College Sports–Related Injuries — United States, 2009–10 Through 2013–14 Academic Years

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Sports-related injuries can have a substantial impact on the long-term health of student-athletes. The National Collegiate Athletic Association (NCAA) monitors injuries among college student-athletes at member schools. In academic year 2013-14, a total of 1,113 member schools fielded 19,334 teams with 478,869 participating student-athletes in NCAA championship sports (i.e., sports with NCAA championship competition) (1). External researchers and CDC used information reported to the NCAA Injury Surveillance Program (NCAA-ISP) by a sample of championship sports programs to summarize the estimated national cumulative and annual average numbers of injuries during the 5 academic years from 2009–10 through 2013–14. Analyses were restricted to injuries reported among student-athletes in 25 NCAA championship sports. During this period, 1,053,370 injuries were estimated to have occurred during an estimated 176.7 million athleteexposures to potential injury (i.e., one athlete's participation in one competition or one practice). Injury incidence varied widely by sport. Among all sports, men's football accounted for the largest average annual estimated number of injuries (47,199) and the highest competition injury rate (39.9 per 1,000 athlete-exposures). Men's wrestling experienced the highest overall injury rate (13.1 per 1,000) and practice injury rate (10.2 per 1,000). Among women's sports, gymnastics had the highest overall injury rate (10.4 per 1,000) and practice injury rate (10.0 per 1,000), although soccer had the highest competition injury rate (17.2 per 1,000). More injuries were estimated to have occurred from practice than from competition for all sports, with the exception of men's ice hockey and baseball. However, injuries incurred during competition were somewhat more severe (e.g., requiring ≥ 7 days to return to full participation) than those acquired during practice. Multiple strategies are employed by NCAA and others to reduce the number of injuries in organized sports. These strategies include committees that recommend rule and policy changes based on surveillance data and education and awareness campaigns that target both athletes and coaches. Continued analysis of surveillance data will help to understand whether these strategies result in changes in the incidence and severity of college sports injuries.

During the 5 academic years from 2009–10 through 2013–14, injuries and athlete-exposures were voluntarily reported to NCAA-ISP by participating team athletic trainers,

using a web-based platform. The number of teams participating in NCAA-ISP varied by sport and year (2). Overall, participation among teams for the study period ranged from a low of 0.7% in men's tennis to a high of 13.2% in men's ice hockey. Data were aggregated across all schools and across all available years for 12 men's championship sports and 13 women's championship sports. Variables examined included the sport, whether the injury occurred during practice or competition, and whether the player required emergency transport, surgery, or \geq 7 days before return to full participation. Injuries were defined as those that occurred in an organized NCAA-approved practice or competition and required medical attention by a physician or athletic trainer (2). An athlete-exposure was defined as one student-athlete's participation in one practice or one competition. Injury rates were calculated by dividing the number of injuries by the number of athlete-exposures. Competition-to-practice injury rate ratios were calculated by dividing the competition injury rate by the practice injury rate. To create national estimates, each injury and exposure was assigned a sample weight on the basis of the inverse of the school selection probability, using stratifications based on sport, division, and academic year (3). The national estimates were then adjusted for potential underreporting (3). For example, over the 5-year study period, among the 123 team seasons of men's football from which data were acquired, 8,680 injuries from 899,321 athlete-exposures were reported by participating team athletic trainers. These data, when weighted and adjusted, produced national estimates of 235,993 injuries and 25,770,273 athlete-exposures (or estimated annual averages of 47,199 injuries and 5,154,055 athlete-exposures).

