SUMMARY REPORT

NATIONAL HIGH SCHOOL SPORTS-RELATED INJURY SURVEILLANCE STUDY

2016-2017 School Year

Compiled by:

R. Dawn Comstock, PhD

Lauren A. Pierpoint, MS

Alexandria N. Erkenbeck, MPH

Jonathan Bihl, BS, ATC

Acknowledgements

We thank the certified athletic trainers (ATs) 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. The content of this report was funded in part by the Centers for Disease Control and Prevention (CDC) grants #R49/CE000674-01 and #R49/CE001172-01. The content of this report is solely the responsibility of the authors and does not necessarily represent the official views of the CDC. We would also like to acknowledge the generous research funding contributions of the National Federation of State High School Associations (NFHS), National Operating Committee on Standards for Athletic Equipment (NOCSAE), and DonJoy Orthotics.

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.

For reprints/further information contact:
R. Dawn Comstock, PhD
Professor
Epidemiology, Colorado School of Public Health
Program for Injury Prevention, Education, and Research (PIPER) program

13001 E. 17th Place, Mailstop B119
Aurora, CO 80045
(303) 724-7881 phone
(303) 724-4489 fax
highschoolrio@ucdenver.edu

Contents

_Toc290547229

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 7.9 million in 2016-17. 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. Through the generous contributions of the Centers for Disease Control and Prevention (CDC) and the National Federation of State High School Associations (NFHS), the National High School Sports-Related Injury Surveillance System was able to be continued during the 2016-17 school year. Previous study years were funded by the Centers for Disease Control and Prevention (CDC), National Federation of State High School Associations (NFHS), the National Operating Committee on Standards for Athletic Equipment (NOCSAE), the Research Institute at Nationwide Children's Hospital, DonJoy Orthotics, EyeBlack, and The Ohio State University.

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 2016-17 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, dental injury, or exertional heat event 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 (AT) 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. Due to lower enrollment this year, strata were first filled with schools reporting for all 9 original sports followed by schools reporting for 5 or more sports. Strata were then filled with schools reporting for any one of the 9 sports in an attempt to have 100 schools reporting for each sport, and to ensure equal distribution of schools between the 8 strata. Participating ATs were offered a $300-$400 honorarium depending on the number of sports reported along with individualized injury reports following the study's conclusion.

1.6 Data Collection

Each AT 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 AT was asked

to complete 47 weekly exposure reports: one for each week from July 25, 2016 through June 18, 2017. 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 AT 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 ATs 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 9.4 and SPSS, version 24.0. 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, 2016-17 School Year*

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Overall total	3,324	**1,591,276**	2.09	1,160,321
Competition	1,929	**450,991**	4.28	699,410
Practice	1,395	**1,140,285**	1.22	460,911
Boys' football total	1516	425,630	3.56	444,281
Competition	852	73,764	11.55	252,462
Practice	664	351,866	1.89	191,819
Boys' soccer total	241	164,433	1.47	145,215
Competition	165	50,702	3.25	98,031
Practice	76	113,731	0.67	47,184
Girls' soccer total	324	131,618	2.46	190,436
Competition	248	41,929	5.91	146,696
Practice	76	89,689	0.85	43,740
Girls' volleyball total	162	142,818	1.13	46,601
Competition	80	47,994	1.67	23,886
Practice	82	94,824	0.86	22,715
Boys' basketball total	309	201,033	1.54	88,927
Competition	165	62,175	2.65	46,251
Practice	144	138,858	1.04	42,676
Girls' basketball total	267	142,869	1.87	70,700
Competition	167	46,033	3.63	44,660
Practice	100	96,836	1.03	26,040
Boys' wrestling total	246	121,765	2.02	67,834
Competition	120	31,871	3.77	34,405
Practice	126	89,894	1.40	33,429
Boys' baseball total	110	149,564	0.74	36,395
Competition	69	55,885	1.23	21,458
Practice	41	93,679	0.44	14,937
Girls' softball total	149	111,546	1.34	69,932
Competition	63	40,638	1.55	31,561
Practice	86	70,908	1.21	38,371

*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, 2016-17 School Year*

	≥1 days time loss	<1 day time loss	Time loss data missing	Total
Overall	**94.0%**	**1.0%**	**5.0%**	**100.0%**
Boys' football	92.5%	1.1%	6.4%	**100.0%**
Boys' soccer	95.2%	1.2%	3.6%	**100.0%**
Girls' soccer	94.1%	1.8%	4.1%	**100.0%**
Girls' volleyball	93.1%	0.0%	6.9%	**100.0%**
Boys' basketball	95.0%	1.0 %	4.0%	**100.0%**
Girls' basketball	96.0%	1.1%	2.9%	**100.0%**
Boys' wrestling	96.5%	0.0%	3.5%	**100.0%**
Boys' baseball	94.0%	0.9%	5.1%	**100.0%**
Girls' softball	98.7%	0.0%	1.3%	**100.0%**

*By study definition, non-time loss injuries were fractures, concussions, dental injuries, and exertional heat events. Because they accounted for 1% of all injuries overall, 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, 2016-17 School Year*

	Male n= 740,814	**Female n= 354,480**
Year in School		
Freshman	23.1%	26.5%
Sophomore	24.7%	27.7%
Junior	26.1%	23.7%
Senior	26.1%	22.1%
Total†	**100.0%**	**100.0%**
Age (years)		
Minimum	12	12
Maximum	19	19
Mean (St. Dev.)	15.9 (1.2)	15.8 (1.3)
BMI		
Minimum	14.5	15.6
Maximum	52.0	40.4
Mean (St. Dev.)	24.6 (4.5)	22.6 (3.4)

*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 2.1 Injury Diagnosis by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

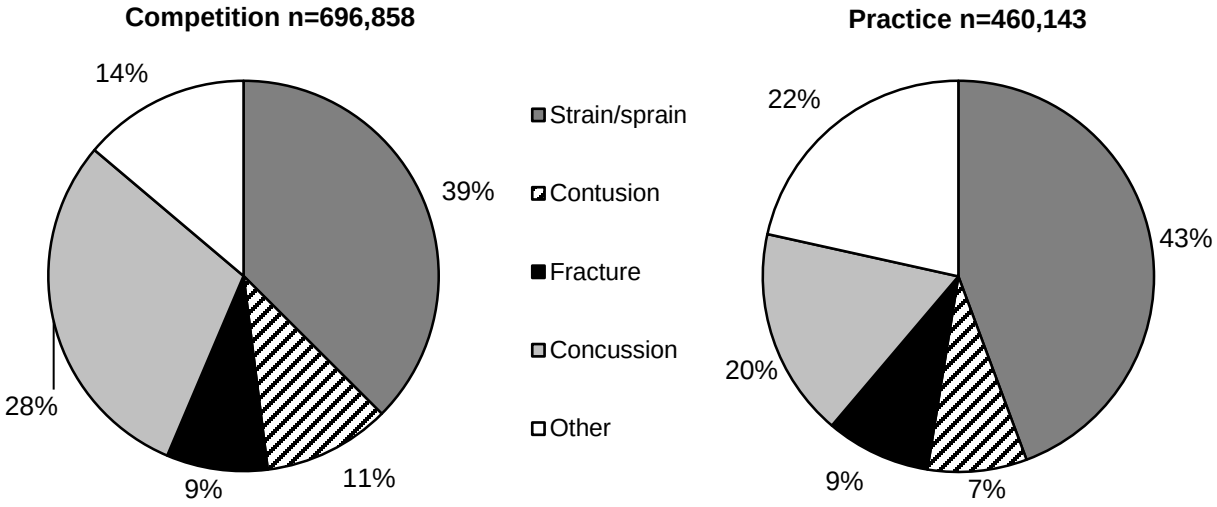


Table 2.4 Body Site of Injury by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Head/face	223,623	32.0%	91,410	19.8%	315,033	27.2%
Ankle	121,560	17.4%	84,906	18.4%	206,466	17.8%
Knee	100,530	14.4%	55,090	12.0%	155,620	13.4%
Hip/thigh/upper leg	44,606	6.4%	60,127	13.0%	104,733	9.0%
Hand/wrist	48,524	6.9%	41,388	9.0%	89,912	7.7%
Shoulder	39,057	5.6%	34,858	7.6%	73,915	6.4%
Lower leg	25,676	3.7%	25,243	5.5%	50,919	4.4%
Trunk	27,603	3.9%	21,755	4.7%	49,358	4.3%
Arm/elbow	26,983	3.9%	16,007	3.5%	42,990	3.7%
Foot	16,359	2.3%	12,426	2.7%	28,785	2.5%
Neck	9,615	1.4%	6,292	1.4%	15,907	1.4%
Other	15,275	2.2%	11,409	2.5%	26,684	2.3%
Total	**699,411**	**100.0%**	**460,911**	**100.0%**	**1,160,322**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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, 2016-17 School Year*

	Male		Female		Total	
	n	% of Ankle Injuries	n	% of Ankle Injuries	n	% of Ankle Injuries
Ankle Ligament Injuries						
Anterior talofibular ligament	79,659	70.5%	65,436	76.6%	145,095	73.1%
Calcaneofibular ligament	34,272	30.3%	27,784	32.5%	62,095	31.3%
Anterior tibiofibular ligament	21,640	19.2%	18,265	21.4%	39,905	20.1%
Posterior talofibular ligament	15,596	13.8%	8,389	9.8%	23,985	12.1%
Deltoid ligament	9,128	8.1%	6,097	7.1%	15,225	7.7%
Posterior tibiofibular ligament	9,001	8.0%	4,476	5.2%	13,477	6.8%
Total Ankle Injuries	**112,978**		**85,389**		**198,376**	

*Multiple ligament responses allowed per injury report. Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 2.6 Most Commonly Injured Knee Structures, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Male		Female		Total	
	n	% of Knee Injuries	n	% of Knee Injuries	n	% of Knee Injuries
Knee Ligament Injuries						
Medial collateral ligament	29,398	29.2%	10,086	20.5%	39,484	26.4%
Patella and/or patellar tendon	19,390	19.3%	16,906	34.4%	36,296	24.2%
Torn cartilage (meniscus)	19,708	19.6%	10,191	20.7%	29,899	20.0%
Anterior cruciate ligament	17,762	17.7%	13,444	27.4%	31,206	20.8%
Lateral collateral ligament	4,920	4.9%	3,355	6.8%	8,275	5.5%
Posterior cruciate ligament	2,378	2.4%	236	0.5%	2,614	1.7%
Total Knee Injuries	**100,578**		**49,143**		**149,721**	

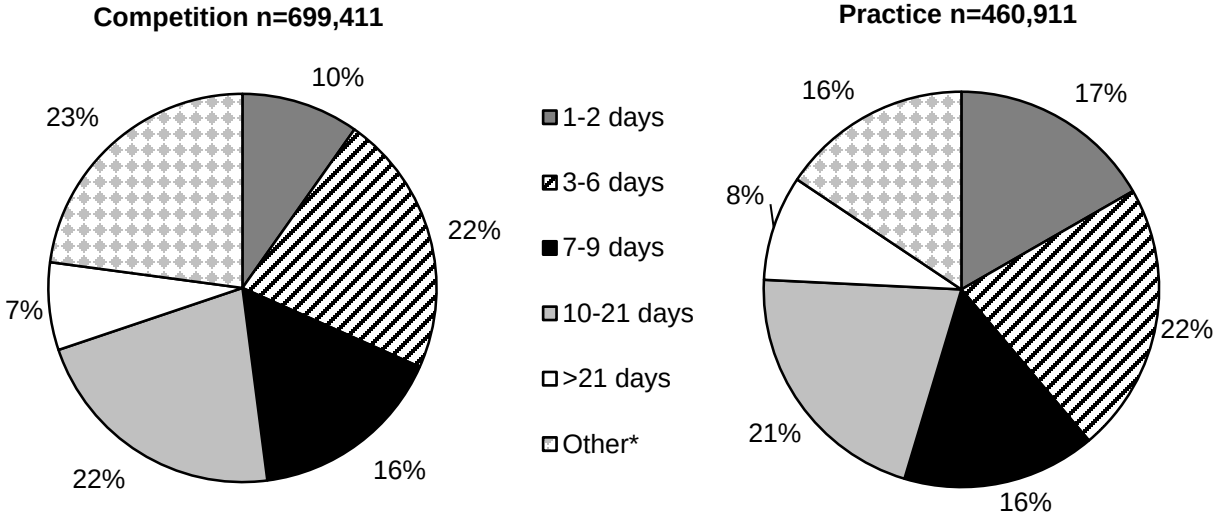
*Multiple ligament responses allowed per injury report. Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Table 2.7 Ten Most Common Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition n=696,861		Practice n=460,142		Overall n= 1,157,003	
	N	%	n	%	n	%
Diagnosis						
Head/face concussion	207,473	29.8%	79,490	17.3%	286,963	24.8%
Ankle strain/sprain	115,003	16.5%	76,284	16.6%	191,287	16.5%
Knee strain/sprain	54,110	7.8%	25,901	5.6%	80,011	6.9%
Hip/thigh/upper leg strain/sprain	27,340	3.9%	47,285	10.3%	74,625	6.4%
Knee other	35,052	5.0%	21,638	4.7%	56,690	4.9%
Hand/wrist fracture	20,941	3.0%	19,232	4.2%	40,173	3.5%
Shoulder other	21,860	3.1%	17,387	3.8%	39,247	3.4%
Shoulder strain/sprain	15,159	2.2%	16,560	3.6%	31,719	2.7%
Hand/wrist strain/sprain	15,003	2.2%	8,421	1.8%	23,424	2.0%
Trunk strain/sprain	9,173	1.3%	12,866	2.8%	22,039	1.9%

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 2.2 Time Loss by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year



*Other category is made up of medical disqualification for season, medical disqualification for career, athlete chooses not to continue, and season ended before athlete returned to play

Table 2.8 Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	14,957	8.0%	26,452	5.8%	81,472	7.1%
Did not require surgery	634,830	92.0%	430,788	94.2%	1,065,618	92.9%
Total*	**689,787**	**100.0%**	**457,303**	**100.0%**	**1,147,090**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 2.3 New and Recurring Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

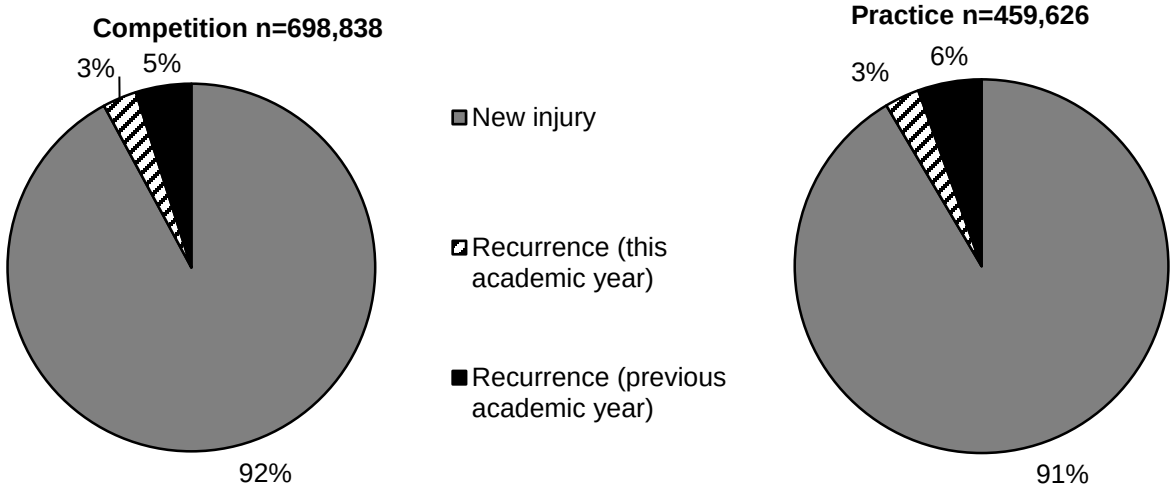


Table 2.9 Time during Season of Injury, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Season		
Preseason	219,152	18.9%
Regular season	893,965	77.2%
Post season	41,436	3.6%
Total	**1,154,553**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries. Unknown was selected in 0.3% of injuries.

Table 2.10 Practice-Related Variables, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Practice		
First ½ hour	40,676	9.1%
Second ½ hour	79,921	17.8%
1-2 hours into practice	220,940	49.2%
>2 hours into practice	30,863	6.9%
Unknown	77,043	17.1%
Total	**449,443**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 2.11 Methods for Injury Evaluation and Assessment, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	n	%
Injuries Evaluated by:*		
Certified athletic trainer	1,066,609	91.9%
Orthopedic physician	243,933	21.0%
General physician	264,938	22.8%
Physician's assistant	12,533	1.1%
Chiropractor	11,959	1.0%
Nurse practitioner	1,755	0.2%
Neurologist/neuropsychologist	6,888	0.6%
Dentist/oral surgeon	154	<0.1%
Other	26,628	2.3%
Total Injuries	**1,160,321**	
Injuries Assessed by:*		
Evaluation	1,139,428	98.2%
X-ray	413,006	35.6%
MRI	129,901	11.2%
CT-scan	35,950	3.1%
Blood work/lab test	6,199	0.5%
Other	12,189	1.1%
Total Injuries	**1,160,321**	

*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, 2016-17 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**1,516**	**425,630**	**3.56**	**444,281**
Competition	852	73,764	11.55	252,462
Practice	664	351,866	1.89	191,819

Table 3.2 Demographic Characteristics of Injured Football Athletes, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

Year in School	**n=431,499**
Freshman	24.7%
Sophomore	25.4%
Junior	25.6%
Senior	24.2%
Total†	**100.0%**
Age (years)	
Minimum	12
Maximum	19
Mean (St. Dev.)	15.8 (1.2)
BMI	
Minimum	14.5
Maximum	52.0
Mean (St. Dev.)	25.8 (4.7)

*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 3.1 Diagnosis of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

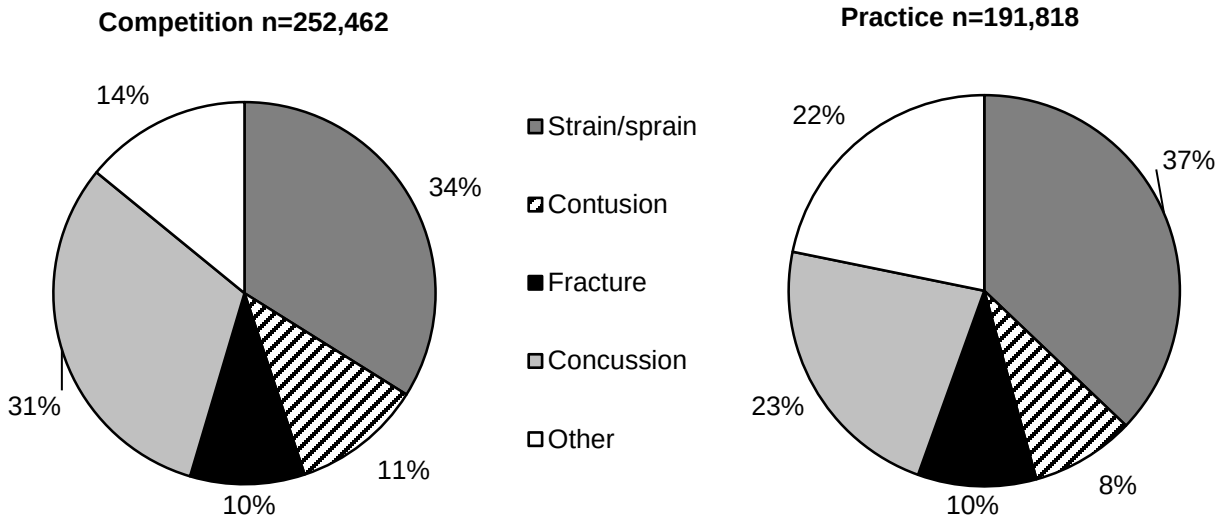


Table 3.3 Body Site of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Body Site						
Head/face	80,729	32.0%	46,023	24.0%	126,752	28.5%
Knee	41,105	16.3%	22,702	11.8%	63,807	14.4%
Ankle	31,845	12.6%	23,027	12.0%	54,872	12.4%
Hand/wrist	18,343	7.3%	22,455	11.7%	40,798	9.2%
Shoulder	21,051	8.3%	16,528	8.6%	37,579	8.5%
Hip/thigh/upper leg	11,128	4.4%	22,175	11.6%	33,303	7.5%
Trunk	9,613	3.8%	9,104	4.7%	18,717	4.2%
Lower leg	10,191	4.0%	7,047	3.7%	17,238	3.9%
Foot	3,609	1.4%	5,770	3.0%	9,379	2.1%
Arm/elbow	13,549	5.4%	5,546	2.9%	19,095	4.3%
Neck	4,750	1.9%	3,996	2.1%	8,746	2.0%
Other	6,549	2.6%	7,445	3.9%	13,994	3.1%
Total	**252,462**	**100.0%**	**191,818**	**100.0%**	**444,280**	**100.0%**

