



Brief Summary Report: 2021/22 National High School Sports-Related Injury Surveillance Study Prepared for the NFHS by Dr. Christy Collins August 2022

Introduction

2021/22 marked the 17^{th} year of the National High School Sports-Related Injury Surveillance Study, more commonly known as High School RIOTM.

- 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 a nationally representative sample of US high schools was continued.
 - o This 17-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 14th year of surveillance of athletes participating in eight additional sports (boys' lacrosse, ice hockey, swimming & diving, and track & field and girls' field hockey, lacrosse, swimming & diving, and track & field) and, for the 13th year, co-ed cheerleading. For the 10th 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.
 - While 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 a low number of schools with athletic trainers who provided services for these sports. Similarly, while also previously included in High School RIO, boys' and girls' tennis data were no longer collected starting in the 2018/19 academic year due to a low number of injuries sustained by athletes participating in tennis.
 - To date, from 2005/06 through 2021/22, participating schools have reported 116,594 injuries during 59,295,404 athletic exposures (AEs) for an overall injury rate of 1.97 injuries per 1,000 AEs for all 24 sports included during the 17-year study period.
 - o 61,099 competition injuries during 14,888,859 competition AEs for an injury rate of 4.10 injuries per 1,000 AE
 - 55,213 practice injuries during 43,891,422 practice AEs for an injury rate of 1.26 injuries per 1,000 AE
 - o 282 performance injuries during 515,123 performance AEs for an injury rate of 0.55 injuries per 1,000 AE (cheerleading only)
- This surveillance study was funded through the generous support of the National Federation of State High School Associations (NFHS) and the NFHS Foundation.

2021/22 Data Snapshot

- When combined, schools reporting for the original and convenience sample reported 4,998 injuries (52% competition-related) during 2,472,652 AEs for an injury rate of 2.02 injuries per 1,000 AEs in the 20 sports studied during the 2021/22 academic year.
- While injury rates varied by sport, competition injury rates were higher than practice injury rates for all but 4 sports (girls' swimming and diving, boys' cross country, girls' cross country, and cheerleading) (Figure 1).
- Patterns of injury varied by sport (Table 1).
 - The head/face was the most commonly injured body site in ten sports (boys' football, wrestling, ice hockey, and lacrosse, and girls' soccer, wrestling, softball, field hockey, and lacrosse as well as cheerleading).
 - In 2020/21, the most commonly injured body site for football was the knee, for girls' soccer was the ankle, and for girls' field hockey was the knee. In 2021/22, the mostly commonly injured body site for these sports was the head/face, which is consistent with previous years.
 - O Also consistent with previous years, strains/sprains were the most common injury diagnosis in all sports except boys' ice hockey and cheerleading (concussion) and boys' and girls' swimming and diving (tendonitis; note tendonitis and strain/strain were tied for most common injury diagnosis in girls' swimming and diving).
 - o Across sports, 0.0% to 13.5% of injuries kept the student athlete out of play for more than three weeks.
 - Across sports, 0.0% to 8.5% of injuries resulted in surgical repair either during or after the season.
 - A greater proportion of girls' softball injuries resulted in surgical repair in 2021/22 (7.7%) compared to 2020/21 (2.3%).
 - Conversely, a smaller proportion of injuries resulted in surgical repair in 2021/22 compared to 2020/21 in boys' wrestling (4.7% vs 10.6%, respectively), girls' volleyball (1.9% vs 13.0%, respectively), girls' field hockey (3.7% vs 8.3%, respectively), and girls' lacrosse (4.2% vs 16.5%, respectively).

Trends Over Time

Interpretation of trends over time become clearer through long-term surveillance efforts. Despite than pandemic, in general, competition injury rates have remained relatively stable over time for each of the nine sports included in the original sample (Figure 2). There was an increase in the rate of boys' wrestling competition injuries in the 2021/22 academic year compared to previous years. We will monitor the rate of competition injuries in boys' wrestling in 2022/23 to determine if this is random floatation or a potential area of focus in terms of injury prevention efforts.

In 2020/21, concussion injury rates were lower than in previous years (Table 2). Multiple factors may have affected concussion rates including characteristics of schools playing sports, athletes who were able to/chose to compete during the pandemic, other injuries sustained during the sport season, ATs ability to participate in High School RIO given other responsibilities, changes in practice-related activities, and the national sample in terms of sport cancellation/modified seasons. Concussion injury rates increased in 2021/22 compared to 2020/21 but continue to be generally lower than pre-pandemic concussion rates. We will continue to monitor concussion rates in 2022/23 and in future academic years.

