.

Instructions for using the SCAT2

The SCAT2 is designed for the use of medical and health professionals. Preseason baseline testing with the SCAT2 can be helpful for interpreting post-injury test scores. Words in Italics throughout the SCAT2 are the instructions given to the athlete by the tester.

This tool may be freely copied for distribtion to individuals, teams, groups and organizations.

What is a concussion?

A concussion is a disturbance in brain function caused by a direct or indirect force to the head. It results in a variety of non-specific symptoms (like those listed below) and often does not involve loss of consciousness. Concussion should be suspected in the presence of **any one or more** of the following:

- Symptoms (such as headache), or
- Physical signs (such as unsteadiness), or
- Impaired brain function (e.g. confusion) or
- Abnormal behaviour.

Any athlete with a suspected concussion should be REMOVED FROM PLAY, medically assessed, monitored for deterioration (i.e., should not be left alone) and should not drive a motor vehicle.

Symptom Evaluation

How do you feel?

You should score yourself on the following symptoms, based on how you feel now.

	none	mild		moderate		severe	
Headache	0	1	2	3	4	5	6
"Pressure in head"	0	1	2	3	4	5	6
Neck Pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like "in a fog"	0	1	2	3	4	5	6
"Don't feel right"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
Trouble falling asleep (if applicable)	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or Anxious	0	1	2	3	4	5	6

Total number of symptoms (Maximum possible 22)

Symptom severity score
(Add all scores in table, maximum possible: 22 x 6 = 132)

Do the symptoms get worse with physical activity? Y N

Do the symptoms get worse with mental activity? Y N

Overall rating

If you know the athlete well prior to the injury, how different is the athlete acting compared to his / her usual self? Please circle one response.

no different very different unsure

Cognitive & Physical Evaluation

1 Symptom score (from page 1)

22 **minus** number of symptoms — of 22

2 Physical signs score

Was there loss of consciousness or unresponsiveness?	Y	N
If yes, how long? minutes		
Was there a balance problem/unsteadiness?	Y	N

Physical signs score (1 point for each negative response) — of 2

3 Glasgow coma scale (GCS)

Best eye response (E)	
No eye opening	1
Eye opening in response to pain	2
Eye opening to speech	3
Eyes opening spontaneously	4
Best verbal response (V)	
No verbal response	1
Incomprehensible sounds	2
Inappropriate words	3
Confused	4
Oriented	5
Best motor response (M)	
No motor response	1
Extension to pain	2
Abnormal flexion to pain	3
Flexion/Withdrawal to pain	4
Localizes to pain	5
Obeys commands	6

Glasgow Coma score (E + V + M) — of 15

GCS should be recorded for all athletes in case of subsequent deterioration

4 Sideline Assessment – Maddocks Score

"I am going to ask you a few questions, please listen carefully and give your best effort."

Modified Maddocks questions (1 point for each correct answer)

At what venue are we at today?	0	1
Which half is it now?	0	1
Who scored last in this match?	0	1
What team did you play last week/game?	0	1
Did your team win the last game?	0	1

Maddocks score — of 5

Maddocks score is validated for sideline diagnosis of concussion only and is not included in SCAT 2 summary score for serial testing

5 Cognitive assessment

Standardized Assessment of Concussion (SAC)

Orientation (1 point for each correct answer)

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1
What time is it right now? (within 1 hour)	0	1

Orientation score — of 5

Immediate memory

"I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order."

Trials 2 & 3:

"I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before."

Complete all 3 trials regardless of score on trial 1 & 2. Read the words at a rate of one per second. Score 1 pt. for each correct response. Total score equals sum across all 3 trials. Do not inform the athlete that delayed recall will be tested.

List	Trial 1		Trial 2		Trial 3		Alternative word list		
elbow	0	1	0	1	0	1	candle	baby	finger
apple	0	1	0	1	0	1	paper	monkey	penny
carpet	0	1	0	1	0	1	sugar	perfume	blanket
saddle	0	1	0	1	0	1	sandwich	sunset	lemon
bubble	0	1	0	1	0	1	wagon	iron	insect
Total									

Immediate memory score — of 15

Concentration

Digits Backward:

"I am going to read you a string of numbers and when I am done, you repeat them back to me backwards, in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7."

If correct, go to next string length. If incorrect, read trial 2. One point possible for each string length. Stop after incorrect on both trials. The digits should be read at the rate of one per second.