Among all 25 sports, an estimated 28,860,299 practice athlete-exposures and 6,472,952 competition athlete-exposures occurred each year. The 1,053,370 injuries estimated during the 5 academic years studied represented an average of 210,674 total injuries per year (Table 1), among which, 134,498 (63.8%) occurred during practices. Overall, 21.9% of all injuries required \geq 7 days before return to full participation (competition: 24.6%; practice: 20.5%) (Figure 1). Among all injuries, those incurred during competition were somewhat more severe than those acquired during practice; overall, 4.0% of injuries required surgery (competition: 5.4%; practice: 3.1%), and 0.9% required emergency transport (competition: 1.4%; practice: 0.6%) (Table 2). These data equated to estimated

Season/Sport	Event	Average annual national estimate of no. of injuries	Average annual national estimate of no. of athlete-exposures	Estimated injury rate per 1,000 athlete-exposures (95% Cl)
All sports	Competition Practice	76,176 134,498	6,472,952 28,860,299	6.0 (5.9–6.0)
All men's sports	Competition Practice	210,674 51,172 78,829	35,333,250 3,387,741 16,530,517	6.5 (6.4–6.6)
All women's sports	Overall Competition Practice	130,000 25,004 55,670	19,918,258 3,085,210 12,329,782	5.2 (5.1–5.4)
	Overall	80,674	15,414,992	
Fail Men's football	Competition Practice	19,982 27,217	500,698 4,653,357	9.2 (9.0–9.4)
Women's field hockey	Overall Competition Practice	47,199 642 888	5,154,055 61,240 174,943	6.5 (5.8–7.1)
Men's soccer	Overall Competition Practice	1,530 6,458 6,977	236,183 360,880 1,323,974	8.0 (7.5–8.4)
Women's soccer	Overall Competition Practice	13,435 7,434 7,679	1,684,854 432,347 1,367,650	8.4 (8.0-8.8)
Women's volleyball	Overall Competition Practice	15,113 2,372 6,589	1,799,997 403,004 988,146	6.4 (6.0–6.8)
Men's cross country	Overall Competition Practice	8,961 441 3,977	1,391,150 85,226 857,815	4.7 (4.1–5.3)
Women's cross country	Overall Competition Practice Overall	4,418 735 4,989	943,041 94,872 983,853 1,078,724	5.3 (4.6–6.0)
Wintor	Overall	5,725	1,078,724	
Men's basketball	Competition Practice	6,259 10,349	417,957 1,534,919	8.5 (8.1–8.9)
Women's basketball	Competition Practice	4,084 6,774	1,952,877 393,620 1,277,664	6.5 (6.1–6.9)
Men's wrestling	Competition Practice	2,283 5,227	59,312 514,972	13.1 (12.3–13.9)
Women's gymnastics	Overall Competition Practice Overall	7,510 175 1,195 1,370	574,284 13,269 119,038 132,307	10.4 (9.5–11.2)

TABLE 1. Average annual national estimates of the number of injuries and athlete-exposures, and estimated injury rates, by 25 championship sports — National Collegiate Athletic Association Injury Surveillance Program, United States, 5 academic years, 2009–10 through 2013–14

See table footnotes on the next page.

annual averages of 46,231 injuries that required \geq 7 days before the athlete could return to full participation; 8,367 that required surgery; and 1,904 that required emergency transport. Approximately half of all injuries were diagnosed as sprains or strains (competition: 45.9%; practice: 45.0%) (Table 1). Sprains (including anterior cruciate ligament tears) and strains also accounted for the largest proportions of injuries in competition and practice requiring \geq 7 days before return to full participation, (52.1% and 47.8%, respectively) and the largest proportion of injuries requiring surgery (57.7% and 52.9%, respectively). In addition, sprains and strains accounted for the largest proportion of practice-related injuries requiring emergency transport (29.4%); however, during competition, the largest proportions of injuries requiring emergency transport were fractures, stress fractures, dislocations, and subluxations (25.8%), and concussions (22.0%).

