



Brief Summary Report: 2018/19 High School Sports-Related Injury Surveillance Study
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Introduction

2018/19 marked the 14th year of the High School Sports-Related Injury Surveillance Study (High School RIO).

- The original surveillance study of athletes participating in 9 sports (boys' football, soccer, basketball, wrestling, and baseball and girls' soccer, volleyball, basketball and softball) from 100 nationally representative randomly selected US high schools was continued.
 - o The data compiled over this 14 year study represents the longest running continuous surveillance study and the largest dataset of all time-loss sports injuries compiled from a national sample of US high school athletes.
- The expanded surveillance study continued the 11th year of surveillance of athletes participating in 8 additional sports (boys' lacrosse, ice hockey, swimming & diving, and track & field and girls' field hockey, lacrosse, swimming & diving, and track & field) and, for the 10th year, cheerleading. For the 7th year, data were also collected for athletes participating in boys' and girls' cross country. The expanded study captures data from a convenience sample of US high schools.
 - o While they were previously included in High School RIO, boys' volleyball and girls' gymnastics data were no longer collected starting in the 2012/13 academic year due to the low number of schools with athletic trainers who provided services for these sports. Similarly, while they were previously included in High School RIO, boys' and girls' tennis data were no longer collected starting in the 2018/19 academic year due to the very low number of injuries sustained by athletes participating in tennis.
- To date, from 2005/06 through 2018/19, participating schools have reported 102,673 injuries during 52,649,508 athletic exposures (AE) for an injury rate of 1.95 injuries per 1,000 AE in the 20 sports studied.
 - o 53,719 competition injuries during 13,265,238 competition exposures for an injury rate of 4.05 injuries per 1,000 AE
 - o 48,713 practice injuries during 38,934,423 practice exposures for an injury rate of 1.25 injuries per 1,000 AE
 - o 241 performance injuries during 449,847 performance exposures for an injury rate of 0.54 injuries per 1,000 AE (cheerleading only)
- This surveillance study was funded through the generous support of the NFHS and an unrestricted research donation from US Lacrosse.

2018/19 Data Snapshot

The surveillance system continued to capture a large amount of high quality, detailed data on incidence of injury, number of athletic exposures, and injury event information.

- When combined, the schools reporting for both the original random sample and the convenience sample reported 7,253 injuries (54% competition related) during 4,003,991 AE for an injury rate of 1.81 injuries per 1,000 AE in the 20 sports studied.
- While injury rates varied by sport, competition injury rates were higher than practice injury rates for all but 2 of the 20 sports (Figure 1).
- Patterns of injury also varied by sport (Table 1)
 - o the head/face and ankle were commonly injured body sites in 10 sports, ankle in 3 sports, lower leg in 3 sports, shoulder in 2 sports, knee in 1 sport, and hip/thigh/upper leg in 1 sport.
 - o strains/sprains were the most common injury diagnosis in all but boys' ice hockey and cheerleading, in which concussions were the most common.
 - o across sports 0.0% to 14.3% of the injuries kept the student athlete out of play for >3 weeks.
 - o across sports 0.0% to 11.9% of the injuries resulted in surgical repair.

Trends Over Time

Interpretation of trends over time become clearer through long-term surveillance efforts, the competition injury rates have generally held steady over time for each of the 9 sports studied in the original sample (Figure 2). Most injury patterns have also remained relatively stable over time.

Trends over time in concussion injury rates have varied. Concussion rates increased dramatically over time from 2006/07 through 2012/13 (Table 2), decreased slightly in 2013/14, but rose again in 2014/15 and 2015/16 before dropping again in 2016/17 and 2017/18. During the first 5 years of the study the proportion of injuries diagnosed as concussions in the 9 sports studied in the original sample ranged from a low of 8.4% in 2006/07 to a high of 14.0% in 2009/10. In 2010/11 this jumped to 20.0% and remained high in 2011/12 (21.9%), 2012/13 (23.1%), 2013/14 (21.9%), 2014/15 (24.9%), 2015/16 (23.9%), 2016/17 (23.6%), and 2017/18 (20.6%)