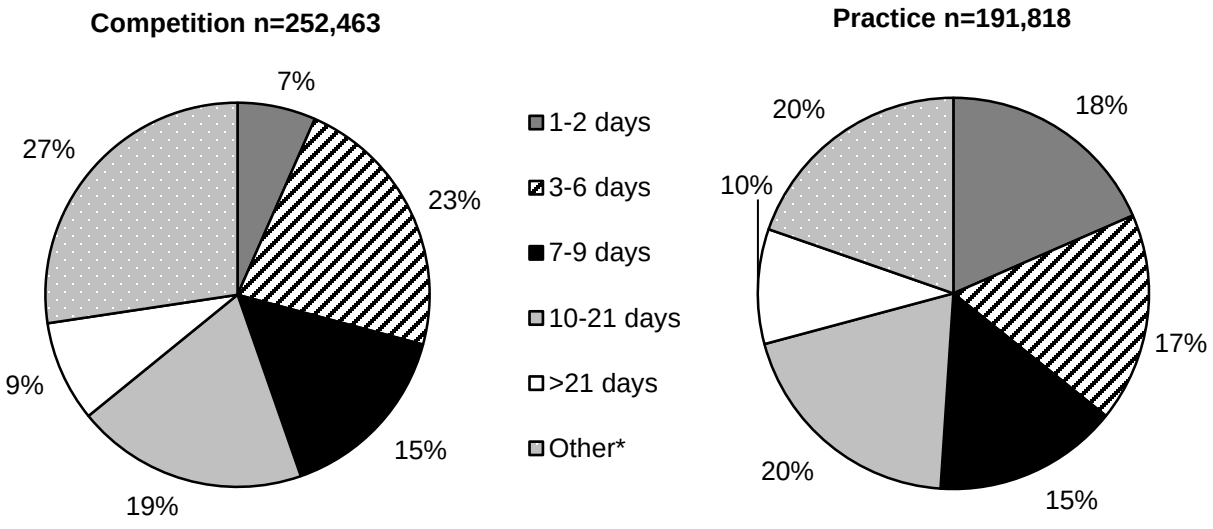
* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Table 3.4 Ten Most Common Football Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition n=251,955		Practice n=191,518		Total n=443,473	
	n	%	n	%	n	%
Diagnosis						
Head/face concussion	78,904	31.3%	43,468	22.7%	122,372	27.6%
Ankle strain/sprain	29,530	11.7%	20,955	10.9%	50,485	11.4%
Knee strain/sprain	24,295	9.6%	12,937	6.8%	37,232	8.4%
Hip/thigh/upper leg strain/sprain	5,275	2.1%	16,872	8.8%	22,147	5.0%
Shoulder other	10,479	4.2%	9,586	5.0%	20,065	4.5%
Hand/wrist fracture	8,613	3.4%	10,687	5.6%	19,300	4.4%
Knee other	10,182	4.0%	5,742	3.0%	15,924	3.6%
Shoulder sprain/strain	9,298	3.7%	6,467	3.4%	15,765	3.6%
Knee contusion	6,026	2.4%	3,671	1.9%	9,697	2.2%
Other other	2,673	1.1%	5,689	3.0%	8,362	1.9%

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 3.2 Time Loss of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year



*Other category is made up of medical disqualification for season, medical disqualification for career, athlete chooses not to continue, and season ended before athlete returned to play

Table 3.5 Football Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	24,329	9.8%	12,858	6.8%	37,187	8.5%
Did not require surgery	224,281	90.2%	177,421	93.2%	401,702	91.5%
Total	**248,610**	**100.0%**	**190,279**	**100.0%**	**438,889**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 3.3 History of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

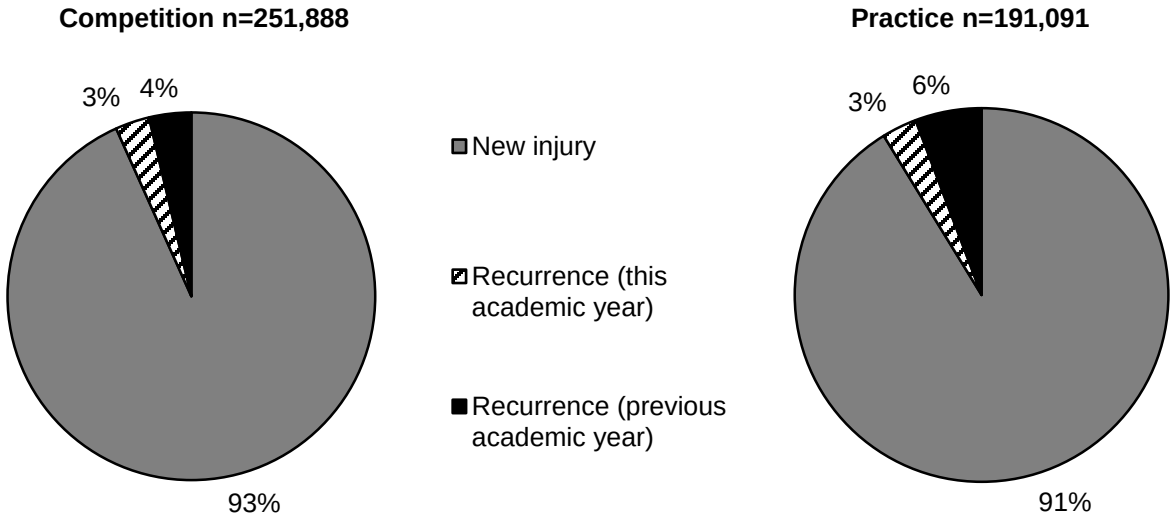


Table 3.6 Time during Season of Football Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Season		
Preseason	105,789	23.9%
Regular season	317,726	71.7%
Post season	17,039	3.8%
Unknown	2,753	0.6%
Total	**443,306**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 3.7 Competition-Related Variables for Football Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Competition		
Pre-competition/warm-ups	504	0.2%
First quarter	31,473	13.7%
Second quarter	72,005	31.3%
Third quarter	71,893	31.3%
Fourth quarter	53,675	23.4%
Overtime	228	0.1%
Total	**229,779**	**100.0%**
Field Location		
Between the 20 yard lines	160,842	69.6%
Red zone (20 yard line to goal line)	33,095	14.3%
End zone	2,659	1.1%
Off the field	1,797	0.8%
Unknown	32,846	14.2%
Total	**231,239**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 3.8 Practice-Related Variables for Football Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Practice		
First 1/2 hour	17,878	6.9%
Second 1/2 hour	32,075	17.1%
1-2 hours into practice	103,222	55.2%
>2 hours into practice	17,560	9.4%
Unknown	16,363	8.7%
Total	**187,098**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 3.4 Player Position of Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

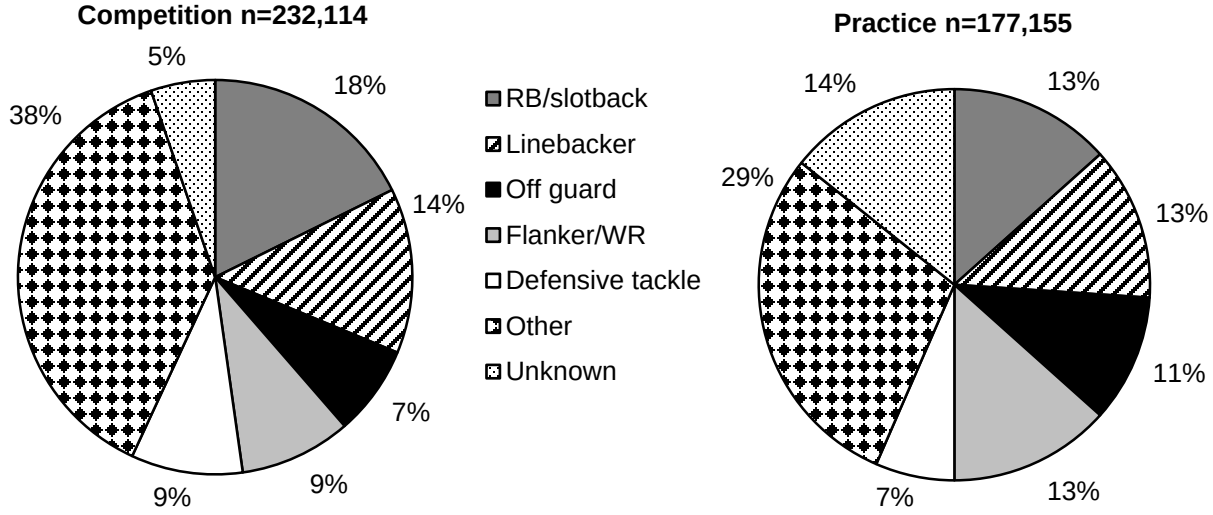


Table 3.9 Activities Leading to Football Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
Tackling	59,761	25.3%	26,040	14.3%	85,801	20.5%
Being tackled	75,385	32.0%	32,333	17.7%	107,718	25.8%
blocking	39,064	16.6%	32,945	18.0%	72,009	17.2%
being blocked	18,040	7.7%	11,904	6.5%	29,944	7.2%
Stepped on/fell on/kicked	14,436	6.1%	9,098	5.0%	23,534	5.6%
Contact with ball	188	0.1%	6,114	3.3%	6,302	1.5%
Contact with blocking dummy	0	0.0%	3,605	2.0%	3,605	0.9%
Rotation around a planted foot/inversion	5,520	2.3%	11,483	6.3%	17,003	4.1%
Uneven playing surface	0	0.0%	2,354	1.3%	2,354	0.6%
n/a	3,463	1.5%	20,787	11.4%	24,250	5.8%
Contact with goal post/yard marker	0	0.0%	432	0.2%	432	0.1%
Other	8,261	3.5%	14,727	8.1%	22,988	5.5%
Unknown	11,648	4.9%	10,734	5.9%	22,382	5.4%
Total	**235,766**	**100.0%**	**182,556**	**100.0%**	**418,322**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 3.10 Activity Resulting in Football Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Diagnosis									
	Strain/Sprain		Contusion		Fracture		Concussion		Other	
	n	%	n	%	n	%	n	%	n	%
Activity										
Being tackled	32,550	21.7%	15,258	36.6%	14,722	35.5%	31,034	27.2%	13,646	19.4%
Tackling	20,006	13.3%	8,722	20.9%	8,625	20.8%	35,817	31.4%	12,632	18.0%
Blocking	29,865	19.9%	8,230	19.8%	3,491	8.4%	19,157	16.8%	11,029	15.7%
Being blocked	7,452	5.0%	3,001	7.2%	3,822	9.4%	11,865	10.4%	3,805	5.4%
No contact (overuse/illness)	9,139	6.1%	0	0.0%	195	0.5%	0	0.0%	14,917	21.3%
Unknown	6,099	4.1%	1,233	3.0%	922	2.2%	11,329	9.9%	2,800	4.0%
Other	45,182	30.1%	5,190	12.5%	9,668	23.3%	4,774	4.2%	11,342	16.2%
Total	**150,293**	**100.0 %**	**41,634**	**100.0%**	**41,445**	**100.0%**	**113,976**	**100.0%**	**70,171**	**100.0%**

IV. Boys' Soccer Injury Epidemiology

Table 4.1 Boys' Soccer Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**241**	**164,433**	**1.47**	**145,215**
Competition	165	50,702	3.25	98,031
Practice	76	113,731	0.67	47,184

Table 4.2 Demographic Characteristics of Injured Boys' Soccer Athletes, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

Year in School	**n= 141,944**
Freshman	21.9%
Sophomore	26.0%
Junior	20.0%
Senior	32.1%
Total†	**100.0%**
Age (years)	
Minimum	12
Maximum	19
Mean (St. Dev.)	15.9 (1.3)
BMI	
Minimum	17.0
Maximum	37.8
Mean (St. Dev.)	22.6 (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, 2016-17 School Year

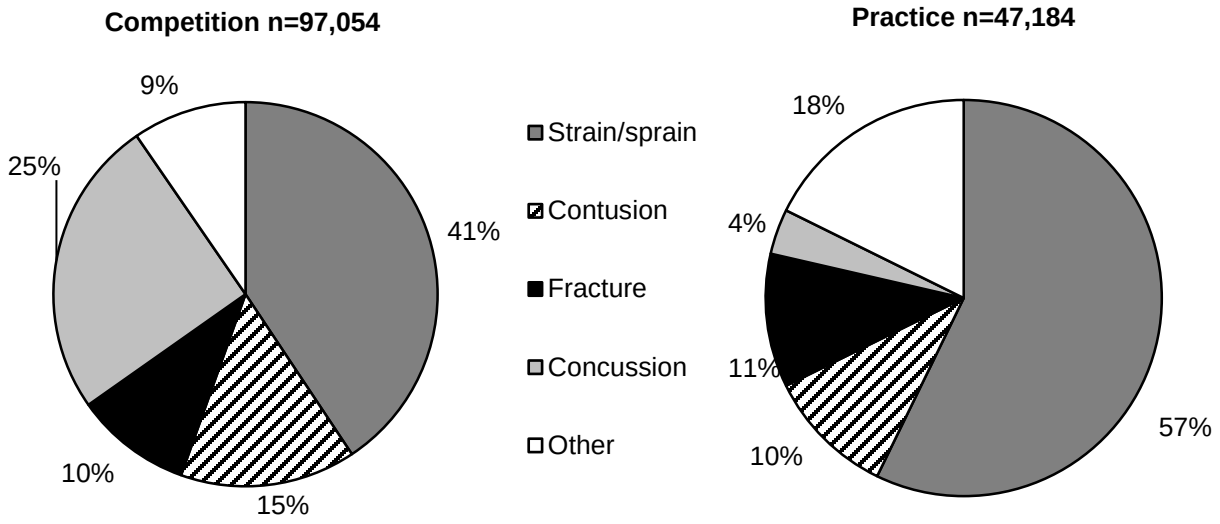


Table 4.3 Body Site of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Head/face	25,462	26.0%	2,244	4.8%	27,706	19.1%
Hip/thigh/upper leg	11,209	11.4%	15,481	32.8%	26,690	18.4%
Knee	12,275	12.5%	2,395	5.1%	14,670	10.1%
Ankle	21,292	21.7%	6,339	13.4%	27,631	19.0%
Hand/wrist	7,808	8.0%	4,659	9.9%	12,467	8.6%
Trunk	5,590	5.7%	2,738	5.8%	8,328	5.7%
Lower leg	4,752	4.8%	7,410	15.7%	12,162	8.4%
Foot	2,175	2.2%	2,187	4.6%	4,362	3.0%
Arm/elbow	873	0.9%	1,210	2.6%	2,083	1.4%
Shoulder	2,488	2.5%	907	1.9%	3,395	2.3%
Neck	977	1.0%	0	0.0%	977	0.7%
Other	3,131	3.2%	1,614	3.4%	4,745	3.3%
Total	**98,032**	**100.0%**	**47,184**	**100.0%**	**145,216**	**100.0%**

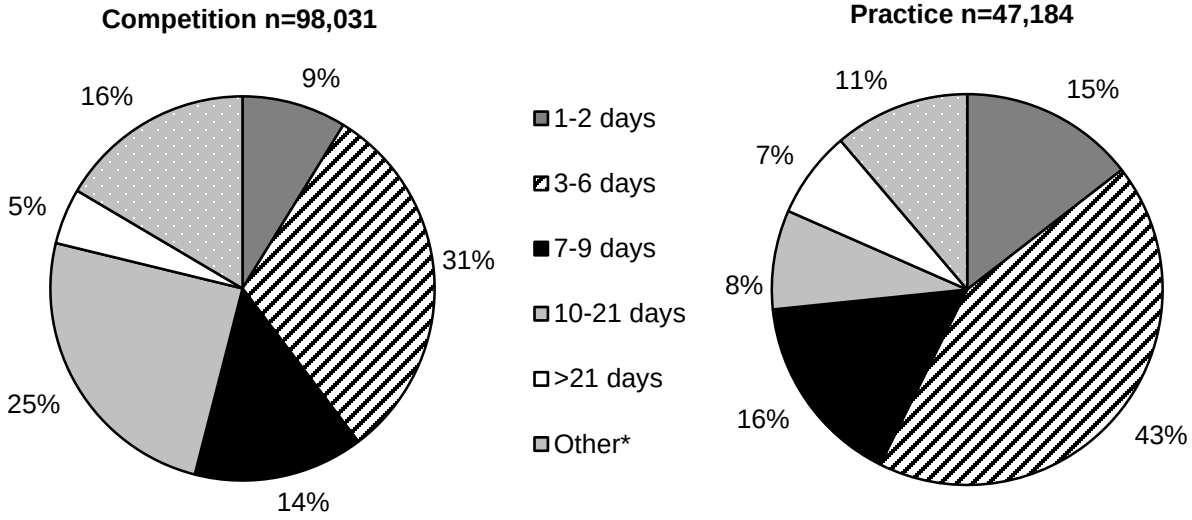
* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Table 4.4 Ten Most Common Boys' Soccer Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition n=97,058		Practice n=47,186		Total n=144,244	
	n	%	n	%	n	%
Diagnosis						
Head/face concussion	24,414	25.2%	1,729	3.7%	26,143	18.1%
Ankle strain/sprain	19,338	19.9%	6,273	13.3%	25,611	17.8%
Hip/thigh/upper leg strain/sprain	6,098	6.3%	12,784	27.1%	18,882	13.1%
Hand/wrist fracture	4,129	4.3%	2,902	6.2%	7,031	4.9%
Knee sprain/strain	5,257	5.4%	1,456	3.1%	6,713	4.7%
Lower leg contusion	3,306	3.4%	2,420	5.1%	5,726	4.0%
Knee other	5,187	5.3%	469	1.0%	5,656	3.9%
Hip/thigh/upper leg contusion	4,313	4.4%	515	1.1%	4,828	3.3%
Lower leg other	977	1.0%	3,797	8.0%	4,774	3.3%
Hand/wrist sprain/strain	2,469	2.5%	1,275	2.7%	3,744	2.6%

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 4.2 Time Loss of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year



*Other category is made up of medical disqualification for season, medical disqualification for career, athlete chooses not to continue, and season ended before athlete returned to play

Table 4.5 Boys' Soccer Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	4,917	5.1%	711	1.5%	5,628	3.9%
Did not require surgery	91,500	94.9%	45,925	98.5%	137,425	96.1%
Total	**96,417**	**100.0%**	**46,636**	**100.0%**	**143,053**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 4.3 History of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

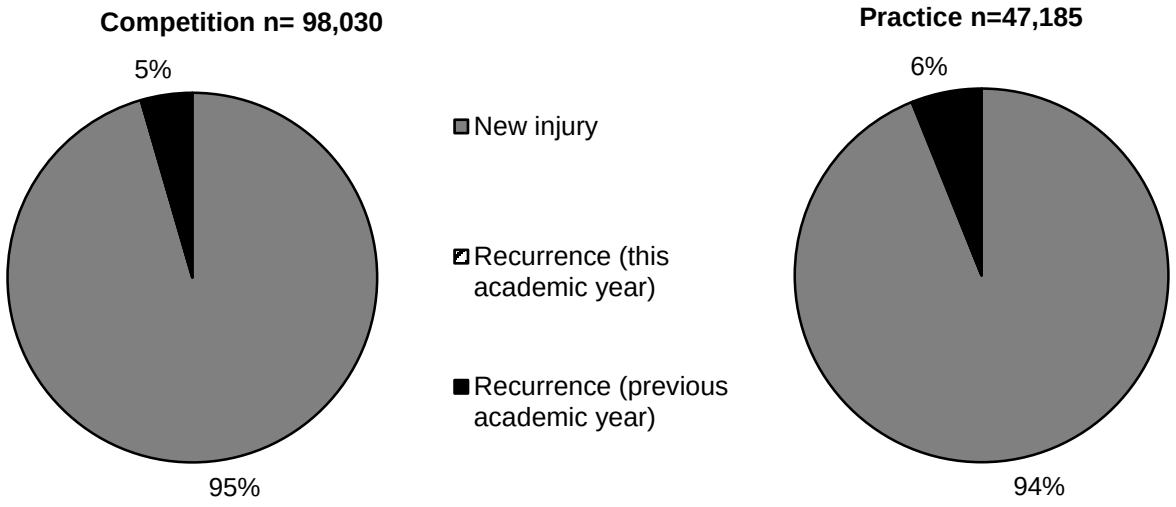


Table 4.6 Time during Season of Boys' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Season		
Preseason	23,675	16.4%
Regular season	111,542	77.3%
Post season	9,020	6.3%
Total	**144,237**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 4.7 Competition-Related Variables for Boys' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Competition		
Pre-competition/warm-ups	3,507	3.7%
First half	22,793	24.2%
Second half	51,712	55.0%
Overtime	217	0.2%
Unknown	15,833	16.8%
Total	**94,062**	**100.0%**
Field Location		
Top of goal box extended to center line(offense)	18,926	20.5%
Top of goal box extended to center line (defense)	15,749	17.1%
Goal box (defense)	12,417	13.5%
Side of goal box (offense)	10,346	11.2%
Side of goal box (defense)	6,465	7.0%
Goal box (offense)	3,415	3.7%
Unknown	24,796	26.9%
Total	**92,114**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 4.8 Practice-Related Variables for Boys' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Practice		
First 1/2 hour	3,134	6.7%
Second 1/2 hour	11,308	24.2%
1-2 hours into practice	20,722	44.4%
>2 hours into practice	1,623	3.5%
Unknown	9,915	21.2%
Total	**46,702**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 4.4 Player Position of Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