Impact

Data from this surveillance study have been used over the past year in multiple forums including:

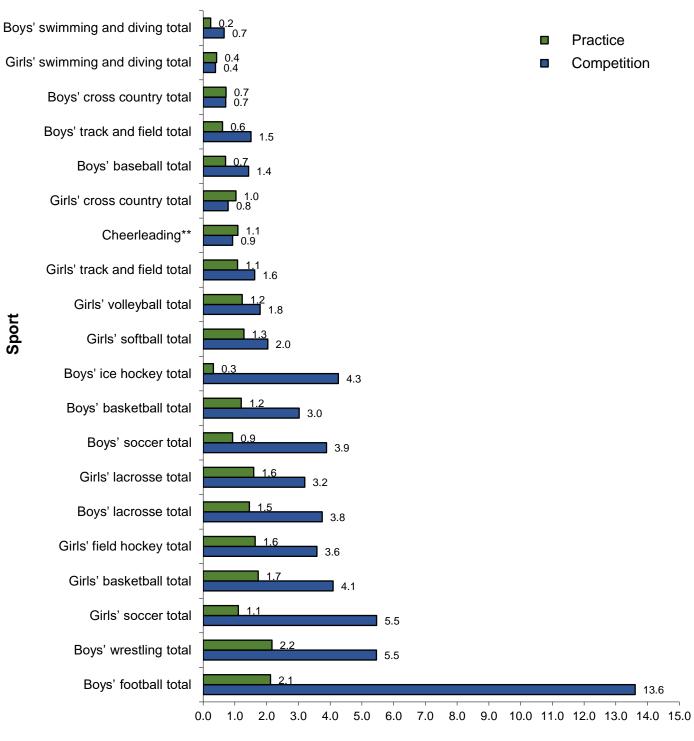
- NFHS Sports Medicine Advisory Committee (SMAC) review at NFHS SMAC committee meetings
- NFHS SMAC data requests to address topics of interest throughout the year
- NFHS Rules Committee reviews
- Continued evaluation of the effectiveness of several NFHS rule changes
- Weekly surveillance for infectious disease outbreaks (skin infections and COVID-19) 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

Future

Dr. Collins, along with the Datalys staff, will work with the NFHS, National Athletic Trainers' Association (NATA), and other partners to increase enrollment in High School RIO to pre-pandemic levels. Datalys will also work closely with reporting schools, the NFHS, NFHS SMAC, and NFHS Rules Committees throughout the year to continue to produce the data needed to help drive evidence-based decisions to keep athletes as healthy as possible.

- 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, COVID-19 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, National High School Sports-Related Injury Surveillance Study, US, 2021/22*



Injury Rate per 1,000 Athletic Exposures

^{*}The COVID-19 pandemic may have affected these results.

^{**}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, National High School Sports-Related Injury Surveillance Study, US, 2021/22*

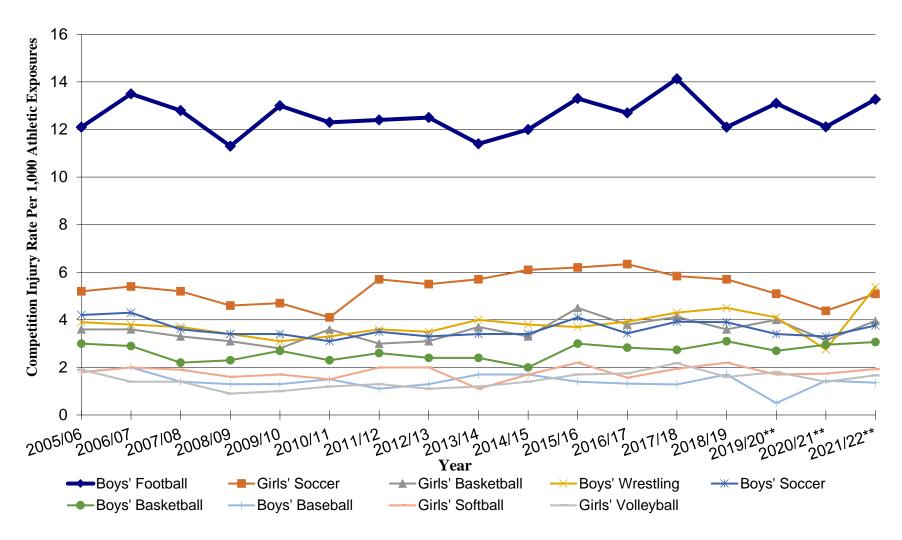
Sport	Most Commonly Injured Body Site	Most Common Diagnosis of Injury	Proportion of Injuries with >3 Weeks Time Loss"	Proportion of Injuries that Resulted in Surgery [†]	
Boys' Sports					
Football	Head/Face	Strain/Sprain	8.0%	8.0%	
Soccer	Ankle	Strain/Sprain	6.2%	5.9%	
Basketball	Ankle	Strain/Sprain	5.5%	5.3%	
Wrestling	Head/Face	Strain/Sprain	5.4%	4.7%	
Baseball	Elbow	Strain/Sprain	8.5%	5.6%	
Ice Hockey	Head/Face	Concussion	4.3%	2.1%	
Lacrosse	Head/Face	Strain/Sprain	9.2%	8.5%	
Swimming & Diving	Shoulder	Tendonitis	0.0%	0.0%	
Track & Field	Thigh/Upper Leg	Strain/Sprain	4.1%	0.8%	
Cross Country	Lower Leg	Strain/Sprain	11.9%	0.0%	
Girls' Sports					
Soccer	Head/Face	Strain/Sprain	4.4%	5.8%	
Volleyball	Ankle	Strain/Sprain	8.2%	1.9%	
Basketball	Ankle	Strain/Sprain	5.3%	4.8%	
Wrestling	Head/Face	Strain/Sprain	13.5%	2.7%	
Softball	Head/Face	Strain/Sprain	7.1%	7.7%	
Field Hockey	Head/Face	Strain/Sprain	0.9%	3.7%	
Lacrosse	Head/Face	Strain/Sprain	9.2%	4.2%	
Swimming & Diving	Shoulder	Tendonitis and Strain/Sprain	9.1%	0.0%	
Track & Field	Lower Leg	Strain/Sprain	4.0%	1.3%	
Cross Country	Lower Leg	Strain/Sprain	6.8%	0.0%	
Coed' Sports					
Cheerleading	Head/Face	Concussion	8.9%	1.8%	