- Trends in concussion rates likely reflect increased recognition, diagnosis, and reporting of concussions over the past decade plus given the ongoing efforts of the NFHS and other organizations to provide concussion education to the high school sports community as well as the continued attention the media has paid to sports-related concussions.
 - o There have been several important successes over the past 13 years. For example; the proportion of athletes returning to play (from the 9 sports in the original sample) the same day after sustaining a concussion has decreased from a high of 5.5% in 2007/08 to a low of 0.0% in 2015/16 (in 2017/18 there were only ten cases), the proportion of athletes removed from play by a coach for a suspected concussion has increased, and the proportion of athletes who were released to return to play by a non-clinician (i.e., coach, parent, etc.) has decreased. Concussion injuries which previously went unrecognized, placing athletes at risk, are now being recognized, athletes are being removed from play, and athletes are being evaluated by clinicians prior to returning to play.
- In boys' football, the overall rate of concussion rose dramatically from 2005/06 through 2012/13, dropped in 2013/14, before rising again from 2014/15 through 2017/18 and then dropping in 2018/19. However, the practice concussion rate remained below 5.0 per 10,000 practice AEs for the 4th consecutive year.

New Findings Driven by Rules Committee Requests

Given the current interest of injury rate during football kickoffs, policy makers at all levels of play (NFL, NCAA, NFHS, and youth) have been reviewing current rules and considering potential rule changes addressing this phase of play as a means of increasing player safety. To ensure they have specific high school football injury data available to drive evidence-based discussions of this issue, the NFHS contracted with Dr. Dawn Comstock to conduct a sub-study within US high schools participating in High School RIO reporting football data in fall 2018. Dr. Comstock and her research team collected data in this supplemental football pilot study, called *GAME STATS*, to provide the NFHS Sports Medicine Advisory Committee and Football Rules Committee with high school level information about injury rates and patterns in different phases of play. The purpose of this study was to provide data to support discussions as these groups consider how best to keep high school football players as healthy and safe as possible while they enjoy playing football. **The full *GAME STATS* report is provided with this report.** The main findings included:

- Overall injury rates were highest in general play offense then defense, followed by kickoffs receiving team then kicking team, and lowest in punts receiving team then kicking team. This indicates that, while additional rule changes to reduce injury rates during kickoffs may effectively further reduce injury rates, this phase of play is already safer than general play. However, concussion rates were highest in kickoffs receiving team then kickoffs kicking team, followed by general play defense then general play offense, and lowest in both punts receiving team and kicking team. This indicates that any rule changes focused on kickoffs should aim to prevent concussions.
- Some have hypothesized that injury rates may be higher in blow-outs due to one team being so dramatically outmatched by their opponent or, alternatively that injury rates may be higher in close games due to the potentially increased intensity as both teams strive to win. Neither of those hypotheses were borne out in this study. Although 23.7% of reported games ended in blow-outs and another 22.9% of games ended in close games, there were no statistically significant differences noted in any phase of play in either blow-outs or close games.

Impact

Data from this surveillance study has been used over the past year in multiple forums