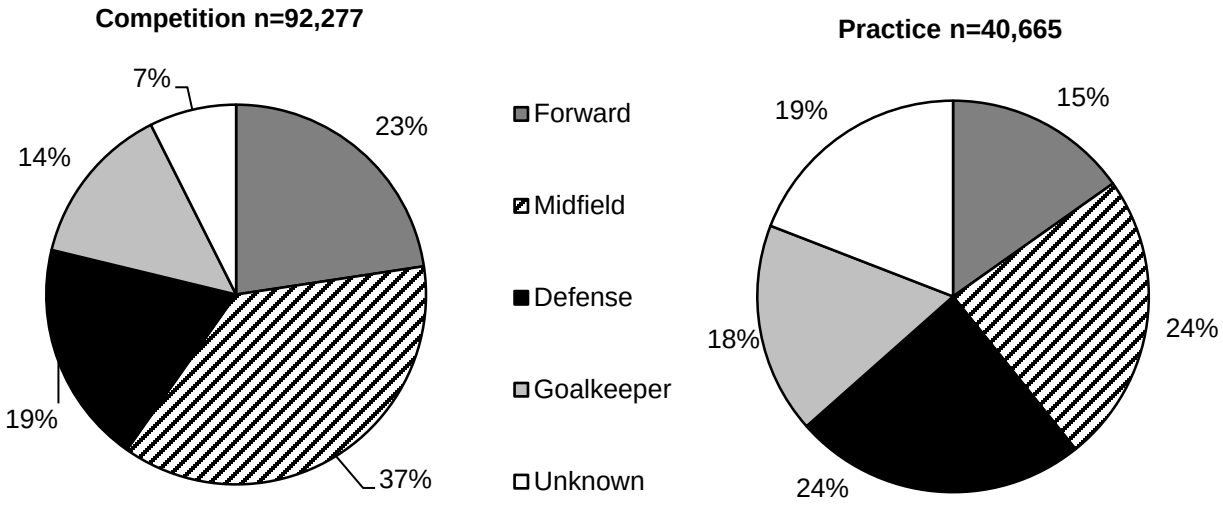


Table 4.9 Activities Leading to Boys' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
Shooting (foot)	5,795	6.2%	2,370	5.8%	8,165	6.1%
Passing (foot)	1,726	1.8%	1,492	3.7%	3,218	2.4%
Receiving pass	6,390	6.8%	0	0.0%	6,390	4.7%
Ball handling/dribbling	10,075	10.7%	2,521	6.2%	12,596	9.3%
Defending	11,876	12.6%	2,338	5.7%	14,214	10.5%
Blocking shot	4,283	4.6%	2,187	5.4%	6,470	4.8%
Chasing loose ball	6,796	7.2%	131	0.3%	6,927	5.1%
Heading ball	6,544	7.0%	217	0.5%	6,761	5.0%
Attempting a slide tackle	1,381	1.5%	0	0.0%	1,381	1.0%
Receiving a slide tackle	1,275	1.4%	1,210	3.0%	2,485	1.8%
Goaltending	8,248	8.8%	5,808	14.3%	14,056	10.4%
Conditioning	0	0.0%	6,482	15.9%	6,482	4.8%
General play	15,538	16.5%	14,715	36.1%	30,253	22.4%
Other	2,886	3.1%	0	0.0%	2,886	2.1%
Unknown	11,248	12.0%	1,259	3.1%	12,507	9.3%
Total	**94,061**	**100.0%**	**40,730**	**100.0%**	**134,791**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 4.10 Activity Resulting in Boys' Soccer Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Diagnosis									
	Strain/Sprain		Contusion		Fracture		Concussion		Other	
	n	%	n	%	n	%	n	%	n	%
Activity										
General Play	20,310	34.0%	2,714	14.1%	777	6.2%	2,808	10.9%	2,665	16.2%
Chasing loose ball	2,239	3.7%	0	0.0%	2,521	20.1%	2,167	8.4%	0	0.0%
Defending	4,896	8.2%	2,113	10.9%	2,902	23.2%	3,788	14.7%	515	3.1%
Shooting	7,005	11.7%	0	0.0%	580	4.6%	0	0.0%	580	3.5%
Heading ball	907	1.5%	131	0.7%	0	0.0%	5,505	21.3%	217	1.3%
Unknown	2,039	3.4%	2,187	11.3%	66	0.5%	4,603	17.8%	3,614	22.0%
Other	22,331	37.4%	12,171	63.0%	5,686	45.4%	6,926	26.8%	8,857	53.8%
Total	**59,727**	**100.0%**	**19,316**	**100.0%**	**12,532**	**100.0%**	**25,797**	**100.0%**	**16,448**	**100.0%**

V. Girls' Soccer Injury Epidemiology

Table 5.1 Girls' Soccer Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**324**	**131,618**	**2.46**	**190,436**
Competition	248	41,929	5.91	146,696
Practice	76	89,689	0.85	43,740

Table 5.2 Demographic Characteristics of Injured Girls' Soccer Athletes, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

Year in School	**n=183,781**
Freshman	25.7%
Sophomore	24.6%
Junior	26.2%
Senior	23.4%
Total†	**100.0%**
Age (years)	
Minimum	13
Maximum	18
Mean (St. Dev.)	15.9 (1.3)
BMI	
Minimum	15.9
Maximum	36.3
Mean (St. Dev.)	22.1 (2.7)

*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, 2016-17 School Year

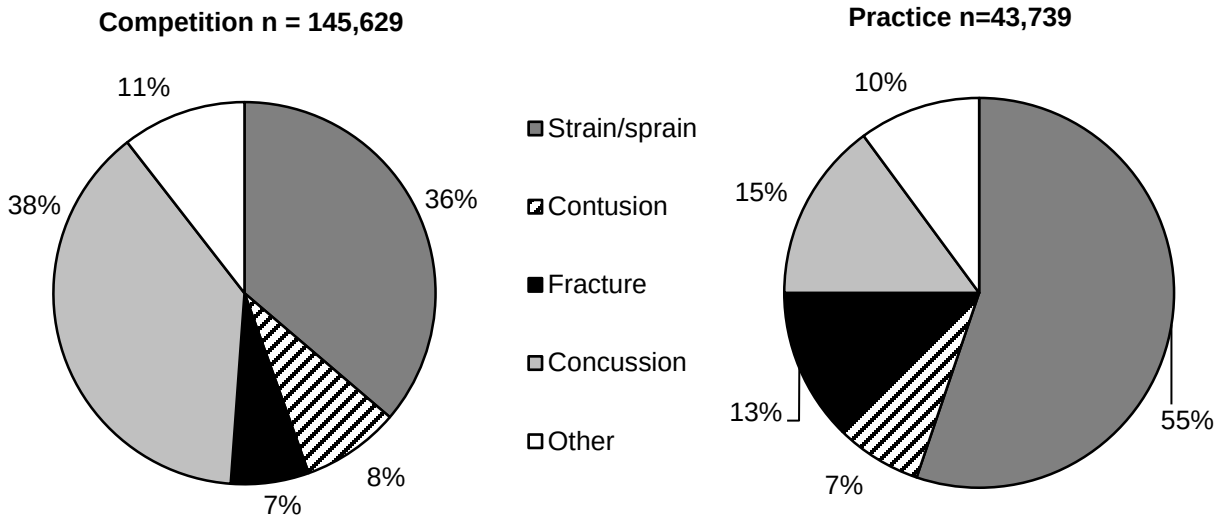


Table 5.3 Body Site of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Head/face	57,179	39.0%	6,519	14.9%	63,698	33.4%
Ankle	28,368	19.3%	15,015	34.3%	43,383	22.8%
Knee	20,576	14.0%	5,110	11.7%	25,686	13.5%
Hip/thigh/upper leg	9,676	6.6%	8,694	19.9%	18,370	9.6%
Lower leg	5,096	3.5%	2,419	5.5%	7,515	3.9%
Foot	5,303	3.6%	2,096	4.8%	7,399	3.9%
Arm/elbow	4,597	3.1%	1,529	3.5%	6,126	3.2%
Hand/wrist	5,120	3.5%	470	1.1%	5,590	2.9%
Trunk	3,417	2.3%	1,478	3.4%	4,895	2.6%
Shoulder	2,819	1.9%	409	0.9%	3,228	1.7%
Neck	2,606	1.8%	0	0.0%	2,606	1.4%
Other	1,939	1.3%	0	0.0%	1,939	1.0%
Total	**146,696**	**100.0%**	**43,739**	**100.0%**	**190,435**	**100.0%**

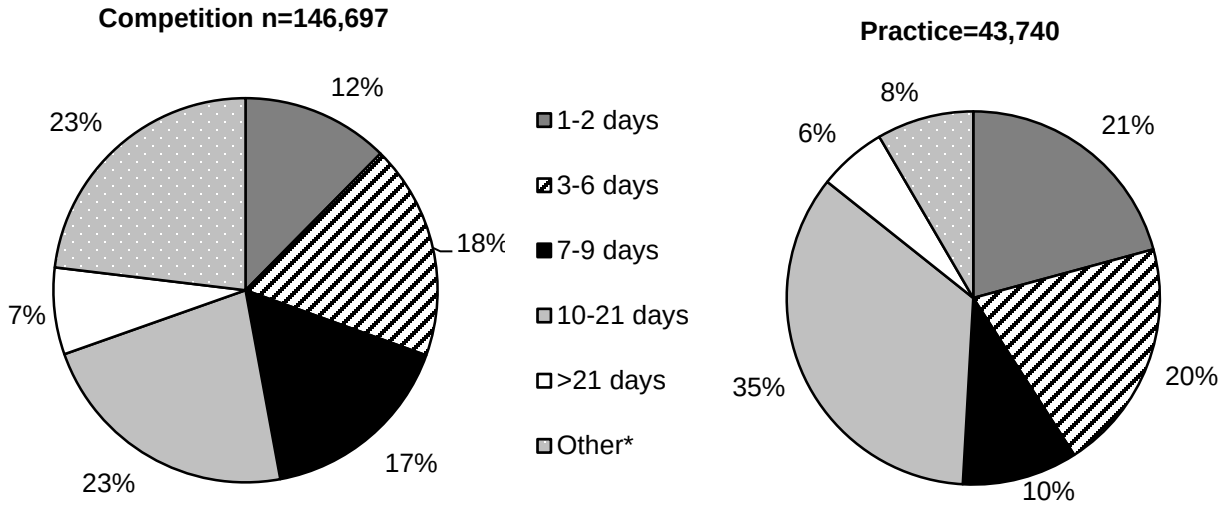
* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Table 5.4 Ten Most Common Girls' Soccer Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition n=145,624		Practice n=43,738		Total n=189,362	
	n	%	n	%	n	%
Diagnosis						
Head/face concussion	55,766	40.5%	6,519	17.5%	62,285	33.2%
Ankle strain/sprain	27,834	17.8%	11,896	22.1%	39,730	19.2%
Hip/thigh/upper leg strain/sprain	6,959	14.0%	7,627	8.9%	14,586	12.4%
Knee sprain/strain	11,963	5.2%	1,931	9.6%	13,894	6.6%
Knee other	7,095	3.7%	1,650	12.0%	8,745	6.4%
Lower leg other	2,593	0.9%	1,885	8.2%	4,478	3.2%
Arm/elbow fracture	2,657	2.6%	1,529	0.0%	4,186	1.8%
Foot contusion	3,357	2.2%	533	0.0%	3,890	1.5%
Hand/wrist fracture	3,417	0.1%	410	3.8%	3,827	1.3%
Hip/thigh/upper leg contusion	2,657	1.8%	1,529	0.1%	3,725	1.3%

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 5.2 Time Loss of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year



*Other category is made up of medical disqualification for season, medical disqualification for career, athlete chooses not to continue, and season ended before athlete returned to play

Table 5.5 Girls' Soccer Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	7,758	5.4%	1,870	4.3%	9,628	5.1%
Did not require surgery	136,333	94.6%	41,583	95.7%	177,916	94.9%
Total	**144,091**	**100.0%**	**43,453**	**100.0%**	**187,544**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 5.3 History of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

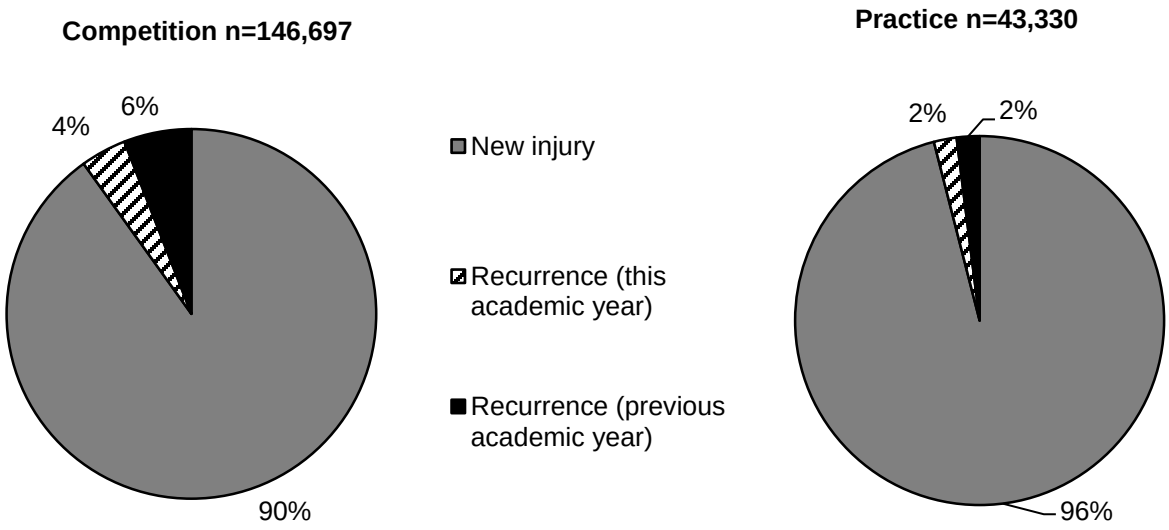


Table 5.6 Time during Season of Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Season		
Preseason	18,989	10.0%
Regular season	170,032	89.3%
Post season	1354	0.7%
Total	**190,376**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 5.7 Competition-Related Variables for Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Competition		
Pre-competition/warm-ups	7,405	5.3%
First half	37,345	27.0%
Second half	70,172	50.7%
Unknown	23,558	17.0%
Total	**138,481**	**100.0%**
Field Location		
Goal box (defense)	28,470	20.8%
Top of goal box extended to center line (offense)	23,761	17.3%
Top of goal box extended to center line (defense)	12,996	9.5%
Goal box (offense)	12,674	9.3%
Side of goal box (offense)	8,967	6.5%
Side of goal box (defense)	8,112	5.9%
off the field	1,636	1.2%
Unknown	40,335	29.5%
Total	**136,952**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 5.8 Practice-Related Variables for Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Practice		
First 1/2 hour	3,946	9.3%
Second 1/2 hour	5,371	12.6%
1-2 hours into practice	13,540	31.8%
>2 hours into practice	1,226	2.9%
Unknown	18,469	43.4%
Total	**42,552**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 5.4 Player Position of Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

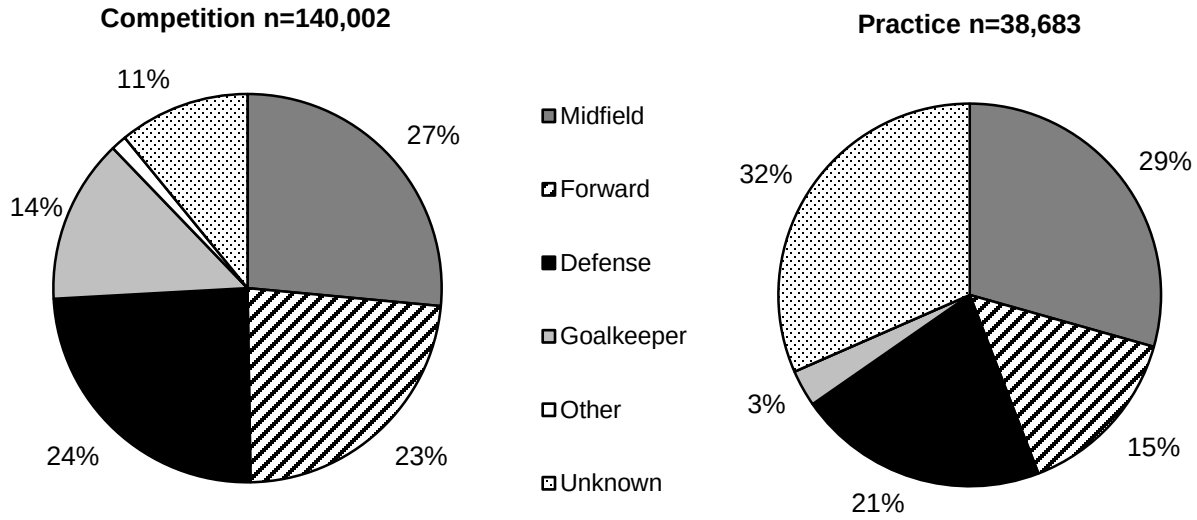


Table 5.9 Activities Leading to Girls' Soccer Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
General play	18,295	13.2%	10,336	26.6%	28,631	16.1%
Defending	24,284	17.5%	3,521	9.0%	27,805	15.6%
Heading ball	15,491	11.1%	3,626	9.3%	19,117	10.7%
Ball handling/dribbling	13,979	10.1%	3,408	8.8%	17,387	9.8%
Goaltending	14,668	10.6%	594	1.5%	15,262	8.6%
Chasing loose ball	11,137	8.0%	2,286	5.9%	13,423	7.5%
Passing (foot)	8,481	6.1%	1,601	4.1%	10,082	5.7%
Shooting (foot)	5,287	3.8%	1,661	4.3%	6,948	3.9%
Blocking shot	4,059	2.9%	594	1.5%	4,653	2.6%
Conditioning	0	0.0%	3,894	10.0%	3,894	2.2%
Receiving pass	2,113	1.5%	760	2.0%	2,873	1.6%
Attempting slide tackle	862	0.6%	0	0.0%	862	0.5%
Receiving a slide tackle	60	0.0%	0	0.0%	60	0.0%
Other	1,529	1.1%	1,478	3.8%	3007	1.7%
Unknown	18,689	13.5%	5,151	13.2%	23,840	13.4%
Total	**138,934**	**100.0%**	**38,910**	**100.0%**	**177,844**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 5.10 Activity Resulting in Girls' Soccer Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Diagnosis									
	Strain/Sprain		Contusion		Fracture		Concussion		Other	
	n	%	n	%	n	%	n	%	n	%
Activity										
General Play	13,971	19.4%	3,191	20.9%	3,540	23.3%	2,802	4.9%	5,127	28.7%
Defending	9,430	13.1%	3,059	20.0%	3,827	25.2%	9,952	17.3%	1,538	8.6%
Heading ball	2,123	3.0%	1,529	10.0%	1,529	10.1%	13,406	23.3%	530	3.0%
Ball handling	12,072	16.8%	0	0.0%	1,529	10.1%	2,657	4.6%	1,128	6.3%
Chasing loose ball	8,710	12.1%	594	3.9%	60	0.4%	2,521	4.4%	1,537	8.6%
Unknown	3,365	4.7%	227	1.5%	410	2.7%	15,285	26.5%	4,553	25.5%
Other	22,206	30.9%	6,688	43.8%	4,288	28.2%	10,982	19.1%	3,474	19.4%
Total	**71,877**	**100.0%**	**15,288**	**100.0%**	**15,183**	**100.0%**	**57,605**	**100.0%**	**17,887**	**100.0%**

VI. Volleyball Injury Epidemiology

Table 6.1 Volleyball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	162	**142,818**	**1.13**	46,601
Competition	80	47,994	1.67	23,886
Practice	82	94,824	0.86	22,715

Table 6.2 Demographic Characteristics of Injured Volleyball Athletes, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

Year in School	**n=45,171**
Freshman	31.9%
Sophomore	29.8%
Junior	13.2%
Senior	25.1%
Total†	**100.0%**
Age (years)	
Minimum	13
Maximum	18
Mean (St. Dev.)	15.4 (1.3)
BMI	
Minimum	16.3
Maximum	40.2
Mean (St. Dev.)	22.5 (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, 2016-17 School Year