			Alternative digit lists		
4-9-3	0	1	6-2-9	5-2-6	4-1-5
3-8-1-4	0	1	3-2-7-9	1-7-9-5	4-9-6-8
6-2-9-7-1	0	1	1-5-2-8-6	3-8-5-2-7	6-1-8-4-3
7-1-8-4-6-2	0	1	5-3-9-1-4-8	8-3-1-9-6-4	7-2-4-8-5-6

Months in Reverse Order:

"Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November ... Go ahead"

1 pt. for entire sequence correct

Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan 0 1

Concentration score — of 5

[1] This tool has been developed by a group of international experts at the 3rd International Consensus meeting on Concussion in Sport held in Zurich, Switzerland in November 2008. The full details of the conference outcomes and the authors of the tool are published in British Journal of Sports Medicine, 2009, volume 43, supplement 1.
The outcome paper will also be simultaneously co-published in the May 2009 issues of Clinical Journal of Sports Medicine, Physical Medicine & Rehabilitation, Journal of Athletic Training, Journal of Clinical Neuroscience, Journal of Science & Medicine in Sport, Neurosurgery, Scandinavian Journal of Science & Medicine in Sport and the Journal of Clinical Sports Medicine.

[2] McCrory P et al. Summary and agreement statement of the 2nd International Conference on Concussion in Sport, Prague 2004. British Journal of Sports Medicine. 2005; 39: 196-204

[3] McCrea M. Standardized mental status testing of acute concussion. Clinical Journal of Sports Medicine. 2001; 11: 176-181

[4] McCrea M, Randolph C, Kelly J. Standardized Assessment of Concussion: Manual for administration, scoring and interpretation. Waukesha, Wisconsin, USA.

[5] Maddocks, DL; Dicker, GD; Saling, MM. The assessment of orientation following concussion in athletes. Clin J Sport Med. 1995;5(1):32–3

[6] Guskiewicz KM. Assessment of postural stability following sport-related concussion. Current Sports Medicine Reports. 2003; 2: 24-30

Sport Concussion Assessment Tool 2 (SCAT2)

6 Balance examination

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)[5]. A stopwatch or watch with a second hand is required for this testing.

Balance testing

"I am now going to test your balance. Please take your shoes off, roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of three twenty second tests with different stances."

(a) Double leg stance:
"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."

(b) Single leg stance:
"If you were to kick a ball, which foot would you use? [This will be the dominant foot] *Now stand on your non-dominant foot. The dominant leg should be held in approximately 30 degrees of hip flexion and 45 degrees of knee flexion. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

(c) Tandem stance:
"Now stand heel-to-toe with your ***non-dominant foot*** *in back. Your weight should be evenly distributed across both feet. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

Balance testing – types of errors

1. Hands lifted off iliac crest
2. Opening eyes
3. Step, stumble, or fall
4. Moving hip into > 30 degrees abduction
5. Lifting forefoot or heel
6. Remaining out of test position > 5 sec

Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the athlete. The examiner will begin counting errors only after the individual has assumed the proper start position. **The modified BESS is calculated by adding one error point for each error during the three 20-second tests. The maximum total number of errors for any single condition is 10.** If a athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once subject is set. Subjects that are unable to maintain the testing procedure for a minimum of **five seconds** at the start are assigned the highest possible score, ten, for that testing condition.

Which foot was tested: Left Right
(i.e. which is the **non-dominant** foot)

Condition	**Total errors**
Double Leg Stance (feet together)	of 10
Single leg stance (non-dominant foot)	of 10
Tandem stance (non-dominant foot at back)	of 10
Balance examination score (30 minus total errors)	of 30

7 Coordination examination

Upper limb coordination

Finger-to-nose (FTN) task: *"I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended). When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose as quickly and as accurately as possible."*

Which arm was tested: Left Right

Scoring: 5 correct repetitions in < 4 seconds = 1

Note for testers: Athletes fail the test if they do not touch their nose, do not fully extend their elbow or do not perform five repetitions. Failure should be scored as 0.

Coordination score of 1

8 Cognitive assessment

Standardized Assessment of Concussion (SAC)

Delayed recall

"Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order."

Circle each word correctly recalled. Total score equals number of words recalled.

List	Alternative word list		
elbow	candle	baby	finger
apple	paper	monkey	penny
carpet	sugar	perfume	blanket
saddle	sandwich	sunset	lemon
bubble	wagon	iron	insect

Delayed recall score of 5

Overall score

Test domain	Score
Symptom score	of 22
Physical signs score	of 2
Glasgow Coma score (E + V + M)	of 15
Balance examination score	of 30
Coordination score	of 1
Subtotal	**of 70**
Orientation score	of 5
Immediate memory score	of 5
Concentration score	of 15
Delayed recall score	of 5
SAC subtotal	**of 30**
SCAT2 total	**of 100**
Maddocks Score	**of 5**

Definitive normative data for a SCAT2 "cut-off" score is not available at this time and will be developed in prospective studies. Embedded within the SCAT2 is the SAC score that can be utilized separately in concussion management. The scoring system also takes on particular clinical significance during serial assessment where it can be used to document either a decline or an improvement in neurological functioning.