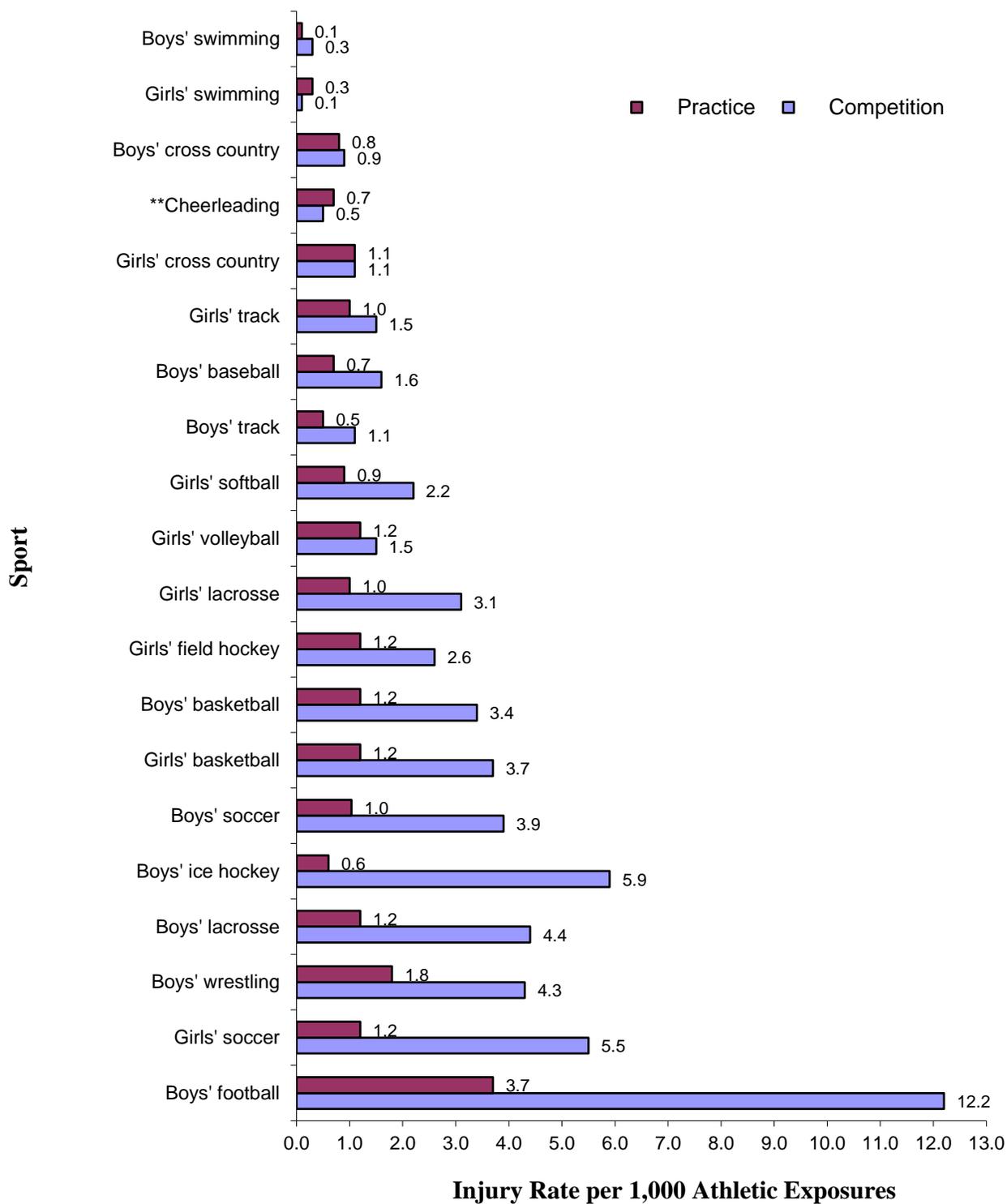
- NFHS SMAC review at NFHS SMAC committee meetings.
- NFHS SMAC data requests to address topics of interest throughout the year.
- NFHS Rules Committee reviews.
- Continued evaluation of the effectiveness of several NFHS rule changes.
- Weekly surveillance for infectious disease outbreaks (skin infections) and communication with affected schools or geographic areas to contain the spread of the illness.
- Weekly surveillance for exertional heat illness and communication with NFHS if increases are noted in specific geographic areas.
- State Associations and State Association SMACs data requests to address topics of interest
- Publications in the scientific literature and presentations at national scientific conferences.
- Data requests from other government or professional organizations including the CDC, NOCSAE, NATA and SFIA.
- Data requests from industry partners (e.g., requests from companies working to improve protective equipment)

Future

During the 2019/20 academic year, High School RIO will begin to transition to Dr. Christy Collins, President of the Datalys Center for Sports Injury Research and Prevention, Inc., a non-profit organization located in Indianapolis, Indiana. Dr. Collins worked with Dr. Comstock on the High School RIO study during the 2004/05 through 2013/14 academic years and looks forward carrying on the important work of High School RIO. She will continue to work closely with the NFHS, NFHS SMAC and NFHS Rules Committees to help drive evidence-based decisions to keep athletes healthy. Dr. Collins will continue the proven successful surveillance methodology while striving to continue to improve service/responsiveness to the needs of the NFHS.