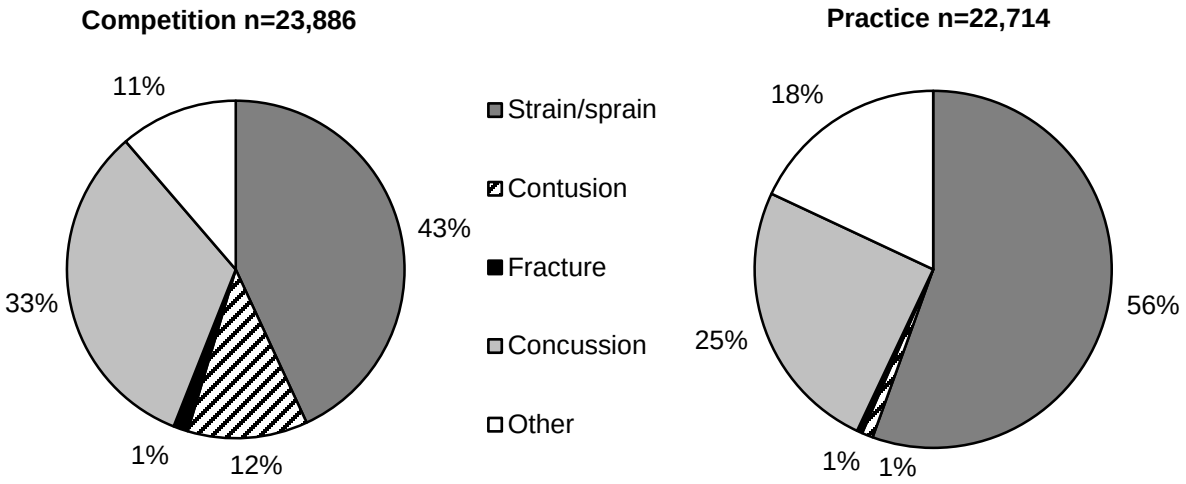


Table 6.3 Body Site of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Head/face	9,734	40.8%	5,798	25.5%	15,532	33.3%
Ankle	5,874	24.6%	6,734	29.6%	12,608	27.1%
Shoulder	918	3.8%	4,097	18.0%	5,015	10.8%
Knee	1,986	8.3%	1,873	8.2%	3,859	8.3%
Hip/thigh/upper leg	1,530	6.4%	1,118	4.9%	2,648	5.7%
Trunk	1,679	7.0%	612	2.7%	2,291	4.9%
Hand/wrist	1,267	5.3%	607	2.7%	1,874	4.0%
Arm/elbow	826	3.5%	0	0.0%	826	1.8%
Neck	73	0.3%	618	2.7%	691	1.5%
Lower leg	0	0.0%	355	1.6%	355	0.8%
Foot	0	0.0%	367	1.6%	367	0.8%
Other	0	0.0%	536	2.4%	536	1.2%
Total	**23,887**	**100.0%**	**22,715**	**100.0%**	**46,602**	**100.0%**

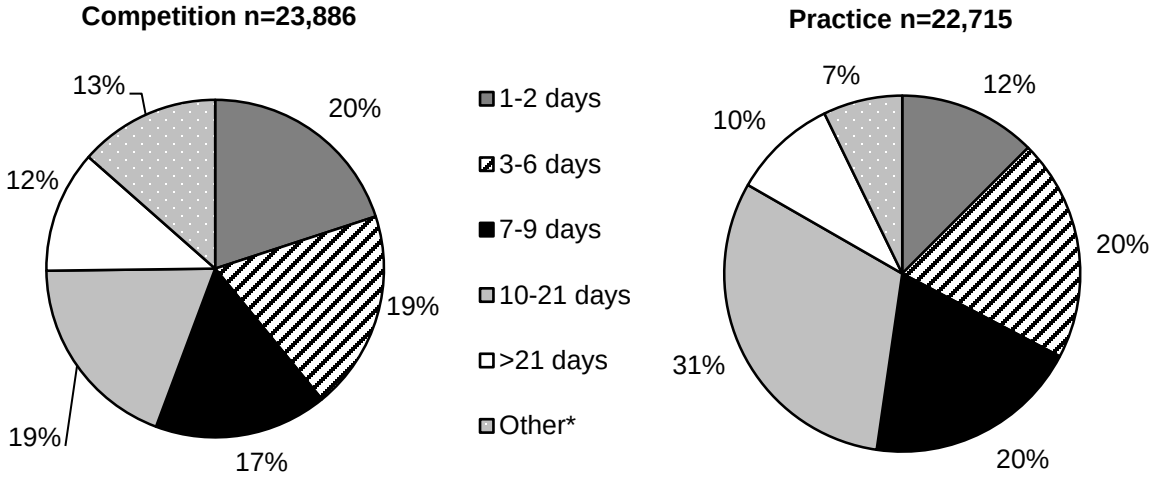
* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Table 6.4 Ten Most Common Volleyball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition n=23,885		Practice n=22,714		Total n=46,599	
	n	%	n	%	n	%
Diagnosis						
Head/face concussion	7,816	32.7%	5,650	24.9%	13,466	28.9%
Ankle strain/sprain	5,771	24.2%	6,734	29.6%	12,505	26.8%
Shoulder strain/sprain	0	0.0%	3,588	15.8%	3,588	7.7%
Knee other	639	2.7%	1,506	6.6%	2,145	4.6%
Hip/thigh/upper leg strain/sprain	1,530	6.4%	509	2.2%	2,039	4.4%
Head/face contusion	1,741	7.3%	0	0.0%	1,741	3.7%
Knee strain/sprain	1,347	5.6%	367	1.6%	1,714	3.7%
Shoulder other	918	3.8%	509	2.2%	1,427	3.1%
Trunk other	536	2.2%	509	2.2%	1,045	2.2%
Hand/wrist other	509	2.1%	459	2.0%	968	2.1%

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 6.2 Time Loss of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year



*Other category is made up of medical disqualification for season, medical disqualification for career, athlete chooses not to continue, and season ended before athlete returned to play

Table 6.5 Volleyball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	0	0.0%	0	0.0%	0	0.0%
Did not require surgery	23,672	100.0%	22,348	100.0%	46,020	100.0%
Total	**23,672**	**100.0%**	**22,348**	**100.0%**	**46,020**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 6.3 History of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

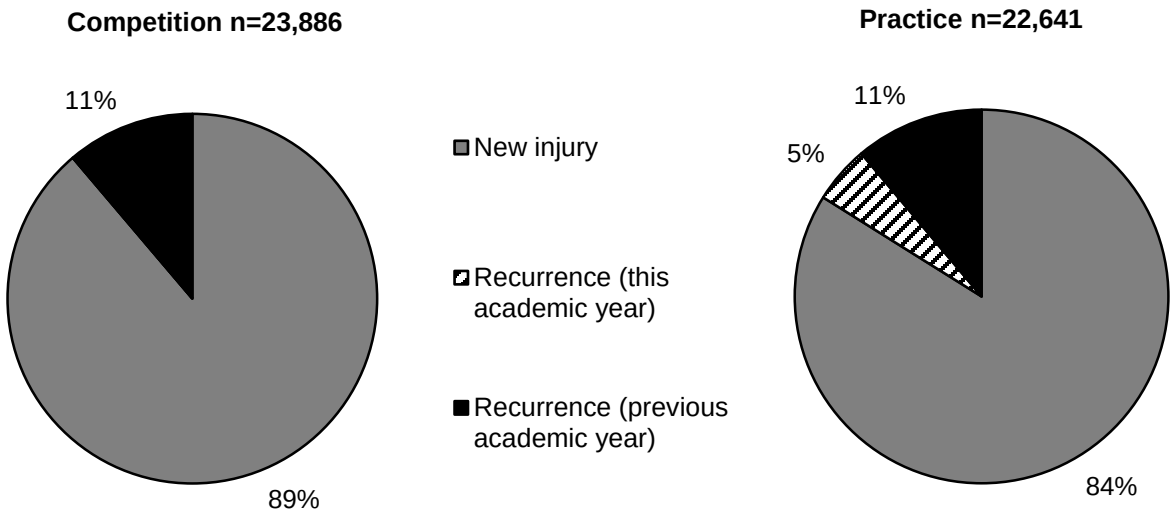


Table 6.6 Time during Season of Volleyball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Season		
Preseason	9,471	20.3%
Regular season	35,780	76.8%
Post season	1,350	2.9%
Total	**46,601**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 6.7 Competition-Related Variables for Volleyball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

Time in Competition	n	%
Pre-competition/warm-ups	3,232	14.2%
First set	2,230	9.8%
Second set	5,719	25.1%
Third set	3,890	17.1%
Fourth set	103	0.5%
Fifth set	207	0.9%
Unknown	7,388	32.4%
Total	**22,769**	**100.0%**

Court Location	n	%
At the net	2,404	10.8%
Left forward	2,002	9.0%
Outside the playable area	1,848	8.3%
Middle forward	1,805	8.1%
Right forward	1,569	7.0%
Right back (server)	1,454	6.5%
Left back	923	4.1%
Outside court (your side)	536	2.4%
Unknown	9,770	43.8%
Total	**22,310**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 6.8 Practice-Related Variables for Volleyball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Practice		
First 1/2 hour	1,981	9.5%
Second 1/2 hour	2,783	13.3%
1-2 hours into practice	12,308	59.0%
>2 hours into practice	2,189	10.5%
Unknown	1,593	7.6%
Total	**20,859**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 6.4 Player Position of Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

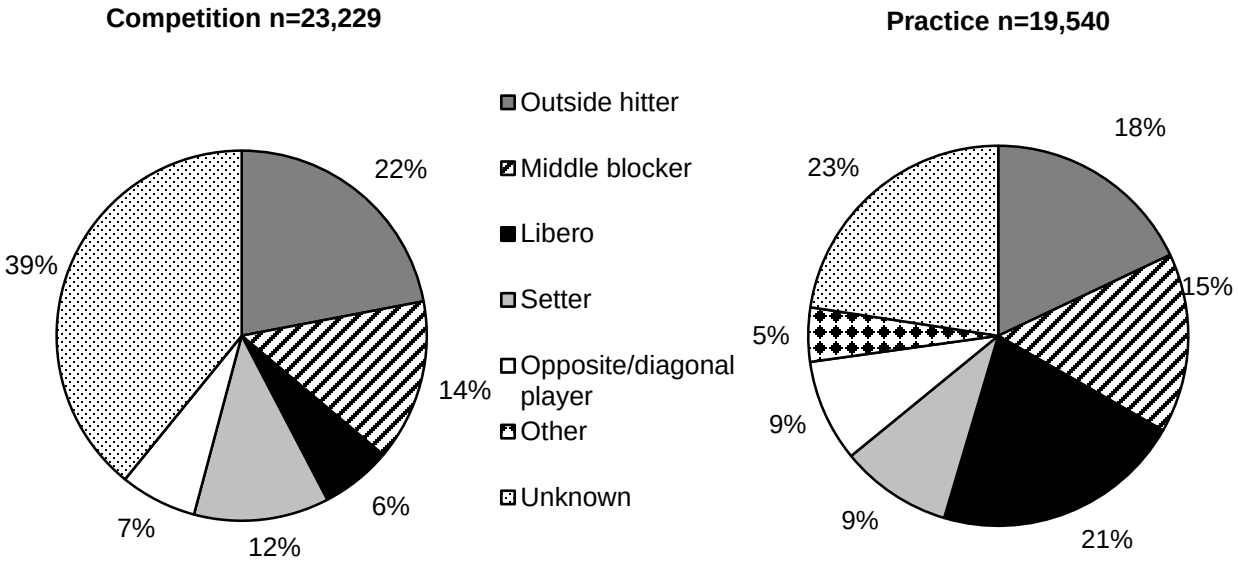


Table 6.9 Activities Leading to Volleyball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	**%**	**n**	**%**	**n**	**%**
Activity						
Blocking	5,399	23.2%	5,251	26.1%	10,650	24.5%
Digging	6,249	26.8%	1,584	7.9%	7,833	18.0%
General play	3,302	14.2%	4,190	20.8%	7,492	17.2%
Passing	1,351	5.8%	3,245	16.1%	4,596	10.6%
Spiking	1,068	4.6%	2,130	10.6%	3,198	7.4%
Serving	639	2.7%	2,379	11.8%	3,018	6.9%
Setting	509	2.2%	148	0.7%	657	1.5%
Conditioning	0	0.0%	509	2.5%	509	1.2%
Other	1,132	4.9%	0	0.0%	1,132	2.6%
Unknown	3,652	15.7%	711	3.5%	4,363	10.0%
Total	**23,301**	**100.0%**	**20,147**	**100.0%**	**43,448**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 6.10 Activity Resulting in Volleyball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Diagnosis									
	Strain/Sprain		Contusion		Fracture		Concussion		Other	
	n	%	n	%	n	%	n	%	n	%
Activity										
Blocking	8,696	41.7%	1,018	36.2%	252	58.9%	148	1.2%	536	7.6%
General play	3,011	14.4%	0	0.0%	103	24.1%	2,719	22.0%	1,659	23.7%
Digging	1,808	8.7%	747	26.6%	73	17.1%	4,003	32.4%	1,201	17.1%
Spiking	3,198	15.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Conditioning	509	2.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Unknown	1,021	4.9%	536	19.1%	0	0.0%	1,281	10.4%	1,525	21.8%
Other	2,615	12.5%	509	18.1%	0	0.0%	4,190	34.0%	2,090	29.8%
Total	**20,858**	**100.0%**	**2,810**	**100.0%**	**428**	**100.0%**	**12,341**	**100.0%**	**7,011**	**100.0%**

VII. Boys' Basketball Injury Epidemiology

Table 7.1 Boys' Basketball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**309**	**201,033**	**1.54**	**88,927**
Competition	165	62,175	2.65	46,251
Practice	144	138,858	1.04	42,676

Table 7.2 Demographic Characteristics of Injured Boys' Basketball Athletes, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

Year in School	**n=87,606**
Freshman	22.9%
Sophomore	23.0%
Junior	25.5%
Senior	28.7%
Total†	**100.0%**
Age (years)	
Minimum	12
Maximum	18
Mean (St. Dev.)	16.2 (1.2)
BMI	
Minimum	15.0
Maximum	42.7
Mean (St. Dev.)	23.0(3.4)

*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 7.1 Diagnosis of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

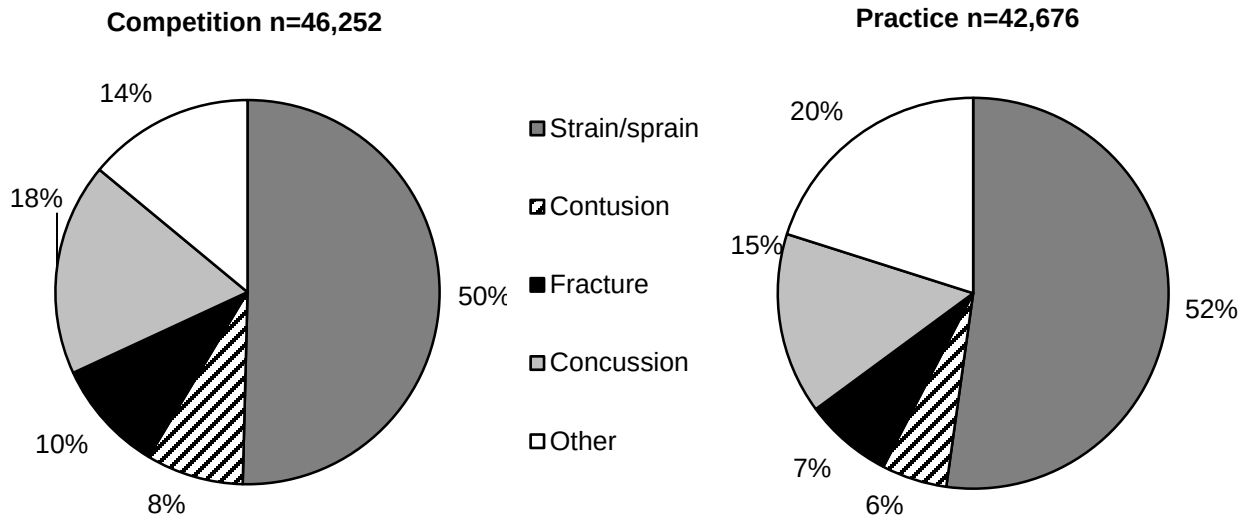


Table 7.3 Body Site of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Ankle	13,646	29.5%	15,848	37.1%	29,494	33.2%
Head/face	11,268	24.4%	9,161	24.5%	20,429	23.0%
Knee	5,063	10.9%	3,748	8.8%	8,811	9.9%
Hand/wrist	4,376	9.5%	2,850	6.7%	7,226	8.1%
Hip/thigh/upper leg	2,223	4.8%	3,257	7.6%	5,480	6.2%
Lower leg	2,740	5.9%	1,708	4.0%	4,448	5.0%
Foot	3,112	6.7%	944	2.2%	4,056	4.6%
Shoulder	1,350	2.9%	1,603	3.8%	2,953	3.3%
Trunk	1,529	3.3%	1,262	3.0%	2,791	3.1%
Arm/elbow	944	2.0%	1,228	2.9%	2,172	2.4%
Neck	0	0.0%	353	0.8%	353	0.4%
Other	0	0.0%	714	1.7%	714	0.8%
Total	**46,251**	**100.0%**	**42,676**	**100.0%**	**88,927**	**100.0%**

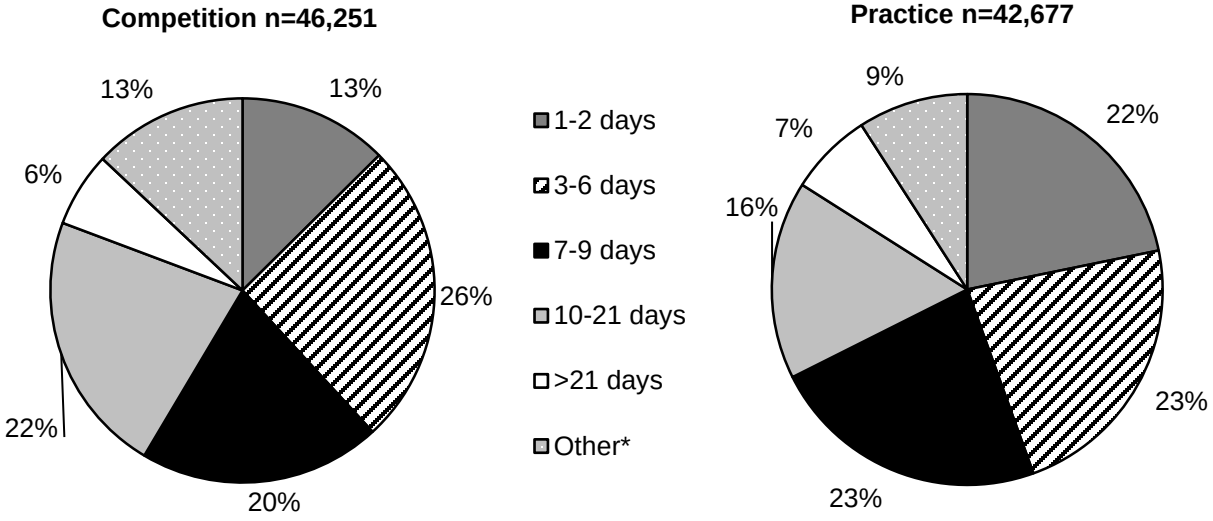
* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Table 7.4 Ten Most Common Boys' Basketball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition n=46,249		Practice n=42,676		Total n=88,925	
	n	%	n	%	n	%
Diagnosis						
Ankle strain/sprain	13,571	29.3%	14,092	33.0%	27,663	31.1%
Head/face concussion	8,265	17.9%	6,416	15.0%	14,681	16.5%
Knee other	2,542	5.5%	1,702	4.0%	4,244	4.8%
Hand/wrist strain/sprain	2,783	6.0%	1,333	3.1%	4,116	4.6%
Knee sprain/strain	2,111	4.6%	1,871	4.4%	3,982	4.5%
Head/face other	1,851	4.0%	1,981	4.6%	3,832	4.3%
Hip/thigh/upper leg strain/sprain	752	1.6%	1,621	3.8%	2,373	2.7%
Hand/wrist fracture	1,309	2.8%	1,037	2.4%	2,346	2.6%
Foot strain/sprain	1,709	3.7%	464	1.1%	2,173	2.4%
Trunk strain/sprain	1,245	2.7%	909	2.1%	2,154	2.4%

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 7.2 Time Loss of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year



*Other category is made up of medical disqualification for season, medical disqualification for career, athlete chooses not to continue, and season ended before athlete returned to play

Table 7.5 Boys' Basketball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	3,684	8.0%	2,181	5.1%	5,865	6.6%
Did not require surgery	42,392	92.0 %	40,319	94.9%	82,711	93.4%
Total	**46,076**	**100.0%**	**42,500**	**100.0%**	**88,576**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 7.3 History of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