^{*}The COVID-19 pandemic may have affected these results.

^{**}Includes "Returned to activity in 22 days or more" (i.e., does not include other categories such as 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, National High School Sports-Related Injury Surveillance Study, US, 2005/06-2021/22*



^{*}The COVID-19 pandemic may have affected these results.

^{**}Includes only time loss injuries

Table 2. Original Sample Concussion National Estimates and Rates by Sport and Type of Exposure, National High School Sports-Related Injury Surveillance Study, US, 2005/06 – 2021/22 School Years

	2005-06	2006-07	2007-08**	2008-09**	2009-10**	2010-11**	2011-12**	2012-13**
Sport and Event Type			# of nationally estimate	ated concussions (rat	te of concussions per	10,000 athlete-exposu	ures)	
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 (Ò.19)	64 (0.08) [′]	221 (Ò.08)	255 (Ò.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 nine sports from the original study which was randomly sampled; **In years 2007/08 through 2021/22, 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; ††The COVID-19 pandemic may have affected these results.

Table 2 (Continued). Original Sample Concussion National Estimates and Rates by Sport and Type of Exposure, National High School Sports-Related Injury Surveillance Study, US, 2005/06 – 2021/22 School Years

	2013-14**	2014-15**	2015-16**	2016-17**	2017-18**	2018-19**	2019-20**††	2020-21**††	2021-22**††
Sport and Event Type # of nationally estimated concussions (rate of concussions per 10,000 athlete-exposures)									
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)	200,478 (4.75)	160,587 (2.76)	222,757 (4.06)
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)	143,635 (13.42)	102,839 (6.71)	154,437 (9.46)
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)	56,843 (1.68)	57,748 (1.36)	68,320 (1.86)
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)	82,495 (8.35)	72,319 (5.23)	86,614 (8.21)
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)	54,912 (31.87)	44,322 (22.17)	58,417 (30.10)
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)	27,583 (3.07)	27,997 (2.30)	28,197 (3.43)
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)	29,915 (4.02)	19,546 (2.18)	20,857 (2.47)
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)	24,037 (11.83)	13,647 (5.17)	16,344 (7.06)
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)	5,878 (0.59)	5,899 (1.07)	4,513 (0.49)
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)	36,781 (6.27)	23,918 (4.27)	38,733 (5.45)
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)	28,097 (17.71)	16,656 (11.11)	33,881 (15.16)
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)	8,684 (1.67)	7,262 (1.62)	4,852 (0.95)
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)	9,975 (2.58)	8,398 (1.35)	9,869 (2.11)
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)	6,203 (5.31)	4,486 (2.86)	6,827 (4.00)
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)	3,772 (1.22)	3,912 (0.69)	3,042 (1.09)
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)	12,343 (2.14)	7,577 (1.10)	11,524 (1.81)
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)	9,521 (5.35)	5,087 (2.13)	7,263 (3.73)
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)	2,822 (0.76)	2,490 (0.71)	4,261 (0.93)
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)	15,331 (4.03)	8,035 (2.39)	19,908 (4.66)
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)	12,471 (10.56)	5,217 (5.17)	12,467 (9.59)
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)	2,860 (1.22)	2,818 (1.33)	7,441 (2.41)
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)	9,732 (3.16)	6,161 (1.99)	16,910 (3.50)
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)	6,802 (7.93)	4,624 (6.34)	12,195 (8.87)
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)	2,930 (1.54)	1,537 (0.78)	4,715 (1.67)
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)	2,091 (0.91)	3,377 (0.47)	3,781 (0.76)
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)	460 (2.32)	2,308 (0.65)	1,096 (0.85)
Practice	2,521 (0.58)	2,338 (0.67)	961 (0.27)	2,153 (0.64)	2,295 (0.68)	1,567 (0.55)	1,631 (0.70)	1,069 (0.37)	2,685 (0.71)
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)	1,815 (1.18)	11,256 (2.79)	14,561 (3.15)
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)	1,132 (3.86)	6,492 (4.53)	5,947 (3.81)
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)	683 (0.50)	4,764 (1.85)	8,614 (2.78)

^{*}Overall totals represent only the nine sports from the original study which was randomly sampled; **In years 2007/08 through 2021/22, 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; ††The COVID-19 pandemic may have affected these results.