- Detailed reports will be provided to the NFHS SMAC at their twice-yearly meetings as well as throughout the year upon request.
- Sentinel incidence reports on specific topics of interest (i.e., exertional heat injuries, skin infections) will again be provided to the NFHS SMAC weekly throughout the year.
- Additional detailed reports will be provided upon request to individual NFHS rules committees.
- Continued cooperation with State Associations and other partner organizations upon request.

Figure 1: Convenience Sample Injury Rates per 1,000 Athletic Exposures by Sport and Type of Athletic Exposure, High School Sports-Related Injury Surveillance Study, US, 2018/19*



*Includes time loss injuries only

**Cheerleading competition rate represents the rate of injury per 1,000 AEs in competition and performance.

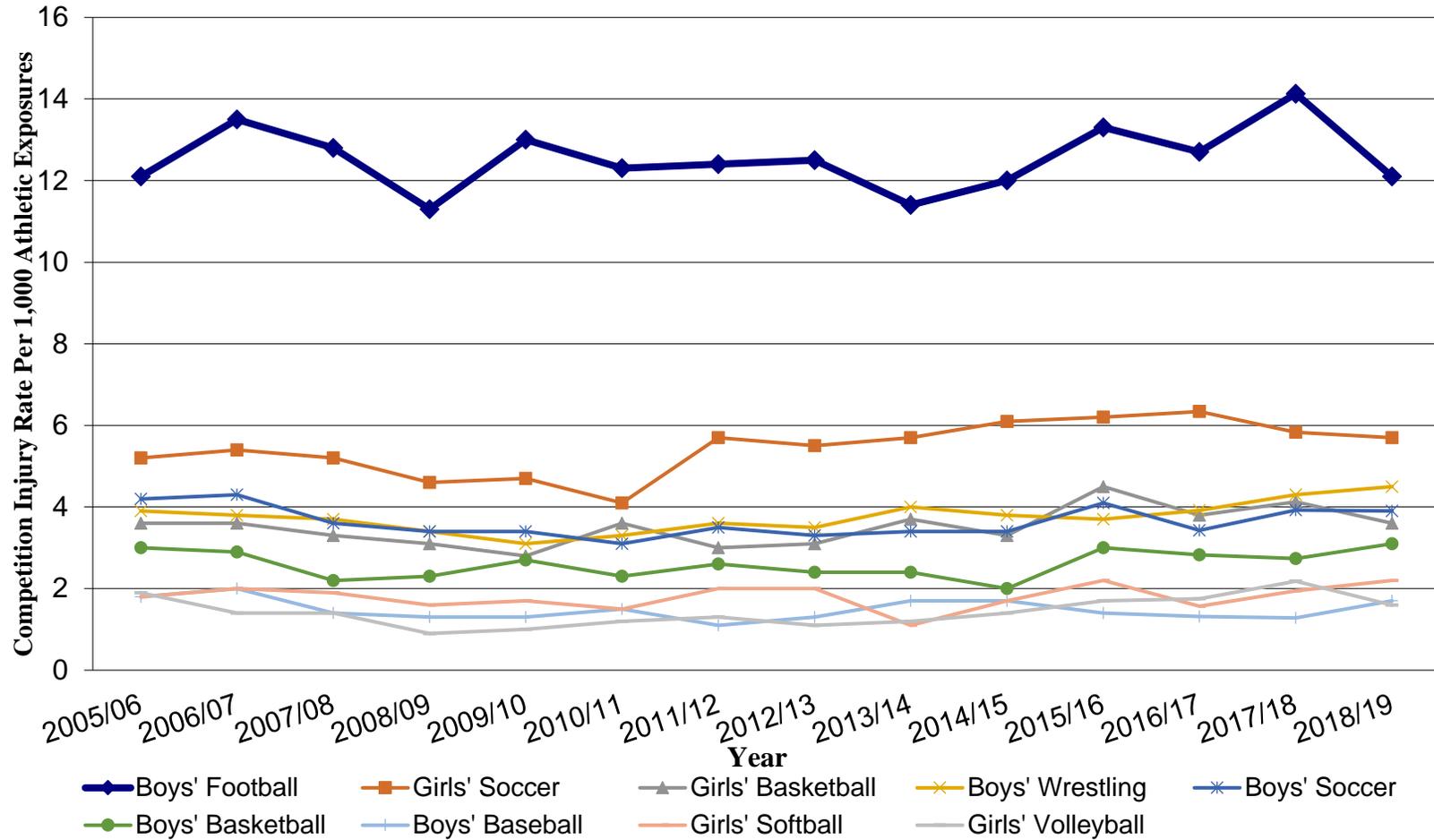
Table 1: Convenience Sample Patterns of Injury by Sport, High School Sports-Related Injury Surveillance Study, US, 2018/19