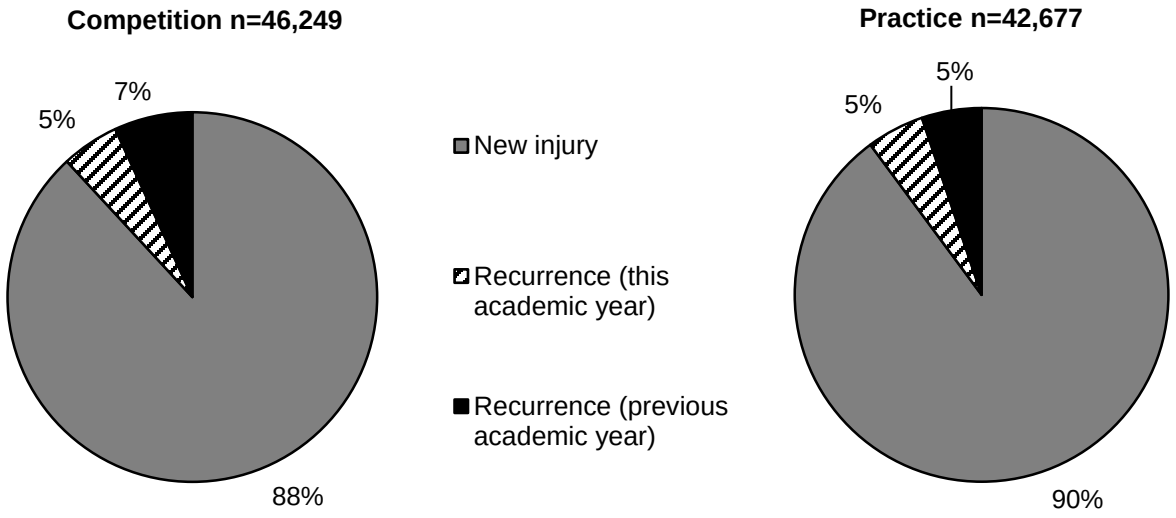


Table 7.6 Time during Season of Boys' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Season		
Preseason	19,708	22.2%
Regular season	68,450	77.0%
Post season	769	0.9%
Total	**88,927**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 7.7 Competition-Related Variables for Boys' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Competition		
Pre-competition/warm-ups	1,498	3.5%
First quarter	3,259	7.7%
Second quarter	9,669	22.9%
Third quarter	12,025	28.5%
Fourth quarter	7,285	17.2%
Overtime	464	1.1%
Unknown	8,043	19.0%
Total	**42,242**	**100.0%**
Court Location		
Unknown	11,909	28.2%
Inside lane (defense)	9,235	21.9%
Inside lane (offense)	8,924	21.1%
Between 3 point arc and lane (offense)	3,804	9.0%
Between 3pt. arc and lane (defense)	2,147	5.1%
Outside 3 point arc - offense	1,882	4.5%
Out of bounds/off the court	1,784	4.2%
Outside 3 point arc - defense	1,740	4.1%
Backcourt	817	1.9%
Total	**42,242**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 7.8 Practice-Related Variables for Boys' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Practice		
First 1/2 hour	4,835	11.5%
Second 1/2 hour	4,076	9.7%
1-2 hours into practice	24,670	58.9%
>2 hours into practice	1,883	4.5%
Unknown	6,425	15.3%
Total	**41,888**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 7.4 Player Position of Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

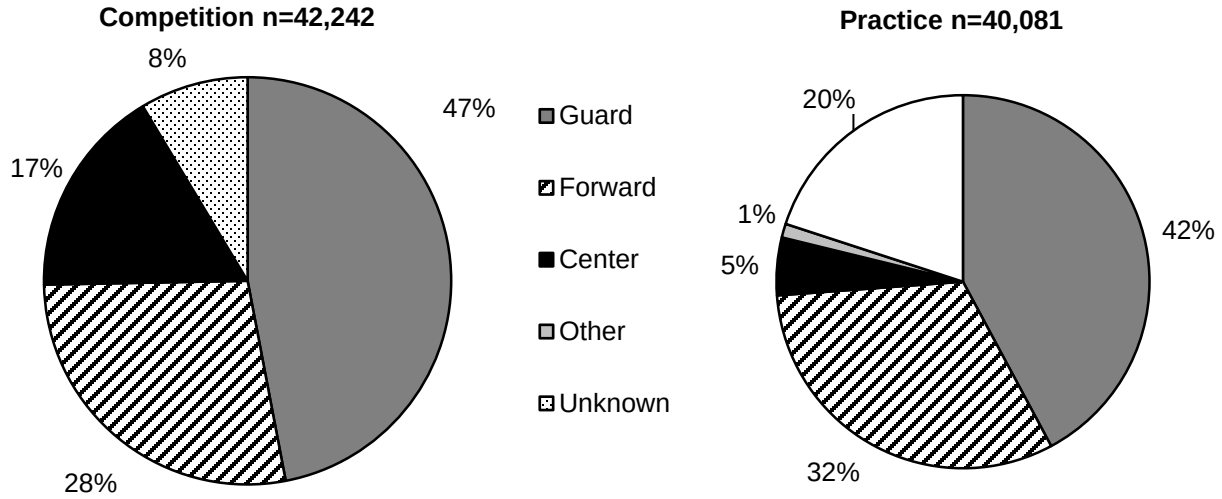


Table 7.9 Activities Leading to Boys' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
Shooting	5,077	11.8%	4,287	10.7%	9,364	11.2%
Passing	125	0.3%	464	1.2%	589	0.7%
Receiving pass	817	1.9%	539	1.3%	1,356	1.6%
Ball handling/dribbling	1,638	3.8%	1,512	3.8%	3,150	3.8%
Defending	3,795	8.8%	3,889	9.7%	7,684	9.2%
Chasing loose ball	4,553	10.5%	1,755	4.4%	6,308	7.6%
Screening	213	0.5%	125	0.3%	338	0.4%
Rebounding	14,468	33.5%	12,356	30.8%	26,824	32.2%
Conditioning	0	0.0%	1,212	3.0%	1,212	1.5%
General play	8,375	19.4%	9,487	23.7%	17,862	21.4%
Other	781	1.8%	1,476	3.7%	2,257	2.7%
Unknown	3,359	7.8%	2,981	7.4%	6,340	7.6%
Total	**43,201**	**100.0%**	**40,083**	**100.0%**	**83,284**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 7.10 Activity Resulting in Boys' Basketball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Diagnosis									
	Strain/Sprain		Contusion		Fracture		Concussion		Other	
	n	%	n	%	n	%	n	%	n	%
Activity										
Rebounding	15,866	37.6%	1,454	23.9%	1,475	21.0%	4,503	34.7%	3,526	23.5%
General play	8,854	21.0%	1,408	23.1%	1,424	20.2%	1,489	11.5%	4,687	31.3%
Defending	2,460	5.8%	585	9.6%	623	8.9%	1,418	10.9%	2,598	17.3%
Shooting	5,309	12.6%	1,045	17.2%	1,317	18.7%	677	5.2%	1,015	6.8%
Chasing loose ball	2,193	5.2%	464	7.6%	251	3.6%	2,614	20.1%	786	5.2%
Unknown	3,520	8.3%	284	4.7%	569	8.1%	1,202	9.3%	765	5.1%
Other	3,988	9.5%	848	13.9%	1,379	19.6%	1,085	8.4%	1,601	10.7%
Total	**42,190**	**100.0 %**	**6,088**	**100.0%**	**7,038**	**100.0%**	**12,988**	**100.0%**	**14,978**	**100.0%**

VIII. Girls' Basketball Injury Epidemiology

Table 8.1 Girls' Basketball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**267**	**142,869**	**1.87**	**70,700**
Competition	167	46,033	3.63	44,660
Practice	100	96,836	1.03	26,040

Table 8.2 Demographic Characteristics of Injured Girls' Basketball Athletes, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

Year in School	**n=67,563**
Freshman	24.8%
Sophomore	32.9%
Junior	26.3%
Senior	16.1%
Total†	**100.0%**
Age (years)	
Minimum	10
Maximum	18
Mean (St. Dev.)	15.5 (1.2)
BMI	
Minimum	15.6
Maximum	36.6
Mean (St. Dev.)	22.6 (3.4)

*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 8.1 Diagnosis of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

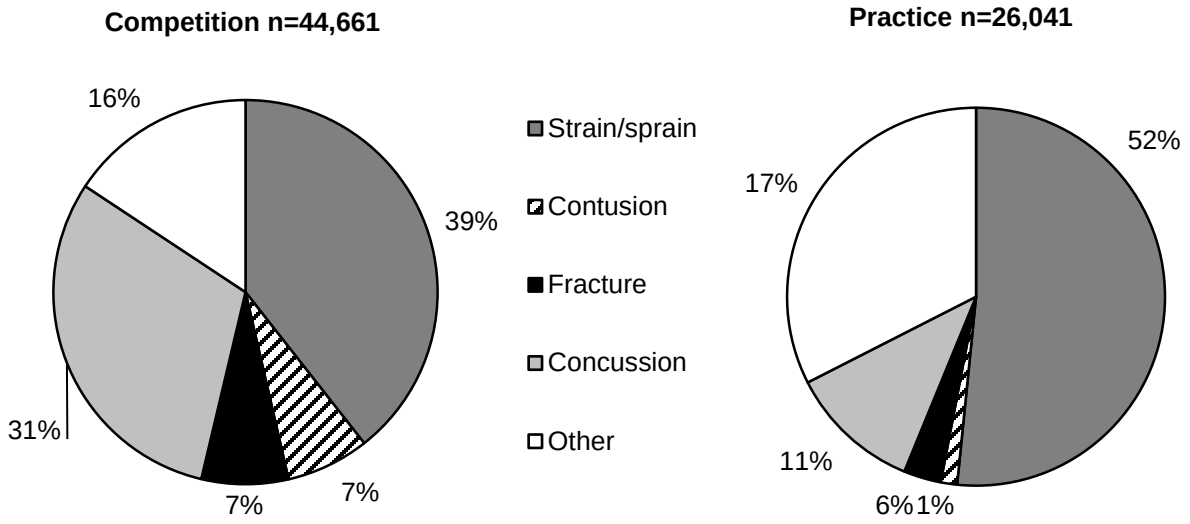


Table 8.3 Body Site of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Ankle	10,880	24.4%	8,164	31.4%	19,044	26.9%
Head/face	15,306	34.3%	3,581	13.8%	18,887	26.7%
Knee	8,330	18.7%	3,066	11.8%	11,396	16.1%
Hand/wrist	3,770	8.4%	1,248	4.8%	5,018	7.1%
Hip/thigh/upper leg	1,931	4.3%	1,815	7.0%	3,746	5.3%
Lower leg	697	1.6%	2,964	11.4%	3,661	5.2%
Trunk	576	1.3%	2,394	9.2%	2,970	4.2%
Shoulder	912	2.0%	1,370	5.3%	2,282	3.2%
Foot	1,103	2.5%	897	3.4%	2,000	2.8%
Neck	0	0.0%	468	1.8%	468	0.7%
Arm/elbow	212	0.5%	0	0.0%	212	0.3%
Other	943	2.1%	72	0.3%	1,015	1.4%
Total	**44,660**	**100.0%**	**26,039**	**100.0%**	**70,699**	**100.0%**

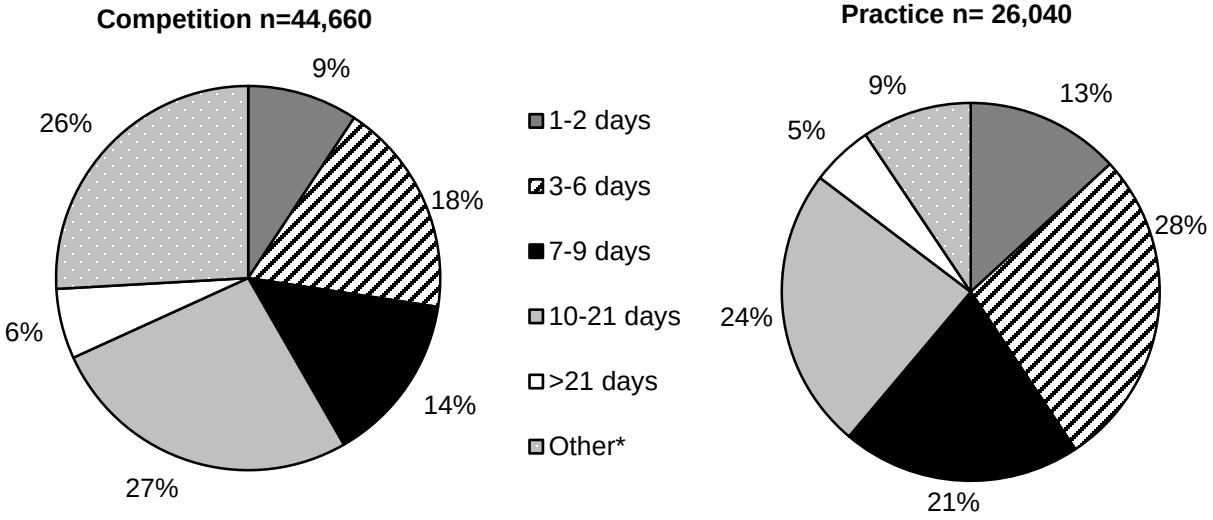
* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Table 8.4 Ten Most Common Girls' Basketball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition n=44,660		Practice n=26,041		Total n=70,701	
	n	%	n	%	n	%
Diagnosis						
Ankle Strain/sprain	9,783	21.9%	7,835	30.1%	17,618	24.9%
Head/face concussion	13,661	30.6%	2,950	11.3%	16,611	23.5%
Knee other	3,493	7.8%	2,219	8.5%	5,712	8.1%
Knee strain/sprain	4,509	10.1%	848	3.3%	5,357	7.6%
Lower leg other	485	1.1%	2,476	9.5%	2,961	4.2%
Hand/wrist fracture	1,997	4.5%	837	3.2%	2,834	4.0%
Hip/thigh/upper leg strain/sprain	1,099	2.5%	1,399	5.4%	2,798	4.0%
Shoulder other	562	1.3%	1,370	5.3%	1,932	2.7%
Trunk strain/sprain	0	0.0%	1,772	6.8%	1,772	2.5%
Hand/wrist strain sprain	1,288	2.9%	206	0.8%	1,494	2.1%

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 8.2 Time Loss of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year



*Other category is made up of medical disqualification for season, medical disqualification for career, athlete chooses not to continue, and season ended before athlete returned to play

Table 8.5 Girls' Basketball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	4,822	11.0%	1,457	5.7%	6,279	9.1%
Did not require surgery	39,019	89.0%	23,891	94.3%	62,910	90.9%
Total	**43,841**	**100.0%**	**25,348**	**100.0%**	**69,189**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 8.3 History of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

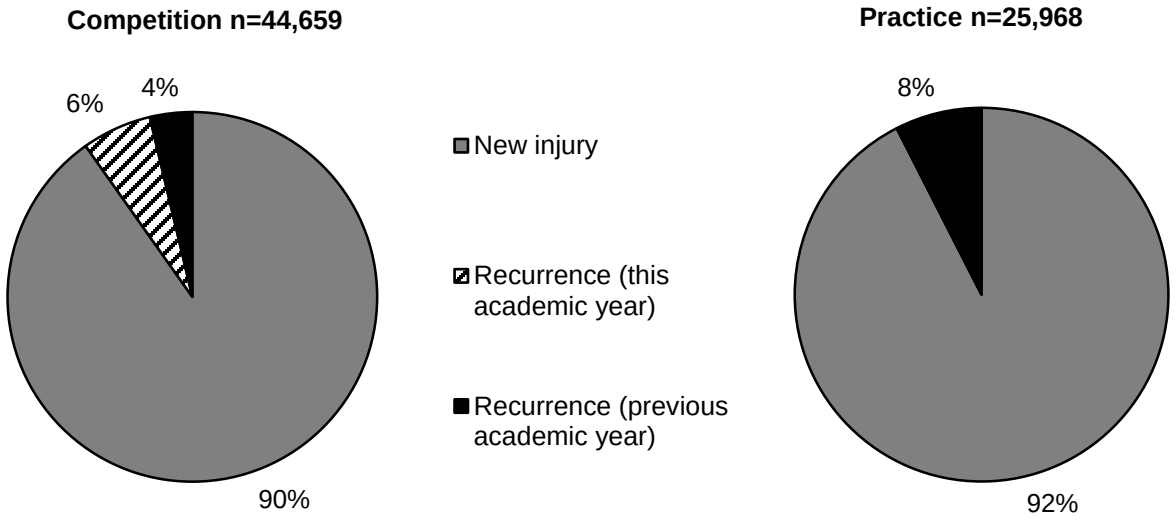


Table 8.6 Time during Season of Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Season		
Preseason	13,868	19.7%
Regular season	55,120	78.1%
Post season	1,567	2.2%
Total	**70,555**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 8.7 Competition-Related Variables for Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Competition		
Pre-competition/warm-ups	401	1.0%
First quarter	2,510	6.0%
Second quarter	11,962	28.4%
Third quarter	10,843	25.8%
Fourth quarter	7,794	18.5%
Unknown	8,579	20.4%
Total	**42,090**	**100.0%**
Court Location		
Inside lane (offense)	7,638	19.2%
Inside lane (defense)	5,310	13.3%
Between 3 point arc and lane (defense)	3,876	9.7%
Between 3 point arc and lane (offense)	3,658	9.2%
Outside 3 point arc - defense	3,030	7.6%
Outside 3 point arc - offense	2,937	7.4%
Backcourt	1,339	3.4%
Off the court	1,266	3.2%
Out of bounds	758	1.9%
Unknown	10,027	25.2%
Total	**39,838**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 8.8 Practice-Related Variables for Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Practice		
First 1/2 hour	2,745	10.9%
Second 1/2 hour	6,997	27.7%
1-2 hours into practice	10,503	41.5%
>2 hours into practice	960	3.8%
Unknown	4,083	16.1%
Total	**25,287**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 8.4 Player Position of Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

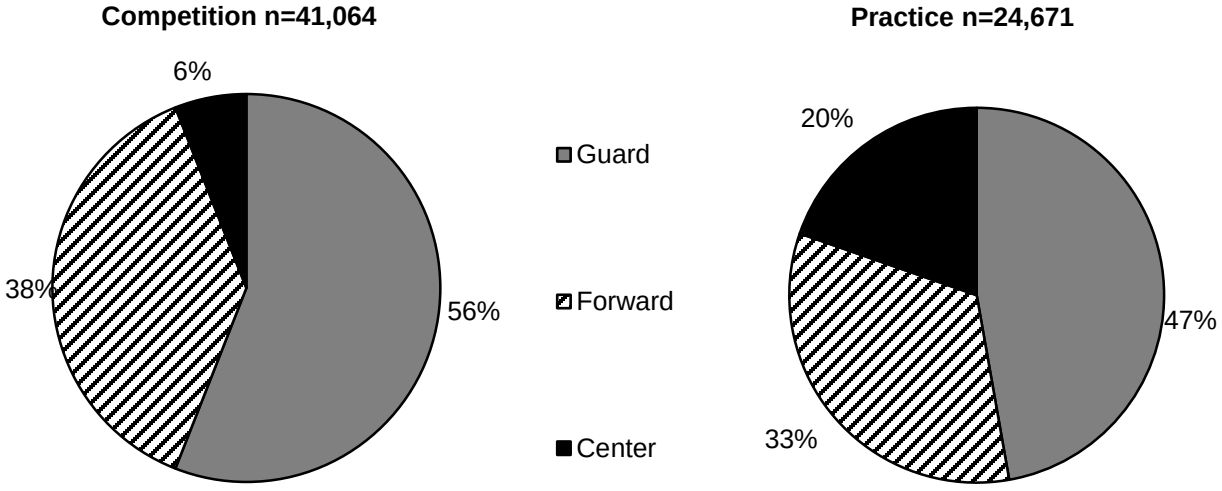


Table 8.9 Activities Leading to Girls' Basketball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
General play	7269	17.6%	6584	26.7%	13853	21.0%
Chasing loose ball	6443	15.6%	3137	12.7%	9580	14.5%
Defending	5949	14.4%	3134	12.7%	9083	13.8%
Rebounding	6947	16.9%	1776	7.2%	8723	13.2%
Shooting	4514	11.0%	2330	9.4%	6844	10.4%
Ball handling/dribbling	3256	7.9%	849	3.4%	4105	6.2%
Receiving pass	1228	3.0%	1624	6.6%	2852	4.3%
Conditioning	0	0.0%	1530	6.2%	1530	2.3%
Passing	826	2.0%	468	1.9%	1294	2.0%
Screening	278	0.7%	0	0.0%	278	0.4%
Other	1361	3.3%	206	0.8%	1567	2.4%
Unknown	3136	7.6%	3033	12.3%	6169	9.4%
Total	**41,207**	**100.0%**	**24,671**	**100.0%**	**65,878**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 8.10 Activity Resulting in Girls' Basketball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Diagnosis									
	Strain/Sprain		Contusion		Fracture		Concussion		Other	
	n	%	n	%	n	%	n	%	n	%
Activity										
General play	5,694	19.0%	0	0.0%	0	0.0%	1,983	13.3%	6,175	44.6%
Shooting	4,876	16.3%	72	2.1%	0	0.0%	468	3.1%	1,428	10.3%
Rebounding	2,874	9.6%	1,305	37.3%	1,259	34.3%	2,246	15.1%	1,039	7.5%
Chasing loose ball	2,774	9.3%	1,544	44.2%	475	12.9%	3,476	23.3%	1,311	9.5%
Unknown	3,278	10.9%	146	4.2%	814	22.2%	1,157	7.8%	774	5.6%
Other	10,448	34.9%	430	12.3%	1,123	30.6%	5,590	37.5%	3,116	22.5%
Total	**29,944**	**100.0%**	**3,497**	**100.0%**	**3,671**	**100.0%**	**14,920**	**100.0%**	**13,843**	**100.0%**