Among men's sports, football accounted for the largest percentage of athlete-exposures (14.6% of all athlete-exposures and 31.2% of all male athlete-exposures), and football teams were estimated to have the highest number of injuries per year

TABLE 1. (Continued) Average annual national estimates of the number of injuries and athlete-exposures, and estimated injury rates, by 25
championship sports — National Collegiate Athletic Association Injury Surveillance Program, United States, 5 academic years, 2009–10 through
2013–14

Concom/Smort	Event	Average annual national estimate of	Average annual national estimate of no. of	Estimated injury rate per 1,000 athlete-exposures
	Event	no. or injunes	atmete-exposures	(95% CI)
Men's ice hockey	Competition	2,450	93,058	9.5 (9.2–9.9)
	Practice	1,233	293,110	
	Overall	3,684	386,168	
Women's ice hockey	Competition	603	53,935	6.1 (5.6–6.6)
	Practice	637	149,463	
	Overall	1,240	203,398	
Men's indoor track	Competition	1,373	211,773	4.0 (3.6–4.4)
	Practice	6,955	1,876,621	
	Overall	8,328	2,088,394	
Women's indoor track	Competition	994	227,565	4.7 (4.3–5.1)
	Practice	10,524	2,205,757	
	Overall	11,519	2,433,322	
Men's swimming and diving	Competition	223	112,986	1.7 (1.5–2.0)
	Practice	1,954	1,133,451	
	Overall	2,177	1,246,437	
Women's swimming and diving	Competition	284	183,840	1.8 (1.6–2.1)
5 5	Practice	3,028	1,619,767	
	Overall	3,312	1,803,607	
Spring				
Men's lacrosse	Competition	2 178	158 541	65(61-69)
Metro Metosse	Practice	3 367	692 681	0.5 (0.1 0.5)
	Overall	5,507	851 222	
Women's lacrosse	Competition	1 1 2 3	116 314	58(53-62)
womens acrosse	Practice	2 188	457 330	5.6 (5.5 6.2)
	Overall	3 3 1 1	573 644	
Man's baseball	Competition	6,916	1 017 800	(1, 2, 5, 0)
Merrs Daseball	Practico	6 3 7 5	1,017,099	4.7 (4.3-5.0)
	Overall	12 202	2 951 256	
Woman's softball	Competition	2 707	620.074	46(43 = 0)
womens soltball	Dractico	5,/9/	1 000 806	4.0 (4.3–5.0)
	Practice	3,032	1,009,890	
Man/a autola autorali	Overall	7,029	1,049,870	27(24,21)
Men's outdoor track	Competition	1,304	239,387	2.7 (2.4–3.1)
	Practice	2,980	1,323,022	
	Overall	4,284	1,562,408	
Women's outdoor track	Competition	1,541	304,598	3.5 (3.0-3.9)
	Practice	4,626	1,4/3,2/6	
	Overall	6,167	1,777,874	
Men's tennis	Competition	1,304	130,025	5.7 (4.7–6.6)
	Practice	2,218	493,238	
	Overall	3,522	623,264	
Women's tennis	Competition	1,220	160,631	5.9 (5.1–6.8)
	Practice	2,720	503,000	
	Overall	3,941	663,630	

Abbreviation: CI = confidence interval.

* Sums of competition and practice values do not equal overall values because of rounding.

(47,199; 22.4% of all injuries and 36.3% of all male injuries). Football also had the highest competition injury rate (39.9 injuries per 1,000 athlete-exposures) and competition-to-practice rate ratio (6.8) (Figure 2) and the third highest overall injury rate (9.2 per 1,000) (Table 1). Overall, football accounted for the largest proportions of injuries requiring \geq 7 days before return to full participation (26.2%), surgery (40.2%), and emergency transport (31.9%). Men's wrestling had the highest overall injury rate (13.1 per 1,000 athlete-exposures) and the highest practice injury rate (10.2 per 1,000). Swimming and

diving had the lowest overall injury rate (1.7 per 1,000). The rates of injury during competition were higher than during practice for all men's sports. However, more injuries occurred in practices than in competitions for all men's sports except ice hockey and baseball.