Sport	Most Commonly Injured Body Site	Most Common Diagnosis of Injury	Proportion of Injuries with >3 Weeks Time Loss*	Proportion of Injuries that Resulted in Surgery**
Boys' Sports				
Football	Head/Face	Strain/Sprain	7.4%	7.6%
Soccer	Head/Face	Strain/Sprain	4.8%	4.3%
Basketball	Ankle	Strain/Sprain	6.3%	3.8%
Wrestling	Head/Face	Strain/Sprain	8.0%	6.1%
Baseball	Head/Face	Strain/Sprain	8.6%	8.8%
Ice Hockey	Head/Face	Concussion	14.3%	2.4%
Lacrosse	Knee	Strain/Sprain	5.8%	10.1%
Swimming & Diving	Shoulder	Strain/Sprain	0.0%	0.0%
Track & Field	Hip/Thigh/Upper Leg	Strain/Sprain	5.5%	1.9%
Cross Country	Lower Leg	Strain/Sprain	2.0%	2.0%
Girls' Sports				
Soccer	Head/Face	Strain/Sprain	4.7%	4.9%
Volleyball	Ankle	Strain/Sprain	7.4%	4.3%
Basketball	Ankle	Strain/Sprain	4.5%	9.0%
Softball	Head/Face	Strain/Sprain	3.7%	5.4%
Field Hockey	Head/Face	Strain/Sprain	4.2%	1.8%
Lacrosse	Head/Face	Strain/Sprain	4.0%	11.9%
Swimming & Diving	Shoulder	Strain/Sprain	3.6%	3.6%
Track & Field	Lower Leg	Strain/Sprain	5.7%	0.9%
Cross Country	Lower Leg	Strain/Sprain	3.5%	0.0%
Coed' Sports				
Cheerleading	Head/Face	Concussion	6.7%	4.2%

*Injury outcomes included in this category consists of ≥ 22 days before athlete returns to play only. It does not include other categories (e.g., season ending, career ending, etc.).

** Includes injuries that were surgically repaired prior to return to play during the sport season and injuries that were repaired after the end of the season.

Figure 2: Original Sample Trends over Time in Rates of Competition Related Injury by Sport, High School Sports-Related Injury Surveillance Study, US, 2005/06-2018/19*



*Includes time loss injuries only

Table 2. Original Sample Concussion National Estimates and Rates by Sport and Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2005/06 – 2018/19 School Years