IX. Wrestling Injury Epidemiology

Table 9.1 Wrestling Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**246**	**121,765**	**2.02**	**67,834**
Competition	120	31,871	3.77	34,405
Practice	126	89,894	1.40	33,429

Table 9.2 Demographic Characteristics of Injured Wrestlers, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

Year in School	**n=66,112**
Freshman	21.0%
Sophomore	21.2%
Junior	39.7%
Senior	18.1%
Total†	**100.0%**
Age (years)	
Minimum	14
Maximum	18
Mean (St. Dev.)	16.0 (1.1)
BMI	
Minimum	16.1
Maximum	39.8
Mean (St. Dev.)	24.8 (5.2)

*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 9.1 Diagnosis of Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

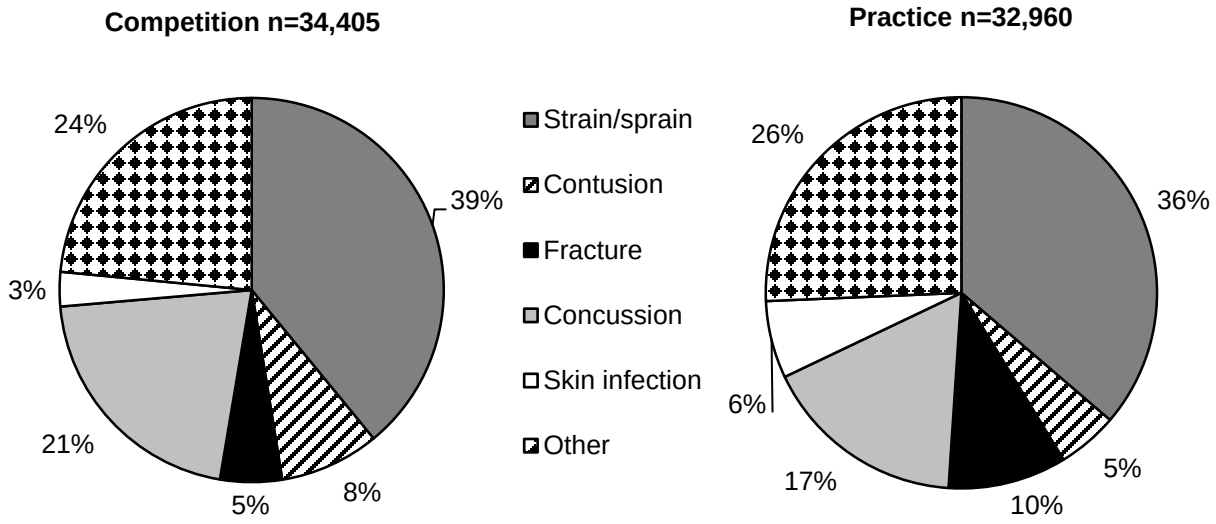


Table 9.3 Body Site of Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Head/face	8,259	24.0%	6,175	18.5%	14,434	21.3%
Knee	6,262	18.2%	6,822	20.4%	13,084	19.3%
Shoulder	5,355	15.6%	4,374	13.1%	9,729	14.3%
Arm/elbow	2,073	6.0%	4,350	13.0%	6,423	9.5%
Trunk	2,657	7.7%	3,236	9.7%	5,893	8.7%
Hand/wrist	2,000	5.8%	3,780	11.3%	5,780	8.5%
Ankle	2,822	8.2%	1,819	5.4%	4,641	6.8%
Hip/thigh/upper leg	1,140	3.3%	1,776	5.3%	2,916	4.3%
Neck	1,209	3.5%	411	1.2%	1,620	2.4%
Foot	771	2.2%	166	0.5%	937	1.4%
Lower leg	0	0.0%	152	0.5%	152	0.2%
Other	1,857	5.4%	368	1.1%	2,225	3.3%
Total	**34,405**	**100.0%**	**33,429**	**100.0%**	**67,834**	**100.0%**

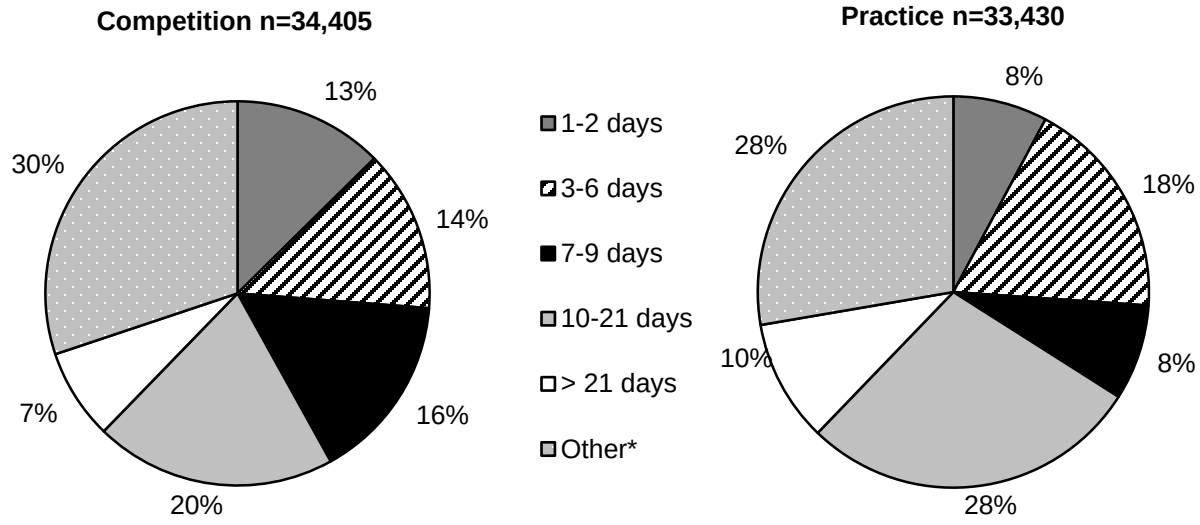
* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Table 9.4 Ten Most Common Wrestling Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition n=34,404		Practice n=32,964		Total n=67,368	
	n	%	n	%	n	%
Diagnosis						
Head/face concussion	7,213	21.0%	5,558	16.9%	12,771	19.0%
Shoulder other	3,102	9.0%	2,940	8.9%	6,042	9.0%
Knee strain/sprain	2,887	8.4%	3,131	9.5%	6,018	8.9%
Knee other	3,057	8.9%	2,668	8.1%	5,725	8.5%
Ankle sprain/strain	2,822	8.2%	1,819	5.5%	4,641	6.9%
Shoulder strain/sprain	2,253	6.5%	1,243	3.8%	3,496	5.2%
Hand wrist fracture	319	0.9%	2,337	7.1%	2,656	3.9%
Arm/elbow sprain/strain	694	2.0%	1,807	5.5%	2,501	3.7%
Trunk contusion	1417	4.1%	814	2.5%	2,231	3.3%
Trunk strain/sprain	303	0.9%	1,775	5.4%	2,078	3.1%

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 9.2 Time Loss of Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year



*Other category is made up of medical disqualification for season, medical disqualification for career, athlete chooses not to continue, and season ended before athlete returned to play

Table 9.5 Wrestling Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	4,169	12.2%	5,621	16.8%	9,790	14.5%
Did not require surgery	29,893	87.8%	27,808	83.2%	57,701	85.5%
Total	**34,062**	**100.0%**	**33,429**	**100.0%**	**67,491**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injury

Figure 9.3 History of Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

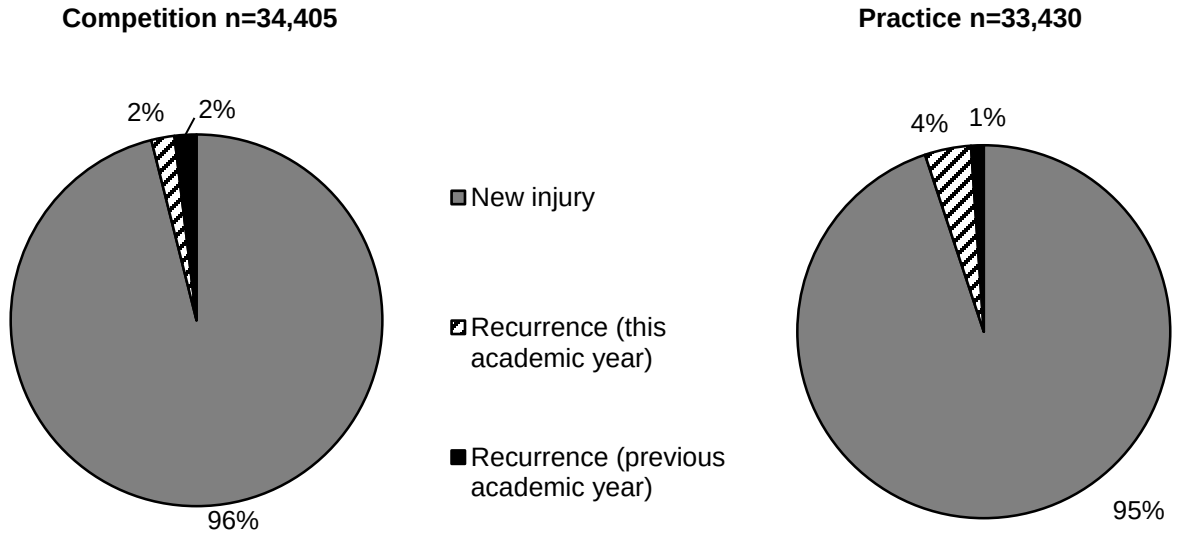


Table 9.6 Time during Season of Wrestling Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Season		
Preseason	11,655	17.2%
Regular season	49,720	73.3%
Post season	6,459	9.5%
Total	**67,834**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 9.7 Competition-Related Variables for Wrestling Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Competition		
Pre-competition/warm-ups	838	2.8%
First period	1728	5.8%
Second period	7515	25.1%
Third period	4141	13.8%
Unknown	15,663	52.3%
Total	**29,885**	**100.0%**
Mat Location		
Within 28 ft. circle	34,564	57.8%
Off the mat	1,030	1.7%
Out of bounds	854	1.4%
Unknown	23,331	39.0%
Total	**59,780**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 9.8 Practice-Related Variables for Wrestling Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Practice		
First 1/2 hour	1,379	4.2%
Second 1/2 hour	5,418	16.5%
1-2 hours into practice	16,725	51.0%
>2 hours into practice	2,714	8.3%
Unknown	6,544	20.0%
Total	**32,780**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 9.9 Activities Leading to Wrestling Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
Takedown	16,748	55.2%	9,991	34.0%	26,739	44.8%
Sparring	1,746	5.8%	7,376	25.1%	9,122	15.3%
Reversal	1,694	5.6%	1,077	3.7%	2,771	4.6%
Fall	938	3.1%	1,077	3.7%	2,015	3.4%
n/a (e.g. skin infection, overuse etc.)	684	2.3%	1,015	3.5%	1,699	2.8%
Conditioning	0	0.0%	1,624	5.5%	1,624	2.7%
Escape	235	0.8%	865	2.9%	1,100	1.8%
Riding	714	2.4%	319	1.1%	1,033	1.7%
Near fall	836	2.8%	0	0.0%	836	1.4%
Other	370	1.2%	2,102	7.2%	2,472	4.1%
Unknown	6,373	21.0%	3,913	13.3%	10,286	17.2%
Total	**30,338**	**100.0%**	**29,359**	**100.0%**	**59,697**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 9.10 Activities Resulting in Wrestling Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Diagnosis											
	Strain/Sprain		Contusion		Fracture		Concussion		Skin Infection		Other	
	n	%	n	%	n	%	n	%	n	%	n	%
Activity												
Takedown	11,012	47.3%	2,074	55.2%	1,761	42.2%	7,505	64.5%	0	0.0%	4,388	30.4%
Riding	344	1.5%	0	0.0%	83	2.0%	236	2.0%	0	0.0%	370	2.6%
Sparring	3,149	13.5%	1,599	42.6%	578	13.8%	1,170	10.1%	108	5.5%	2,049	14.2%
Escape	539	2.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	561	3.9%
N/A*	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1,483	75.0%	216	1.5%
Unknown	3,395	14.6%	0	0.0%	994	23.8%	2,079	17.9%	387	19.6%	3,430	23.8%
Other	4,842	20.8%	83	2.2%	758	18.2%	638	5.5%	0	0.0%	3,399	23.6%
Total	**23,281**	**100.0%**	**3,756**	**100.0%**	**4,174**	**100.0%**	**11,628**	**100.0%**	**1,978**	**100.0%**	**14,413**	**100.0%**

***N/A category consists of skin infections, overuse injuries, heat illness, etc.**

X. Baseball Injury Epidemiology

Table 10.1 Baseball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**110**	**149,564**	**0.74**	**36,395**
Competition	69	55,885	1.23	21,458
Practice	41	93,679	0.44	14,937

Table 10.2 Demographic Characteristics of Injured Baseball Athletes, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

Year in School	**n=35,251**
Freshman	17.4%
Sophomore	28.0%
Junior	29.1%
Senior	25.4%
Total†	**100.0%**
Age (years)	
Minimum	12
Maximum	18
Mean (St. Dev.)	16.3 (1.1)
BMI	
Minimum	15.8
Maximum	32.5
Mean (St. Dev.)	23.0 (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 10.1 Diagnosis of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

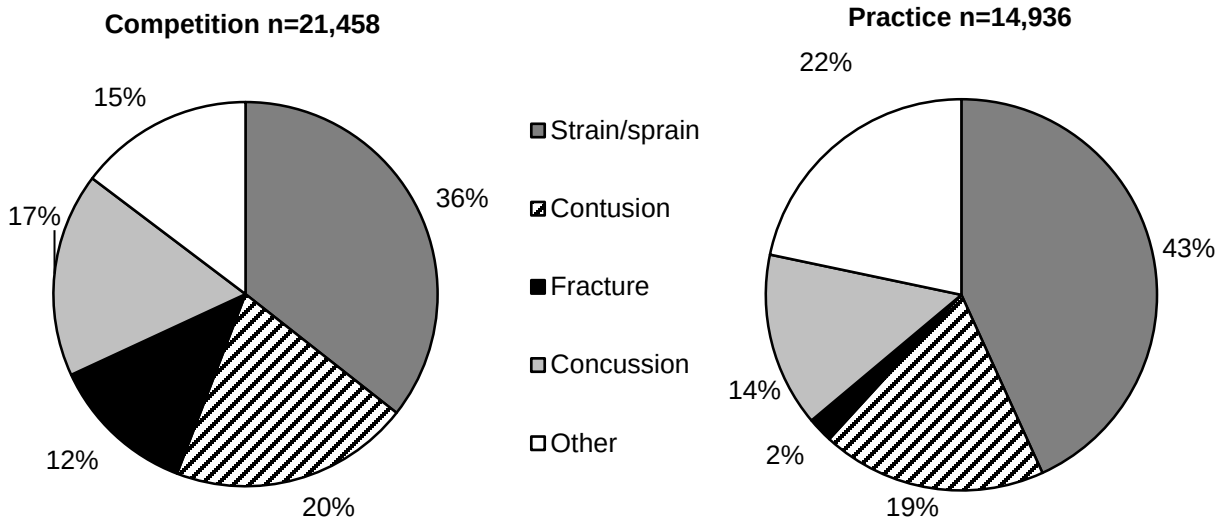


Table 10.3 Body Site of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Head/face	6,160	28.7%	3,519	23.6%	9,679	26.6%
Hip/thigh/upper leg	3,136	14.6%	2,893	19.4%	6,029	16.6%
Knee	1,645	7.7%	2,876	19.3%	4,521	12.4%
Ankle	1,820	8.5%	1,279	8.6%	3,099	8.5%
Hand/wrist	1,113	5.2%	721	4.8%	1,834	5.0%
Lower leg	761	3.5%	580	3.9%	1,341	3.7%
Foot	286	1.3%	0	0.0%	286	0.8%
Arm/elbow	3,910	18.2%	1,160	7.8%	5,070	13.9%
Shoulder	2,628	12.2%	1,910	12.8%	4,538	12.5%
Total	**21,459**	**100.0%**	**14,938**	**100.0%**	**36,397**	**100.0%**

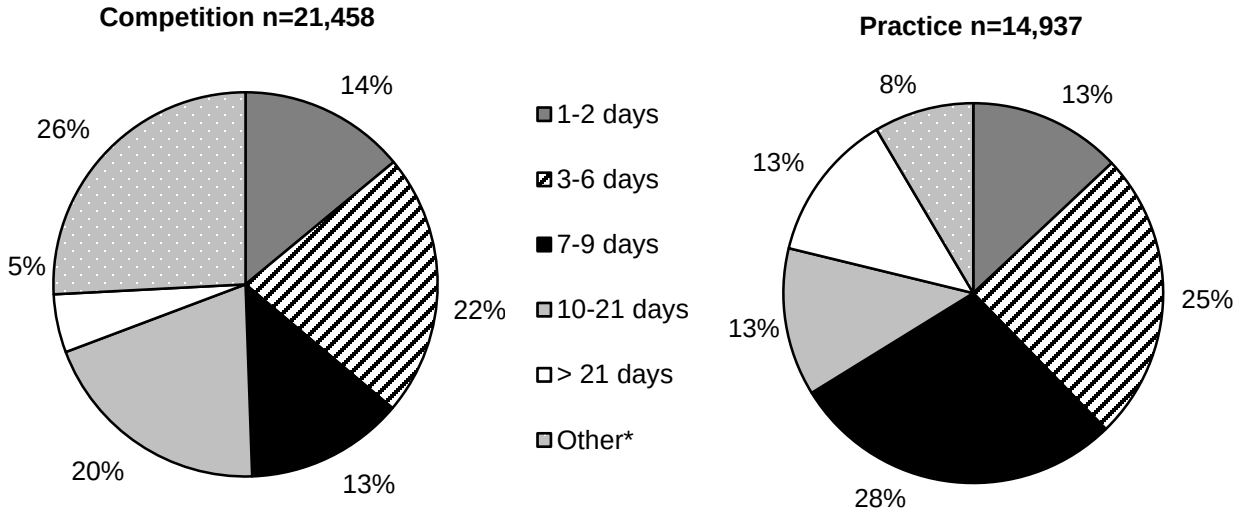
* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Table 10.4 Ten Most Common Baseball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition n=21,456		Practice n=14,936		Total n=36,392	
	n	%	n	%	n	%
Diagnosis						
Head/face concussion	3,685	17.2%	2,153	14.4%	5,838	16.0%
Hip/thigh/upper leg strain/sprain	2,127	9.9%	2,893	19.4%	5,020	13.8%
Knee strain/sprain	1,491	6.9%	1,646	11.0%	3,137	8.6%
Ankle strain/sprain	1,340	6.2%	853	5.7%	2,193	6.0%
Shoulder other	1,283	6.0%	852	5.7%	2,135	5.9%
Shoulder strain/sprain	777	3.6%	1,057	7.1%	1,834	5.0%
Head/face contusion	286	1.3%	1,366	9.1%	1,652	4.5%
Arm/elbow contusion	1,545	7.2%	1,160	7.8%	1,545	4.3%
Head/face other	1,428	6.7%	0	0.0%	1,428	3.9%
Arm/elbow other	205	1.0%	1,160	7.8%	1,365	3.8%

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 10.2 Time Loss of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year



*Other category is made up of medical disqualification for season, medical disqualification for career, athlete chooses not to continue, and season ended before athlete returned to play

Table 10.5 Baseball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	1,962	9.1%	605	4.1%	2,567	7.1%
Did not require surgery	19,495	90.9%	14,332	95.9%	33,827	92.9%
Total	**21,457**	**100.0%**	**14,937**	**100.0%**	**36,394**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 10.3 History of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