Scoring data from the SCAT2 or SAC should not be used as a stand alone method to diagnose concussion, measure recovery or make decisions about an athlete's readiness to return to competition after concussion.

Sport Concussion Assessment Tool 2 (SCAT2)

Athlete Information

Any athlete suspected of having a concussion should be removed from play, and then seek medical evaluation.

Signs to watch for

Problems could arise over the first 24-48 hours. You should not be left alone and must go to a hospital at once if you:

- Have a headache that gets worse
- Are very drowsy or can't be awakened (woken up)
- Can't recognize people or places
- Have repeated vomiting
- Behave unusually or seem confused, are very irritable
- Have seizures (arms and legs jerk uncontrollably)
- Have weak or numb arms or legs
- Are unsteady on your feet; have slurred speech

Remember, it is better to be safe.
Consult your doctor after a suspected concussion.

Return to play

Athletes should not be returned to play the same day of injury. When returning athletes to play, they should follow a stepwise symptom-limited program, with stages of progression. For example:

1. rest until asymptomatic (physical and mental rest)
2. light aerobic exercise (e.g. stationary cycle)
3. sport-specific exercise
4. non-contact training drills (start light resistance training)
5. full contact training after medical clearance
6. return to competition (game play)

There should be approximately 24 hours (or longer) for each stage and the athlete should return to stage 1 if symptoms recur. Resistance training should only be added in the later stages.
Medical clearance should be given before return to play.

Tool	Test domain	Time	Score			
		Date tested				
		Days post injury				
SCAT2	Symptom score					
	Physical signs score					
	Glasgow Coma score (E + V + M)					
	Balance examination score					
	Coordination score					
SAC	Orientation score					
	Immediate memory score					
	Concentration score					
	Delayed recall score					
	SAC Score					
Total	**SCAT2**					
Symptom severity score (max possible 132)						
Return to play			Y N	Y N	Y N	Y N

Additional comments

Concussion injury advice (To be given to concussed athlete)

This patient has received an injury to the head. A careful medical examination has been carried out and no sign of any serious complications has been found. It is expected that recovery will be rapid, but the patient will need monitoring for a further period by a responsible adult. Your treating physician will provide guidance as to this timeframe.

If you notice any change in behaviour, vomiting, dizziness, worsening headache, double vision or excessive drowsiness, please telephone the clinic or the nearest hospital emergency department immediately.

Other important points:

- **Rest and avoid strenuous activity for at least 24 hours**
- **No alcohol**
- **No sleeping tablets**
- **Use paracetamol or codeine for headache. Do not use aspirin or anti-inflammatory medication**
- **Do not drive until medically cleared**
- **Do not train or play sport until medically cleared**

Clinic phone number

Patient's name

Date/time of injury

Date/time of medical review

Treating physician

Contact details or stamp

Pocket SCAT2

Concussion should be suspected in the presence of **any one or more** of the following: symptoms (such as headache), or physical signs (such as unsteadiness), or impaired brain function (e.g. confusion) or abnormal behaviour.

1. Symptoms

Presence of any of the following signs & symptoms may suggest a concussion.

- Loss of consciousness
- Seizure or convulsion
- Amnesia
- Headache
- "Pressure in head"
- Neck Pain
- Nausea or vomiting
- Dizziness
- Blurred vision
- Balance problems
- Sensitivity to light
- Sensitivity to noise
- Feeling slowed down
- Feeling like "in a fog"
- "Don't feel right"
- Difficulty concentrating
- Difficulty remembering
- Fatigue or low energy
- Confusion
- Drowsiness
- More emotional
- Irritability
- Sadness
- Nervous or anxious

2. Memory function

Failure to answer all questions correctly may suggest a concussion.

"At what venue are we at today?"
"Which half is it now?"
"Who scored last in this game?"
"What team did you play last week/game?"
"Did your team win the last game?"

3. Balance testing

Instructions for tandem stance

"Now stand heel-to-toe with your ***non-dominant*** *foot in back. Your weight should be evenly distributed across both feet. You should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

Observe the athlete for 20 seconds. If they make more than 5 errors (such as lift their hands off their hips; open their eyes; lift their forefoot or heel; step, stumble, or fall; or remain out of the start position for more that 5 seconds) then this may suggest a concussion.