	2005-06	2006-07	2007-08**	2008-09**	2009-10**	2010-11**	2011-12**	2012-13**
	# of nationally estimated concussions (rate of concussions per 10,000 athlete-exposures)							
Overall total	134,965 (2.27)	123,864 (2.28)	137,802 (2.41)	149,699 (2.55)	192,051 (3.22)	249,655 (4.09)	333,253 (5.11)	348,565 (5.47)
Competition	92,795 (5.40)	87,749 (5.66)	95,957 (5.99)	109,645 (6.47)	135,983 (7.72)	186,804 (10.16)	210,457 (11.59)	231,621 (12.14)
Practice	42,170 (1.06)	36,114 (1.04)	41,846 (1.09)	40,053 (1.10)	56,067 (1.55)	62,847 (1.79)	122,796 (2.75)	116,944 (2.93)
Boys' football total	55,007 (4.66)	60,136 (4.80)	70,929 (5.29)	70,672 (5.20)	100,928 (7.20)	117,173 (8.20)	140,057 (9.41)	167,604 (11.08)
Competition	33,723 (15.48)	39,265 (18.53)	43,850 (19.82)	46,439 (19.09)	65,227 (27.34)	85,095 (33.73)	69,810 (31.12)	93,029 (35.50)
Practice	21,284 (2.12)	20,870 (2.12)	27,079 (2.41)	24,233 (2.37)	35,701 (3.36)	32,078 (3.11)	70,247 (5.31)	74,575 (6.02)
Boys' soccer total	21,972 (2.22)	15,355 (2.01)	17,447 (1.92)	14,215 (1.67)	20,247 (2.23)	30,716 (2.97)	41,813 (4.14)	46,511 (3.92)
Competition	19,761 (6.09)	12,316 (5.24)	13,847 (5.48)	10,253 (4.71)	18,456 (6.39)	25,858 (8.09)	34,751 (11.14)	38,972 (11.14)
Practice	2,212 (0.38)	3,039 (0.70)	3,600 (0.42)	3,962 (0.39)	1,791 (0.43)	4,858 (0.76)	7,062 (1.30)	7,539 (0.90)
Girls' soccer total	29,204 (3.61)	21,570 (2.26)	23,595 (2.65)	31,739 (3.53)	25,954 (2.96)	37,611 (4.19)	59,215 (7.34)	67,677 (7.87)
Competition	23,080 (9.95)	18,188 (6.50)	21,748 (7.91)	27,684 (10.24)	22,552 (8.23)	35,194 (12.20)	49,180 (21.82)	58,826 (22.99)
Practice	6,124 (0.82)	3,382 (0.52)	1,847 (0.41)	4,055 (0.69)	3,401 (0.67)	2,417 (0.51)	10,035 (1.45)	8,851 (1.46)
Girls' volleyball total	2,568 (0.50)	2,962 (0.68)	4,330 (1.00)	1,837 (0.32)	5,628 (0.88)	4,498 (1.06)	8,667 (1.70)	7,603 (1.72)
Competition	500 (0.46)	2,469 (1.51)	2,625 (1.97)	1,443 (0.62)	2,756 (0.95)	2,335 (1.61)	7,241 (3.94)	4,504 (2.26)