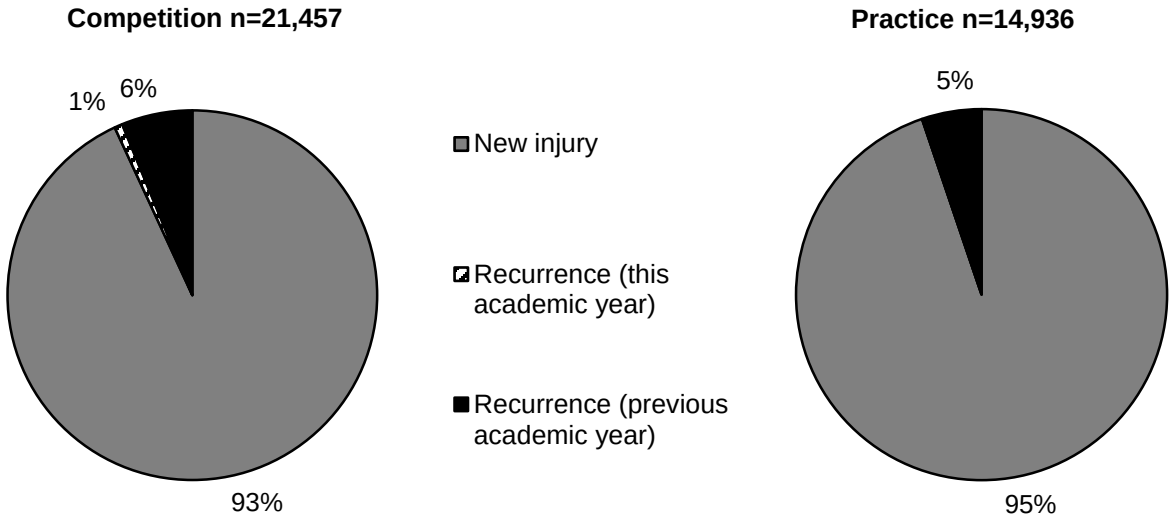


Table 10.6 Time during Season of Baseball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Season		
Preseason	6,757	18.6%
Regular season	28,363	77.9%
Post season	1,274	3.5%
Total	**36,394**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 10.7 Competition-Related Variables for Baseball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Competition		
Pre-competition/warm-ups	1,367	6.6%
First inning	871	4.2%
Second inning	571	2.8%
Third inning	5,717	27.6%
Fourth inning	3,837	18.5%
Fifth inning	1,198	5.8%
Sixth inning	1,373	6.6%
Seventh inning	389	1.9%
Extra innings	81	0.4%
Unknown	5,281	25.5%
Total	**20,685**	**100.0%**
Field Location		
Home plate	6,859	33.2%
First base	1,862	9.0%
Second base	3,860	18.7%
Third base	2,846	13.8%
Infield	1,007	4.9%
Pitcher's mound	1,367	6.6%
Outfield	964	4.7%
Foul territory	607	2.9%
Other	205	1.0%
Unknown	1,107	5.3%
Total	**20,685**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 10.8 Practice-Related Variables for Baseball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Practice		
First 1/2 hour	2,662	17.9%
Second 1/2 hour	2,175	14.6%
1-2 hours into practice	3,686	24.8%
>2 hours into practice	580	3.9%
Unknown	5,753	38.7%
Total	**14,856**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 10.4 Player Position of Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

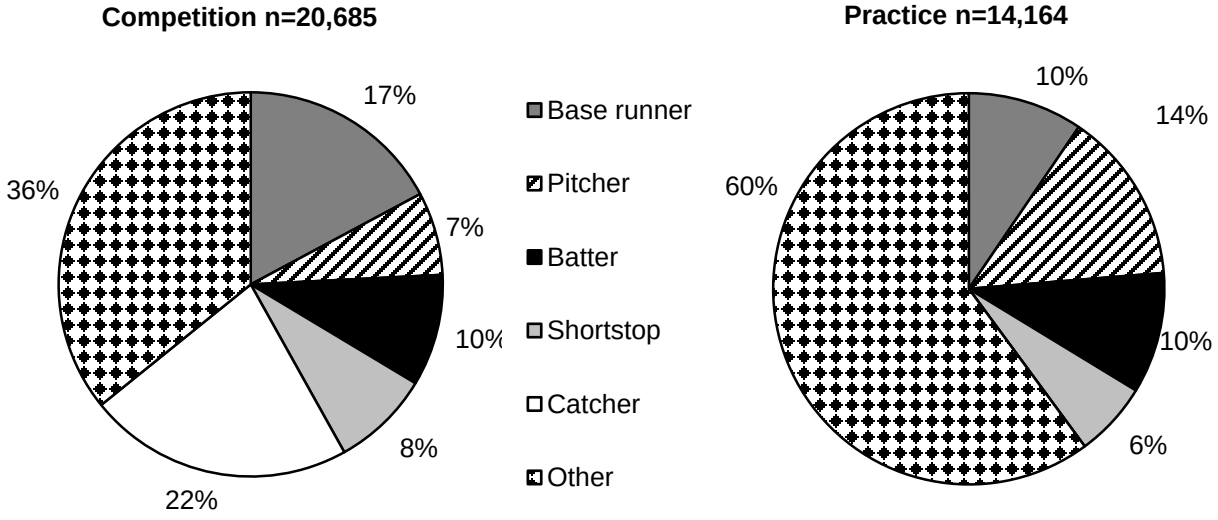


Table 10.9 Activities Leading to Baseball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
Running bases	4,155	20.1%	2,690	19.0%	6,845	19.6%
Batting	2,830	13.7%	852	6.0%	3,682	10.6%
Fielding a batted ball	1,631	7.9%	1,823	12.9%	3,454	9.9%
Pitching	1,367	6.6%	2,012	14.2%	3,379	9.7%
Throwing (not pitching)	1,999	9.7%	1,278	9.0%	3,277	9.4%
Sliding	2,240	10.8%	721	5.1%	2,961	8.5%
Fielding a thrown ball	2,157	10.4%	802	5.7%	2,959	8.5%
Catching	1,363	6.6%	471	3.3%	1,834	5.3%
General play	307	1.5%	1,380	9.7%	1,687	4.8%
Conditioning	0	0.0%	906	6.4%	906	2.6%
Other	2,635	12.7%	236	1.7%	2,871	8.2%
Unknown	0	0.0%	994	7.0%	994	2.9%
Total	**20,684**	**100.0%**	**14,165**	**100.0%**	**34,849**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 10.5 Activity Resulting in Baseball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Diagnosis									
	Strain/Sprain		Contusion		Fracture		Concussion		Other	
	n	%	n	%	n	%	n	%	n	%
Activity										
Fielding	1,394	10.5%	1,999	28.9%	1,149	38.9%	1,005	17.2%	875	15.0%
Running	5,151	38.7%	205	3.0%	1,253	42.4%	0	0.0%	236	4.1%
Pitching	1,383	10.4%	205	3.0%	0	0.0%	0	0.0%	1,791	30.7%
Batting	400	3.0%	1,877	27.2%	0	0.0%	852	14.6%	553	9.5%
Sliding	1,037	7.8%	1,135	16.4%	553	18.7%	236	4.0%	0	0.0%
Other	3,957	29.7%	1,489	21.6%	0	0.0%	3,179	54.4%	1,944	33.4%
Unknown	0	0.0%	0	0.0%	0	0.0%	567	9.7%	426	7.3%
Total	**13,322**	**100.0%**	**6,910**	**100.0%**	**2,955**	**100.0%**	**5,839**	**100.0%**	**5,825**	**100.0%**

XI. Softball Injury Epidemiology

Table 11.1 Softball Injury Rates by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	# Injuries	# Exposures	Injury rate (per 1,000 athlete-exposures)	Nationally Estimated # Injuries
Total	**149**	**111,546**	**1.34**	**69,932**
Competition	63	40,638	1.55	31,561
Practice	86	70,908	1.21	38,371

Table 11.2 Demographic Characteristics of Injured Softball Athletes, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

Year in School	**n=67,490**
Freshman	31.0%
Sophomore	26.3%
Junior	20.0%
Senior	22.6%
Total†	**100.0%**
Age (years)	
Minimum	14
Maximum	19
Mean (St. Dev.)	15.9 (1.3)
BMI	
Minimum	17.2
Maximum	40.4
Mean (St. Dev.)	23.6 (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 11.1 Diagnosis of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

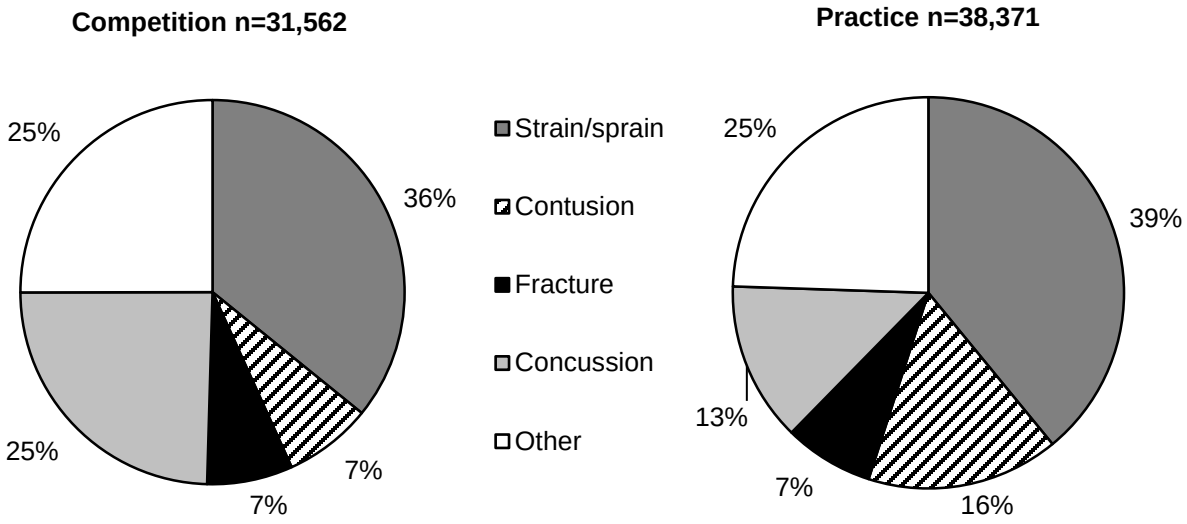


Table 11.3 Body Site of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Body Site						
Head/face	9,527	30.2%	8,391	21.9%	17,918	25.6%
Ankle	5,013	15.9%	6,681	17.4%	11,694	16.7%
Knee	3,288	10.4%	6,499	16.9%	9,787	14.0%
Hand/wrist	4,727	15.0%	4,597	12.0%	9,324	13.3%
Hip/thigh/upper leg	2,632	8.3%	2,917	7.6%	5,549	7.9%
Shoulder	1,536	4.9%	3,661	9.5%	5,197	7.4%
Lower leg	1,438	4.6%	2,608	6.8%	4,046	5.8%
Trunk	2,542	8.1%	930	2.4%	3,472	5.0%
Arm/elbow	0	0.0%	984	2.6%	984	1.4%
Neck	0	0.0%	445	1.2%	445	0.6%
Other	857	2.7%	659	1.7%	1,516	2.2%
Total	**31,560**	**100.0%**	**38,372**	**100.0%**	**69,932**	**100.0%**

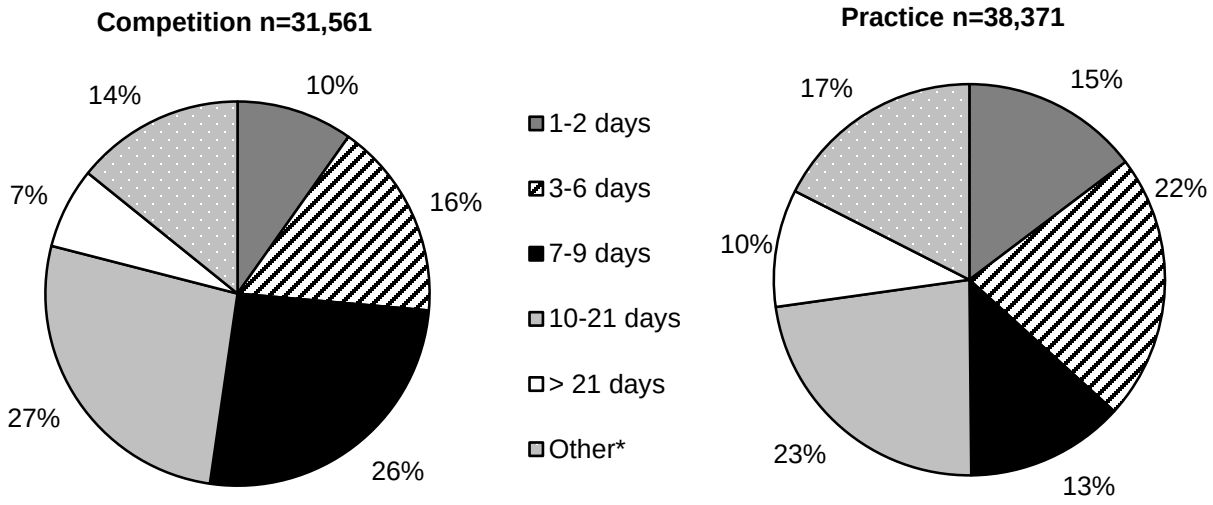
* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Table 11.4 Ten Most Common Softball Injury Diagnoses by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition n=31,560		Practice n=38,367		Total n=69,927	
	n	%	n	%	n	%
Diagnosis						
Head/face concussion	7,748	24.55%	5,046	13.15%	12,794	18.30%
Ankle strain/sprain	5,013	15.88%	5,828	15.19%	10,841	15.50%
Knee other	2,703	8.56%	4,784	12.47%	7,487	10.71%
Hip/thigh/upper leg sprain/strain	2,632	8.34%	2,563	6.68%	5,195	7.43%
Hand/wrist contusion	1,313	4.16%	2,212	5.77%	3,525	5.04%
Trunk sprain/strain	2,208	7.00%	840	2.19%	3,048	4.36%
Shoulder other	1,446	4.58%	1,536	4.00%	2,982	4.26%
Hand/wrist other	2,315	7.34%	408	1.06%	2,723	3.89%
Head/face fracture	1,438	4.56%	868	2.26%	2,542	3.64%
Shoulder sprain/strain	90	0.29%	2,125	5.54%	2,215	3.17%

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 11.2 Time Loss of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year



*Other category is made up of medical disqualification for season, medical disqualification for career, athlete chooses not to continue, and season ended before athlete returned to play

Table 11.5 Softball Injuries Requiring Surgery by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Need for surgery						
Required surgery	3,316	10.5%	1,211	3.2%	4,527	6.5%
Did not require surgery	28,244	89.5%	37,160	96.8%	65,404	93.5%
Total	**31,560**	**100.0%**	**38,371**	**100.0%**	**69,931**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 11.3 History of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

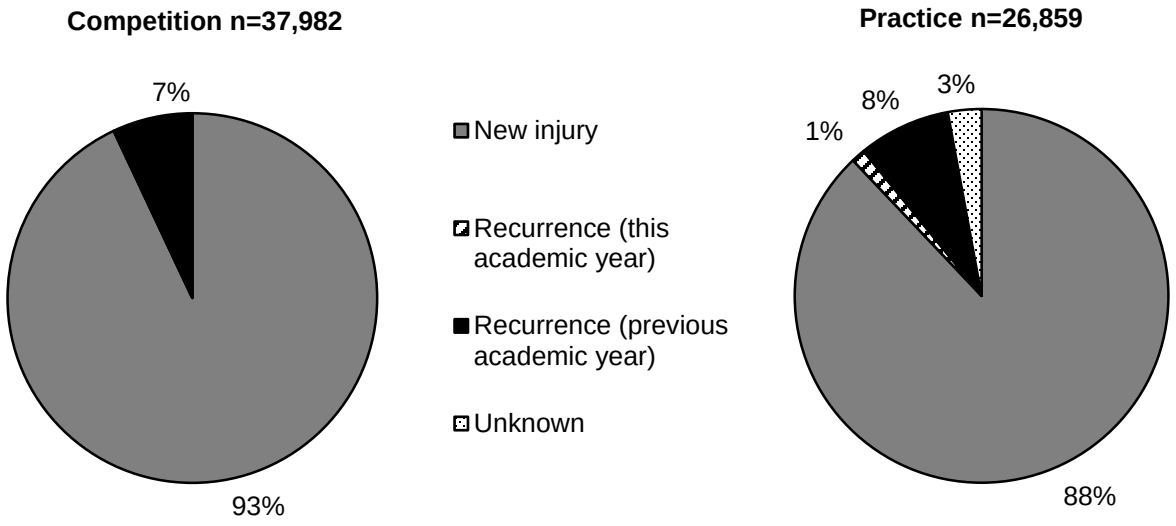


Table 11.6 Time during Season of Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Season		
Preseason	9,238	13.2%
Regular season	57,233	81.8%
Post season	2,604	3.7%
Unknown	857	1.2%
Total	**69,932**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 11.7 Competition-Related Variables for Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Competition		
Pre-competition/warm-ups	4,585	15.6%
First inning	688	2.3%
Second inning	3,179	10.8%
Third inning	2,294	7.8%
Fourth inning	4,075	13.9%
Fifth inning	4,098	14.0%
Sixth inning	1,371	4.7%
Unknown	9,063	30.9%
Total	**29,353**	**100.0%**
Field Location		
Outfield	7,848	26.7%
Second base	5,770	19.7%
Third base	2,822	9.6%
First base	2,693	9.2%
Home plate	1,957	6.7%
Infield	1,779	6.1%
Pitcher's mound	1,800	6.1%
Other	2,295	7.8%
Unknown	2,389	8.1%
Total	**29,353**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 11.8 Practice-Related Variables for Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	n	%
Time in Practice		
First 1/2 hour	2,117	5.7%
Second 1/2 hour	9,717	26.0%
1-2 hours into practice	15,564	41.6%
>2 hours into practice	2,129	3.9%
Unknown	7,897	21.1%
Total	**37,424**	**100.0%**

* Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 11.4 Player Position of Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

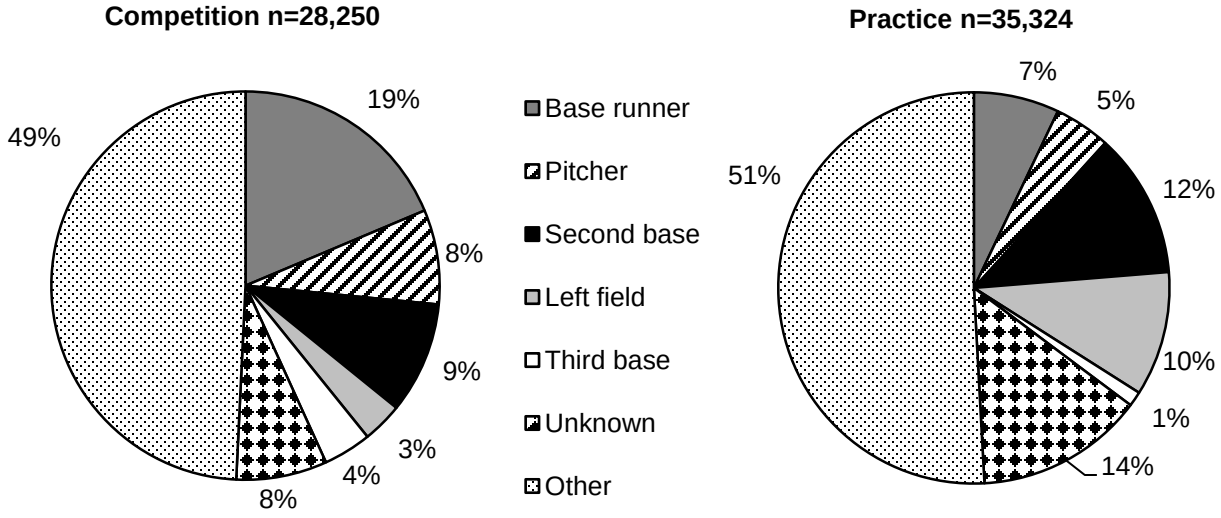


Table 11.9 Activities Leading to Softball Injuries by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year*

	Competition		Practice		Overall	
	n	%	n	%	n	%
Activity						
Fielding a batted ball	6,215	21.2%	7,792	21.0%	14,007	21.1%
General Play	2,295	7.8%	6,849	18.5%	9,144	13.8%
Running bases	6,030	20.5%	1,929	5.2%	7,959	12.0%
Sliding	2,798	9.5%	4,750	12.8%	7,548	11.4%
Fielding a thrown ball	2,150	7.3%	2,986	8.1%	5,136	7.7%
Catching	4,232	14.4%	341	0.9%	4,573	6.9%
Batting	90	0.3%	4,240	11.4%	4,330	6.5%
Pitching	1,549	5.3%	948	2.6%	2,497	3.8%
Throwing(not pitching)	341	1.2%	1,201	3.2%	1,542	2.3%
Conditioning	0	0.0%	889	2.4%	889	1.3%
Other	2,212	7.5%	2,083	5.6%	4,295	6.5%
Unknown	1,442	4.9%	3,029	8.2%	4,471	6.7%
Total	**29,354**	**100.0%**	**37,037**	**100.0%**	**66,391**	**100.0%**