Any athlete with a suspected concussion should be IMMEDIATELY REMOVED FROM PLAY, urgently assessed medically, should not be left alone and should not drive a motor vehicle.

From UK. SPORTS SAFETY

General Guidelines for Managing a Medical Emergency

Identify Emergency/ Primary Survey
- Airway Obstruction
- Breathing Difficulties
- Severe Bleeding
- Cardiac Arrest
- Unconsciousness
- Head and Spinal Injuries
- Heat Injuries
- Other Life-threatening Injuries
- Other Catastrophic Injuries

It is recommended that all staff be certified in CPR/first aid

Manage the Emergency
- If an emergency, call 911 immediately
- State name, title, exact location, type of emergency, phone number, and be the last to hang up
- Notify AD/ATC/school administrator
- Keep area clear/other athletes calm until help arrives

Physical Forms
- Includes parent consent and insurance info in case of emergencies
- Located with coach at field AT ALL TIMES
- Located in training room (file cabinet/boys in top file, girls in second)
  - Every athletes file has current and old physical forms. Make sure you grab the current one.
- Located in AD's office

Emergency Equipment
- AED located ___________ Bring the towel in the case with the AED.
- AED ____________ Bring the towel located in the case with it.
- Vacuum splints for fractures _____________ Bring the whole bag.

Arrival of EMS
- Keep area clear of other athletes, spectators, etc. (have police assist if present)
- Make sure gates/doors are open for EMS to get through
- Provide vital information (what happened, vital signs, treatment given thus far, etc.)
- Provide EMS with current Physical Form
- Identify individual to go with athlete to the hospital

Follow up
- Call parents to check on athlete
- Call administrators to let them know status of athlete
- Document all events

Site Specific Emergency Plan

School: ______________________________

Sport: ______________________________

Location: ______________________________

Exact Location of Nearest Phones and Numbers
(personal cell phones, land lines)

____

____

Exact directions to location of sport
(street directions and best way to enter field)

____

____

Individual to Make EMS call

____

____(alternate)

Individual to meet EMS/crowd control
(keep pathway clear)

____

____(alternate)

Individual to get emergency equipment
(AED, vacuum splints)

____

____(alternate)

Individual to go with patient to the hospital/get physical form
(ride in ambulance or drive separately, stay with patient until parent arrives)

____

____(alternate)

Individual to contact parent
(tell vital information, which hospital, offer help/support as needed)

____

____(alternate)

Coach____date________________

Athletic Director____________________________________date________________

Principal____date________________

ATC____date________________

High School: Students enrolled in grades 9-12
Middle School: Students enrolled in graded 5-8
Secondary School: Students enrolled in grades 7-12

156.551. Definitions for KRS 156.551 to 156.555.
As used in KRS 156.551 to 156.555, unless the context requires otherwise:
(1) "Center" means the Center for Middle School Academic Achievement;
(2) "Fund" means the Teachers' Professional Growth Fund;
(3) "Middle school" means grades five (5) through eight (8), regardless of school or district configuration; and
(4) "Reliable, replicable research" means objective, valid, scientific studies that:
(a) Include rigorously defined samples of subjects that are sufficiently large and representative to support the general conclusions drawn;
(b) Rely on measurements that meet established standards of reliability and validity;
(c) Test competing theories, where multiple theories exist; and
(d) Are subjected to peer review before results are published.
(Enact. Acts 2000, ch. 527, § 1, effective July 14, 2000.)

157.320. Definitions for KRS 157.310 to 157.440.
As used in KRS 157.310 to 157.440, unless the context otherwise requires:

(11) "Secondary school" means a school consisting of grades seven (7) through twelve (12), or any appropriate combination of grades within this range as determined by the plan of organization for schools authorized by the district board. When grades seven (7) through nine (9) or ten (10) are organized separately as a junior high school, or grades ten (10) through twelve (12) are organized separately as a senior high school and are conducted in separate school plant facilities, each shall be considered a separate secondary school for the purposes of KRS 157.310 to 157.440

164.7874. Definitions for KRS 164.7871 to 164.7885.
As used in KRS 164.7871 to 164.7885:

(**11) "High school" means any Kentucky public high school, the Gatton Academy and Mathematics and Science in Kentucky, and any private, parochial, or church school located in Kentucky that has been certified by the Kentucky Board of Education as voluntarily complying with curriculum, certification, and textbook standards established by the Kentucky Board of Education under KRS 156.160;**