Practice	2,069 (0.53)	493 (0.28)	1,705 (0.53)	394 (0.16)	2,871 (0.85)	2,163 (0.77)	1,426 (0.55)	3,099 (1.42)
Boys' basketball total	3,513 (0.69)	4,452 (0.73)	4,179 (0.84)	4,247 (0.85)	11,013 (1.98)	11,699 (2.05)	11,011 (2.35)	13,076 (2.26)
Competition	1,639 (1.14)	3,403 (1.98)	2,418 (1.75)	3,439 (2.32)	7,985 (4.73)	8,083 (4.02)	7,648 (5.42)	7,055 (3.99)
Practice	1,874 (0.51)	1,049 (0.21)	1,761 (0.46)	808 (0.24)	3,028 (0.84)	3,616 (1.18)	3,363 (1.08)	6,021 (1.50)
Girls' basketball total	13,136 (2.20)	7,552 (2.04)	7,389 (1.81)	8,700 (1.98)	10,662 (2.02)	19,909 (4.21)	16,902 (3.65)	19,663 (4.53)
Competition	10,826 (6.38)	5,084 (4.48)	6,021 (4.90)	6,643 (5.13)	7,553 (5.02)	14,769 (9.77)	13,186 (8.85)	13,081 (10.14)
Practice	2,310 (0.53)	2,468 (1.00)	1,368 (0.50)	2,057 (0.67)	3,109 (0.69)	5,139 (1.79)	3,715 (1.52)	6,582 (1.98)
Boys' wrestling total	5,417 (1.74)	5,133 (1.54)	5,982 (1.45)	10,096 (2.16)	7,350 (2.15)	13,196 (3.81)	27,041 (5.70)	13,895 (4.89)
Competition	2,268 (3.23)	3,375 (3.43)	2,870 (2.75)	8,206 (5.65)	3,652 (3.49)	6,971 (6.75)	10,976 (8.25)	6,890 (8.28)
Practice	3,149 (1.27)	1,758 (0.87)	3,113 (0.98)	1,891 (0.90)	3,699 (1.65)	6,224 (2.76)	16,065 (4.76)	7,005 (3.63)
Boys' baseball total	1,450 (0.39)	2,747 (0.43)	523 (0.21)	1,858 (0.43)	2,990 (0.37)	6,391 (1.04)	8,594 (1.35)	4,773 (0.99)
Competition	846 (0.63)	1,982 (0.86)	459 (0.45)	1,637 (1.07)	2,735 (0.86)	4,527 (1.80)	6,013 (2.76)	3,245 (1.75)
Practice	605 (0.26)	765 (0.19)	64 (0.08)	221 (0.08)	255 (0.10)	1,863 (0.64)	2,582 (0.57)	1,528 (0.59)
Girls' softball total	2,695 (0.67)	3,957 (0.75)	3,428 (0.69)	6,332 (1.49)	7,279 (1.38)	8,462 (1.39)	19,953 (2.96)	7,763 (1.87)
Competition	152 (0.21)	1,667 (0.94)	2,119 (1.16)	3,901 (2.03)	5,067 (3.12)	3,972 (1.87)	11,652 (5.17)	6,019 (3.91)
Practice	2,543 (0.91)	2,290 (0.65)	1,309 (0.43)	2,432 (1.20)	2,212 (0.49)	4,489 (1.15)	8,301 (1.80)	1,744 (0.83)