Among women's sports, soccer accounted for the highest estimated number of injuries per year (15,113), and the highest competition injury rate (17.2 per 1,000); the competition-to-practice rate ratio was 3.1 (Figure 2). Gymnastics had the highest overall injury rate (10.4 per 1,000 athlete-exposures)

FIGURE 1. Percentages of competition and practice injuries requiring ≥7 days before return to full participation, by 25 championship sports — National Collegiate Athletic Association Injury Surveillance Program, United States, 5 academic years, 2009–10 through 2013–14



and practice injury rate (10.0 per 1,000). The lowest overall estimated injury rate (1.8 per 1000) was for swimming and diving. Injury rates were significantly higher during competitions than practices for all women's sports except volleyball, indoor track, and swimming and diving. Compared with practice injuries, a larger proportion of competition injuries required \geq 7 days before return to full participation for eight of the 13 women's sports (Figure 1). However, more injuries occurred in practices than in competitions for all women's

sports because more than twice as many athlete-exposures each year occurred in practices compared with competition (55,670 versus 25,004).

Among men and women, overall injury rates were similar for soccer, swimming and diving, tennis, and both indoor and outdoor track and field. However, overall injury rates were significantly higher among men than women in basketball, ice hockey, and lacrosse. Overall injury rates were significantly higher among women than men in cross country.

TABLE 2.	Cumulative	national e	stimates o	of the number	and p	percentage of	competitio	on and pr	ractice i	njuries,	by injury	types ar	nd sele	ected
diagnose	s — Nation	al Collegia	ate Athleti	c Association	Injur	y Surveillance	e Program,	United S	States,	5 acader	nic years,	2009-1	0 thro	ough
2013–14														

	Injury type*						
	Injuries of all severity	Injuries requiring ≥7 days before return to full participation	Injuries requiring surgery	Injuries requiring emergency transport No. (%)			
Activity type/Diagnosis	No. (%)	No. (%)	No. (%)				
Competition							
Concussion	26,394 (6.9)	14,888 (15.9)	96 (0.5)	1,174 (22.0)			
Contusion	69,406 (18.2)	4,956 (5.3)	257 (1.2)	512 (9.6)			
Fracture/Stress fracture/Dislocation/Subluxation	26,989 (7.1)	12,525 (13.4)	5,158 (24.9)	1,378 (25.8)			
Inflammatory condition	22,918 (6.0)	3,272 (3.5)	376 (1.8)	39 (0.7)			
Sprain/Strain	174,845 (45.9)	48,761 (52.1)	11,949 (57.7)	1,082 (20.2)			
Other	60,327 (15.8)	9,189 (9.8)	2,868 (13.9)	1,158 (21.7)			
Total	380,879 (100.0)	93,591 (100.0)	20,704 (100.0)	5,342 (100.0)			
Practice							
Concussion	26,408 (3.9)	16,384 (11.9)	92 (0.4)	348 (8.3)			
Contusion	49,781 (7.4)	4,198 (3.1)	410 (1.9)	355 (8.5)			
Fracture/Stress fracture/Dislocation/Subluxation	38,292 (5.7)	15,817 (11.5)	4,558 (21.6)	734 (17.6)			
Inflammatory condition	99,758 (14.8)	12,586 (9.1)	1,190 (5.6)	0 (—)			
Sprain/Strain	302,288 (45.0)	65,736 (47.8)	11,188 (52.9)	1,228 (29.4)			
Other	155,965 (23.2)	22,845 (16.6)	3,694 (17.5)	1,513 (36.2)			
Total	672,491 (100.0)	137,566 (100.0)	21,133 (100.0)	4,178 (100.0)			

* Categories are not mutually exclusive.