* Overall totals represent only the 9 sports from the Original Study which was randomly sampled

**In years 2007/08 through 2018/19, the definition of injury was expanded to include all concussions, regardless of whether or not they resulted in restriction of the student-athlete's participation

†Numbers do not always sum due to rounding.

Table 2 (Con't). Original Sample Concussion National Estimates and Rates by Sport and Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2005/06 – 2018/19 School Years

	2013-14**	2014-15**	2015-16**	2016-17**	2017-18**	2018-19**
Overall total*†	342,393 (5.30)	315,540 (5.63)	367,306 (5.81)	305,128 (5.43)	283,956 (5.39)	283,433 (5.24)
Competition	228,016 (12.01)	208,943 (13.24)	241,515 (13.69)	220,454 (12.87)	212,671 (13.15)	204,249 (12.91)
Practice	114,377 (2.71)	106,597 (2.78)	125,791 (2.78)	84,674 (2.49)	71,287 (2.26)	79,184 (2.22)
Boys' football total	161,874 (9.97)	141,715 (10.07)	150,249 (10.39)	132,361 (10.50)	114,876 (11.54)	116,846 (10.35)
Competition	96,275 (32.98)	83,364 (33.87)	90,689 (35.80)	85,678 (38.37)	81,923 (43.20)	77,672 (37.84)
Practice	65,599 (5.19)	58,351 (5.24)	59,560 (4.77)	46,683 (4.66)	32,953 (4.46)	39,174 (4.20)
Boys' soccer total	40,583 (4.38)	29,386 (4.10)	41,380 (4.44)	28,582 (3.34)	32,093 (3.36)	35,287 (3.65)
Competition	32,110 (12.10)	24,572 (11.10)	28,058 (9.87)	25,881 (9.47)	27,380 (8.82)	31,923 (10.46)
Practice	8,473 (0.93)	4,814 (0.99)	13,322 (1.95)	2,702 (0.62)	4,713 (0.89)	3,364 (0.60)
Girls' soccer total	58,946 (6.95)	78,490 (10.39)	76,447 (8.63)	64,707 (7.52)	66,140 (7.44)	56,904 (7.27)
Competition	50,990 (18.38)	59,226 (27.14)	63,317 (23.97)	58,188 (21.23)	56,364 (20.37)	44,760 (18.61)
Practice	7,956 (1.93)	19,264 (2.93)	12,830 (1.73)	6,519 (1.11)	9,776 (1.70)	12,144 (2.04)
Girls' volleyball total	10,874 (2.50)	13,246 (3.17)	16,471 (3.09)	14,734 (3.85)	12,927 (3.00)	10,925 (2.97)
Competition	4,791 (3.45)	6,713 (4.87)	8,013 (4.93)	8,718 (6.45)	7,646 (5.01)	6,325 (4.76)
Practice	6,083 (2.00)	6,533 (2.32)	8,458 (2.20)	6,016 (2.54)	5,282 (1.92)	4,600 (2.11)
Boys' basketball total	12,177 (2.13)	5,627 (1.16)	14,608 (2.57)	14,894 (2.54)	10,038 (1.86)	10,410 (2.07)
Competition	8,105 (4.25)	2,934 (1.90)	7,613 (5.09)	8,478 (4.66)	6,246 (3.73)	5,410 (4.57)
Practice	4,072 (1.18)	2,693 (0.84)	6,995 (1.51)	6,416 (1.58)	3,793 (1.03)	5,000 (1.01)
Girls' basketball total	20,927 (4.58)	17,824 (4.88)	29,111 (6.12)	17,314 (4.27)	16,410 (3.96)	19,555 (4.61)
Competition	15,713 (12.01)	12,960 (11.53)	19,723 (14.72)	14,218 (10.43)	12,679 (9.95)	14,373 (10.68)
Practice	5,214 (1.25)	4,864 (1.96)	9,388 (2.32)	3,096 (1.34)	3,731 (1.23)	5,182 (1.96)
Boys' wrestling total	20,431 (5.97)	14,191 (4.39)	22,448 (5.83)	13,334 (4.22)	13,114 (4.76)	18,543 (5.07)
Competition	11,205 (12.35)	11,017 (12.22)	11,490 (11.09)	7,624 (8.79)	7,003 (9.84)	13,147 (12.87)
Practice	9,226 (3.67)	3,174 (1.92)	10,958 (4.04)	5,710 (2.63)	6,111 (2.86)	5,396 (2.37)
Boys' baseball total	6,523 (1.07)	6,570 (1.49)	5,078 (1.05)	6,074 (1.07)	7,009 (1.17)	5,557 (1.00)
Competition	4,002 (1.95)	4,232 (2.99)	4,117 (2.50)	3,921 (1.79)	4,714 (2.03)	3,990 (1.81)
Practice	2,521 (0.58)	2,338 (0.67)	961 (0.27)	2,153 (0.64)	2,295 (0.68)	1,567 (0.55)
Girls' softball total	10,058 (1.57)	8,491 (2.51)	11,514 (2.26)	13,128 (2.69)	11,349 (2.56)	9,406 (2.74)
Competition	4,825 (1.96)	3,925 (4.23)	8,195 (4.03)	7,748 (3.94)	8,716 (4.86)	6,649 (5.06)
Practice	5,233 (1.37)	4,566 (1.59)	3,319 (1.32)	5,380 (1.97)	2,633 (1.32)	2,757 (1.46)

* Overall totals represent only the 9 sports from the Original Study which was randomly sampled

**In years 2007/08 through 2018/19, the definition of injury was expanded to include all concussions, regardless of whether or not they resulted in restriction of the student-athlete's participation

†Numbers do not always sum due to rounding.