Discussion

Men's football accounts for the most college sport injuries each year, as well as the largest proportions of injuries requiring \geq 7 days before return to full participation, or requiring surgery or emergency transport. Thus, prevention efforts that focus on football will target the largest number of severe injuries. The large overall number of football-related injuries is attributable to football having the largest number of student-athletes (71,291 during the 2013-14 academic year) among all 25 reported NCAA sports (16.1%) (2). Although wrestling had the highest overall injury rate among all 25 reported NCAA sports, the number of student-athlete wrestlers was much smaller (6,982). At the same time, the competition injury rates in wrestling and football were nearly equivalent, although the practice injury rate in wrestling was higher than that in football. Among women's sports, gymnastics had the highest rate of injury each year, whereas soccer contributed the largest number of injuries. Many of these data are consistent with earlier reports and can be used to guide resource allocation decisions and research to identify specific risk factors or to evaluate prevention measures (4). It is also important to note that the injury rates reported from these data are higher than those reported from NCAA-ISP before 2004–05 (4) because, unlike previous estimates, rates since the 2009-10 academic year have included injuries requiring <1 day before return to full participation.

The relationship between injury numbers and rates in practice and competition is similar to previous findings (4). Competition injury rates were higher than practice injury rates, and more than five-fold higher for men's football and ice hockey. This difference might be attributable to a higher intensity of activity during competitions compared with practices; in most sports, the proportion of injuries requiring ≥ 7 days before return to full participation was higher in competitions than in practices. However, a larger number of injuries occurred during practices than competition, because there were nearly 4.5 times as many practice athlete-exposures as competition athlete-exposures. Approximately one in five practice injuries required \geq 7 days before return to full participation. Major injuries, such as concussion or those resulting in surgery or emergency transport, occurred commonly in both competition and practice. Injury prevention strategies that target not only competition, but also the more controlled practice environment, might provide additional opportunities to reduce injury incidence.

The findings in this report are subject to at least four limitations. First, not all sports have athletic trainers present at every practice; therefore, practice and overall injury rates might be underreported and thus underestimated in certain sports. Second, these data are descriptive and cannot be used to ascertain reasons for the various injury rates. Third, multiple years of data were required to be combined to provide stable



FIGURE 2. Competition and practice injury rates per 1,000 athlete-exposures and competition/practice rate ratios, by 25 championship sports — National Collegiate Athletic Association Injury Surveillance Program, United States, 5 academic years, 2009–10 through 2013–14

Championship sport

annual estimates. For methodologic reasons, it cannot be ascertained whether rates have changed over time. Additional years of injury surveillance will aid detection of changes in injury incidence and severity. Finally, although weights were used to calculate national rate estimates, these data are drawn from reports from participating teams, which amounts to a convenience sample and not a random sample. Thus, these data might not be generalizable to all teams in all NCAA member schools.

Sports injury data, such as those collected by NCAA-ISP, have been used to describe the incidence of injury, develop and evaluate various rule and policy changes (e.g., changing football kickoff and touchback yard lines to reduce injuries*), guide resource allocation, and focus injury prevention efforts (2,4–10). NCAA-ISP data are now available online to researchers to aid in their analyses of sports injuries and in their development of strategies for injury prevention.[†]

Summary

What is already known on this topic?

The risk for injury to college athletes varies by the sport played, the sex of the athlete, and whether the athlete is engaged in practice or competition.

What is added by this report?

Data from the National Collegiate Athletic Association Injury Surveillance Program indicate that, among men's sports, the highest injury rates are in football and wrestling. For women, the highest injury rates are in soccer and gymnastics. Estimated injury rates are higher during competition than during practice. However, the majority of injuries overall and within most sports occur during practices because they are conducted more frequently than competitions.

What are the implications for public health practice?

Injury prevention strategies that target practices as well as competitions might provide additional opportunities for reduction in injury incidence. Injury surveillance data can be used to compare injury incidence across sports, develop and evaluate rule and policy changes, and focus injury prevention research and programs. Continual analysis of surveillance data will help to understand changes in the incidence and severity of college sports injuries.

^{*} Additional information available at http://www.ncaa.org/about/resources/mediacenter/news/playing-rules-oversight-panel-approves-rules-changes-football.

[†]Additional information available at http://www.datalyscenter.org/index.php.

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