***** Totals and n's are not always equal due to slight rounding of the weighted number of injuries and missing responses. 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 11.5 Activity Resulting in Softball Injuries by Injury Diagnosis, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Diagnosis									
	Strain/Sprain		Contusion		Fracture		Concussion		Other	
	n	%	n	%	n	%	n	%	n	%
Activity										
Fielding	4,935	20.1%	1,313	15.6%	1,639	34.3%	4,249	34.1%	1,871	11.6%
Running	5,174	21.1%	334	4.0%	90	1.9%	424	3.4%	1,937	12.0%
Catching	0	0.0%	251	3.0%	424	8.9%	2,370	19.0%	1,528	9.4%
Pitching	0	0.0%	535	6.4%	0	0.0%	0	0.0%	1,961	12.1%
Sliding	4,886	19.9%	0	0.0%	857	17.9%	857	6.95	948	5.9%
Other	7,587	20.3%	5,397	37.5%	1,772	16.3%	4,311	34.6%	6,273	29.9%
Unknown	1,961	8.0%	584	6.9%	0	0.0%	251	2.0%	1,674	10.3%
Total	**24,543**	**100.0%**	**8,414**	**100.0%**	**4,782**	**100.0%**	**12,462**	**100.0%**	**16,192**	**100.0%**

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, 2016-17 School Year

	Boys' soccer	Girls' soccer*	RR (95% CI)†
Total	1.47	**2.46**	**1.67 (1.24-1.74)**
Competition	3.25	**5.91**	**1.82 (2.67-3.96)**
Practice	0.67	**0.85**	1.27 (0.92-1.74)

*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, 2016-17 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Body Site			
Hip/thigh/upper leg	**18.4%**	9.6%	**1.91 (1.09-3.34)**
Head/face	19.1%	**33.4%**	**1.75 (1.23-2.51)**
Ankle	19.0%	**22.8%**	1.20 (0.80-1.80)
Knee	10.1%	**13.5%**	1.34 (0.75-1.04)
Hand/wrist	**8.6%**	2.9%	**2.93 (1.16-7.41)**
Foot	3.0%	**3.9%**	1.29 (0.46-3.66)
Lower leg	**8.4%**	3.9%	2.12 (0.95-4.75)
Trunk	**5.7%**	2.6%	2.23 (0.76-6.57)
Arm/elbow	1.4%	**3.2%**	2.24 (0.48-10.52)
Shoulder	**2.3%**	1.7%	1.38 (0.35-5.52)
Neck	0.7%	**1.4%**	2.03 (0.21-19.88)
Other	**3.3%**	1.0%	3.21 (0.54-19.15)
Total	**100.0%**	**100.0%**	--

Table 12.3 Comparison of Diagnoses of Boys' and Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Diagnosis			
Strain/sprain	**46.1%**	40.6%	1.14 (0.89-1.44)
Contusion	**13.4%**	8.1%	1.66 (0.88-3.10)
Fracture	**10.2%**	8.0%	1.26 (0.64-2.52)
Concussion	18.1%	**32.9%**	**1.82 (1.25-2.63)**
Other	17.6%	**20.9%**	1.18 (0.77-1.81)
Total	**100.0%**	**100.0%**	--

Table 12.4 Most Common Boys' and Girls' Soccer Injury Diagnoses*, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Diagnosis			
Ankle strain/sprain	17.6%	**20.9%**	1.18 (00.77-1.81)
Head/face concussion	18.0%	**32.7%**	**1.82 (1.25-2.64)**
Hip/thigh/upper leg strain/sprain	**13.0%**	7.7%	1.70 (0.88-3.26)
Knee strain/sprain	4.6%	**7.3%**	1.58 (0.68-3.66)
Knee other	3.9%	**4.6%**	1.18 (0.42-3.30)

*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, 2016-17 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Time Loss			
1-2 days	10.6%	**14.3%**	1.35 (0.75-2.41)
3-6 days	**34.8%**	18.5%	**1.88 (1.30-2.71)**
7-9 days	14.8%	**15.1%**	1.02 (0.64-1.64)
10-21 days	19.4%	**25.4%**	1.30 (0.88-1.93)
22 days or more	5.5%	**7.0%**	1.26 (0.55-2.91)
Other	14.8%	**19.7%**	1.33 (0.84-2.11)
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, 2016-17 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Soccer Mechanism			
Contact with another player	28.0%	**29.1%**	1.04 (0.75-1.46)
Stepped on/fell on/kicked	11.3%	**11.8%**	1.05 (0.59-1.86)
Rotation around a planted foot/inversion	9.7%	**11.7%**	1.20 (0.64-2.25)
Overuse, heat illness, conditioning, etc.	**12.3%**	8.6%	1.44 (0.75-2.77)
Contact with ball	15.8%	**22.3%**	1.41 (0.90-2.12)
Uneven playing surface	0.9%	**1.8%**	2.03 (0.24-17.10)
Slide tackle	**2.7%**	2.4%	1.13 (0.31-4.11)
Contact with goal	**0.4%**	--	--
Other	**10.4%**	5.7%	1.83 (0.81-4.15)
Unknown	**8.5%**	6.6%	1.28 (0.60-2.72)
Total	**100.0%**	**100.0%**	---

Table 12.7 Comparison of Activities of Boys' and Girls' Soccer Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Boys' soccer	Girls' soccer	IPR (95% CI)
Soccer Activity			
General play	**22.4%**	16.1%	1.39 (0.89-2.19)
Defending	10.5%	**15.6%**	1.48 (0.86-2.56)
Chasing loose ball	**7.5%**	5.1%	1.47 (0.65-3.32)
Ball handling/dribbling	9.3%	**9.8%**	1.05 (0.54-2.04)
Goaltending	8.6%	**10.4%**	1.22 (0.63-2.34)
Shooting (foot)	**6.1%**	3.9%	1.55 (0.60-4.02)
Heading ball	5.0%	**10.7%**	**2.14 (1.03-4.46)**
Passing (foot)	2.4%	**5.7%**	2.37 (0.79-7.14)
Receiving pass	**4.7%**	1.6%	**2.94 (1.04-8.29)**
Conditioning	**4.8%**	2.2%	2.20 (0.59-8.25)
Other	**9.8%**	4.8%	2.03 (0.87-4.75)
Unknown	9.3%	**13.4%**	1.45 (0.77-2.73)
Total	**100.0%**	**100.0%**	---

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, 2016-17 School Year

	Boys' basketball	Girls' basketball	RR (95% CI)*
Total	1.54	**1.87**	**1.21 (1.03-1.43)**
Competition	2.65	**3.63**	**1.37 (1.10-1.70)**
Practice	**1.04**	1.03	1.01 (0.78-1.30)

*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 12.9 Comparison of Body Sites of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Body Site			
Ankle	**33.2%**	26.9%	1.23 (0.93-1.64)
Knee	9.9%	**16.1%**	**1.63 (1.02-2.60)**
Head/face	23.0%	**26.7%**	1.16 (0.84-1.61)
Hip/thigh/upper leg	**6.2%**	5.3%	1.16 (0.54-2.51)
Hand/wrist	**8.1%**	7.1%	1.15 (0.60-2.17)
Shoulder	**3.3%**	3.2%	1.03 (0.38-2.83)
Trunk	3.1%	**4.2%**	1.34 (0.50-3.57)
Lower leg	5.0%	**5.2%**	1.04 (0.54-2.39)
Arm/elbow	**2.4%**	0.3%	8.14 (0.95-69.62)
Foot	**4.6%**	2.8%	1.61 (0.58-4.50)
Neck	0.4%	**0.7%**	1.67 (0.11-26.47)
Other	0.8%	**1.4%**	1.79 (0.30-10.66)
Total	**100.0%**	**100.0%**	---

Table 12.10 Comparison of Diagnoses of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Diagnosis			
Strain/sprain	**51.3%**	43.9%	1.17 (0.96-1.42)
Contusion	**6.8%**	4.9%	1.38 (0.65-2.94)
Fracture	**8.4%**	5.8%	1.46 (0.75-2.85)
Concussion	16.5%	**23.5%**	1.42 (0.98-2.07)
Other	16.9%	**21.9%**	1.29 (0.88-1.90)
Total	**100.0%**	**100.0%**	---

Table 12.11 Most Common Boys' and Girls' Basketball Injury Diagnoses*, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Diagnosis			
Ankle strain/sprain	**31.1%**	24.9%	1.25 (0.93-1.68)
Head/face concussion	16.5%	**23.5%**	1.42 (0.98-2.07)
Knee strain/sprain	4.5%	**7.6%**	1.69 (0.92-3.51)
Knee other	4.8%	**8.1%**	1.69 (0.86-3.35)
Hand/wrist fracture	2.6%	**4.0%**	1.52 (0.58-3.97)
Hip/thigh/upper leg strain/sprain	2.7%	**3.5%**	1.32 (0.45-3.89)

*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, 2016-17 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Time Loss			
1-2 days	**17.0%**	10.7%	1.58 (0.99-2.55)
3-6 days	**24.2%**	21.6%	1.12 (0.80-1.58)
7-9 days	**21.7%**	16.6%	1.31 (0.88-1.94)
10-21 days	19.4%	**25.7%**	1.32 (0.94-1.86)
22 days or more	**6.6%**	5.7%	1.16 (0.55-2.47)
Other	11.1%	**19.8%**	**1.78 (1.14-2.76)**
Total	**100.0%**	**100.0%**	---

Table 12.13 Comparison of Mechanisms of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Basketball Mechanism			
Collision with another player	28.0%	**28.5%**	1.02 (0.75-1.37)
Jumping/landing	**28.4%**	17.0%	**1.67 (1.15-2.43)**
Overuse, heat illness, conditioning, etc.	6.7%	**13.2%**	**1.98 (1.05-3.73)**
Rotation around a planted foot/inversion	12.3%	**15.5%**	1.27 (0.80-2.00)
Stepped on/fell on/kicked	**7.8%**	6.6%	1.20 (0.60-2.39)
Contact with ball	3.2%	**3.8%**	1.20 (0.45-3.19)
Other	**12.3%**	10.2%	1.21 (0.70-2.09)
Unknown	1.3%	**5.2%**	4.04 (1.14-14.30)
Total	**100.0%**	**100.0%**	---

Table 12.14 Comparison of Activities of Boys' and Girls' Basketball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Boys' basketball	Girls' basketball	IPR (95% CI)
Basketball Activity			
Rebounding	**32.2%**	13.2%	2.43 (1.64-3.60)
General play	**21.4%**	21.0%	1.02 (0.69-1.50)
Defending	9.2%	**13.8%**	1.49 (0.90-2.48)
Chasing loose ball	7.6%	**14.5%**	**1.92 (1.10-3.34)**
Shooting	**11.2%**	10.4%	1.08 (0.62-1.90)
Conditioning	1.5%	**2.3%**	1.60 (0.40-3.39)
Ball handling/dribbling	3.8%	**6.2%**	1.65 (0.75-3.61)
Receiving pass	1.6%	**4.3%**	2.66 (0.76-9.30)
Other	3.8%	**4.8%**	1.25 (0.52-2.97)
Unknown	7.6%	**9.4%**	1.23 (0.67-2.27)
Total	**100.0%**	**100.0%**	---

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, 2016-17 School Year

	Baseball	Softball	RR (95% CI)
Total	0.74	**1.34**	**1.81 (1.42-2.32)**
Competition	1.23	**1.55**	1.26 (0.90-1.77)
Practice	0.44	**1.21**	**2.75 (1.90-3.99)**

Table 12.16 Comparison of Body Sites of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Baseball	Softball	IPR (95% CI)
Body Site			
Ankle	8.5%	**16.7%**	1.96 (0.86-4.49)
Knee	12.4%	**14.0%**	1.13 (0.52-2.46)
Head/face	**26.6%**	25.6%	1.04 (0.64-1.69)
Hip/thigh/upper leg	**16.6%**	7.9%	2.09 (0.84-5.18)
Hand/wrist	5.0%	**13.3%**	2.65 (1.01-6.96)
Shoulder	**12.5%**	7.4%	1.68 (0.67-4.20)
Trunk	--	**5.0%**	--
Lower leg	3.7%	**5.8%**	1.57 (0.39-6.32)
Arm/elbow	**13.9%**	1.4%	**9.90 (2.50-39.22)**
Foot	**0.8%**	--	--
Neck	--	**0.6%**	--
Other	--	**2.2%**	--
Total	**100.0%**	**100.0%**	---

Table 12.17 Comparison of Diagnoses of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Baseball	Softball	IPR (95% CI)
Diagnosis			
Strain/sprain	**38.7%**	37.6%	1.03 (0.71-1.49)
Contusion	**19.6%**	12.0%	1.63 (0.84-3.15)
Fracture	**8.1%**	7.3%	1.11 (0.41-3.00)
Concussion	16.0%	**18.3%**	1.14 (0.60-2.17)
Other	17.6%	**24.7%**	1.41 (0.80-2.49)
Total	**100.0%**	**100.0%**	---

Table 12.18 Most Common Baseball and Softball Injury Diagnoses*, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Baseball	Softball	IPR (95% CI)
Diagnosis			
Ankle strain/sprain	6.0%	**15.5%**	2.57 (0.96-6.92)
Hand/wrist fracture	0.9%	**2.5%**	2.84 (0.67-12.04)
Head/face concussion	16.0%	**18.3%**	1.14 (0.60-2.17)
Hip/thigh/upper leg strain/sprain	**13.8%**	7.4%	1.86 (0.70-4.93)
Knee strain/sprain	**8.6%**	2.8%	3.07 (0.74-12.75)
Shoulder strain/sprain	**5.0%**	3.2%	1.59 (0.41-6.13)
Knee other	2.2%	**10.7%**	**4.78 (1.23-18.62)**

*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, 2016-17 School Year

	Baseball	Softball	IPR (95% CI)
Time Loss			
1-2 days	**13.6%**	12.5%	1.09 (0.55-2.17)
3-6 days	**23.2%**	19.6%	1.19 (0.67-2.08)
7-9 days	**19.5%**	18.9%	1.03 (0.58-1.92)
10-21 days	16.9%	**24.7%**	1.46 (0.82-2.61)
22 days or more	8.1%	**8.4%**	1.04 (0.43-2.53)
Other	**18.7%**	16.0%	1.17 (0.60-2.25)
Total	**100.0%**	**100.0%**	---

Table 12.20 Comparison of Mechanisms of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Baseball	Softball	IPR (95% CI)
Baseball/Softball Mechanism			
Overuse, heat illness, conditioning, etc.	9.9%	**11.2%**	1.13 (0.43-2.78)
Contact with another player	**15.0%**	12.4%	1.21 (0.57-2.58)
Contact with bases	**12.6%**	11.6%	1.09 (0.48-2.44)
Throwing - not pitching	**5.9%**	1.9%	3.13 (0.78-12.55)
Throwing - pitching	**8.5%**	3.0%	2.88 (0.62-13.34)
Contact with thrown ball (non-pitch)	5.4%	**12.1%**	2.24 (0.83-6.08)
Rotation around a planted foot/inversion	6.7%	**10.1%**	1.50 (0.57-3.94)
Hit by batted ball	**12.1%**	7.5%	1.61 (0.69-3.76)
Hit by pitch	**5.6%**	3.6%	1.54 (0.38-6.36)
Other	15.9%	**19.1%**	1.20 (0.62-2.34)
Unknown	2.4%	**7.6%**	3.13 (0.66-14.75)
Total	**100.0%**	**100.0%**	---

Table 12.21 Comparison of Activities of Baseball and Softball Injuries, High School Sports-Related Injury Surveillance Study, US, 2016-17 School Year

	Baseball	Softball	IPR (95% CI)
Baseball/Softball Activity			
Fielding a batted ball	9.9%	**21.1%**	**2.13 (1.01-4.50)**
Fielding a thrown ball	**8.5%**	7.7%	1.10 (0.42-2.84)
Running bases	**19.6%**	12.0%	1.64 (0.81-3.30)
Pitching	**9.7%**	3.8%	2.58 (0.72-9.23)
Batting	**10.6%**	6.5%	1.62 (0.59-4.45)
Sliding	8.5%	**11.4%**	1.34 (0.53-3.37)
Throwing (not pitching)	**9.4%**	2.3%	4.05 (1.36-12.03)
General play	4.8%	**13.8%**	2.85 (0.91-8.87)
Conditioning	**2.6%**	1.3%	1.94 (0.35-10.64)
Catching	5.3%	**6.9%**	1.31 (0.42-4.08)
Other	**8.2%**	6.5%	1.27 (0.43-3.78)
Unknown	2.9%	**6.7%**	2.36 (0.49-11.42)
Total	**100.0%**	**100.0%**	---

XIII. Trends over Time

Table 13.1 Injury Rates by Sport, Type of Exposure, and Year, High School Sports-Related Injury Surveillance Study, US, 2005/06-2016/17 School Years (continued on next page)

	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	p-value for trend*
Overall total	2.51	2.59	2.31	2.01	2.10	1.97	2.17	2.16	2.18	2.13	2.32	2.09	0.12
Competition	4.63	4.88	4.45	4.05	4.19	4.10	4.26	4.31	4.22	4.40	4.74	4.28	0.53
Practice	**1.69**	**1.75**	**1.52**	**1.26**	**1.32**	**1.16**	**1.40**	**1.34**	**1.39**	**1.28**	**1.39**	**1.22**	**0.03**
Boys' football total	4.36	4.45	4.18	3.50	3.81	3.50	3.78	3.87	3.74	3.73	4.08	3.56	0.07
Competition	12.09	13.50	12.80	11.26	12.95	12.30	12.41	12.53	11.38	11.97	12.68	11.55	0.24
Practice	2.54	2.68	2.47	1.92	2.06	1.74	2.16	2.08	2.15	2.06	2.18	1.89	0.05
Boys' soccer total	**2.43**	**2.27**	**1.75**	**1.62**	**1.75**	**1.56**	**1.64**	**1.52**	**1.62**	**1.60**	**1.87**	**1.47**	**0.02**
Competition	4.22	4.31	3.63	3.43	3.39	3.08	3.47	3.28	3.40	3.43	3.95	3.25	0.10
Practice	**1.58**	**1.45**	**0.96**	**0.87**	**1.04**	**0.90**	**0.90**	**0.78**	**0.82**	**0.78**	**0.91**	**0.67**	**0.002**
Girls' soccer total	2.36	2.51	2.35	2.07	2.00	1.93	2.42	2.29	2.47	2.64	2.59	2.46	0.20
Competition	**5.21**	**5.43**	**5.15**	**4.59**	**4.67**	**4.13**	**5.68**	**5.54**	**5.72**	**6.11**	**5.93**	**5.91**	**0.04**
Practice	1.10	1.31	1.16	1.00	0.85	0.93	1.09	0.92	1.04	1.09	1.09	0.85	0.16
Girls' volleyball total	1.64	1.37	1.22	0.89	0.99	0.96	1.00	0.89	0.99	1.11	1.19	1.13	0.15
Competition	1.92	1.40	1.43	0.90	1.00	1.18	1.27	1.08	1.15	1.39	1.52	1.67	0.96
Practice	**1.48**	**1.36**	**1.12**	**0.88**	**0.99**	**0.85**	**0.85**	**0.78**	**0.91**	**0.97**	**1.02**	**0.86**	**0.02**
Boys' basketball total	1.89	1.75	1.39	1.35	1.45	1.34	1.40	1.47	1.45	1.08	1.48	1.54	0.11
Competition	2.98	2.87	2.23	2.32	2.72	2.30	2.60	2.44	2.40	1.98	2.84	2.65	0.45
Practice	**1.46**	**1.28**	**1.04**	**0.95**	**0.92**	**0.91**	**0.91**	**1.04**	**1.02**	**0.68**	**0.90**	**1.04**	**0.03**

	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	p-value for trend*
Girls' basketball total	2.01	2.09	1.61	1.54	1.58	1.73	1.57	1.83	1.88	1.65	2.14	1.87	0.78
Competition	3.6	3.6	3.3	3.13	2.84	3.59	3.03	3.13	3.66	3.27	4.17	3.63	0.37
Practice	1.37	1.44	0.9	0.87	1.02	0.92	0.98	1.24	1.08	0.94	1.24	1.03	0.47
Boys' wrestling total	2.50	2.51	2.27	2.17	1.98	2.01	2.50	2.33	2.48	2.12	2.23	2.02	0.26
Competition	3.93	3.80	3.70	3.35	3.09	3.32	3.56	3.54	3.95	3.76	3.43	3.77	0.99
Practice	2.04	2.06	1.76	1.75	1.56	1.55	2.10	1.88	1.95	1.61	1.83	1.40	0.17
Boys' baseball total	1.19	1.25	0.93	0.78	0.82	0.81	0.83	0.88	1.01	0.94	0.84	0.74	0.05
Competition	1.77	2.01	1.37	1.32	1.27	1.49	1.14	1.30	1.68	1.67	1.35	1.23	0.20
Practice	**0.87**	**0.82**	**0.68**	**0.48**	**0.57**	**0.46**	**0.65**	**0.66**	**0.63**	**0.55**	**0.56**	**0.44**	**0.03**
Girls' softball total	1.13	1.11	1.29	1.04	1.12	0.94	1.46	1.15	0.99	1.00	1.30	1.34	0.56
Competition	1.78	1.96	1.86	1.62	1.66	1.45	2.04	1.96	1.09	1.67	2.10	1.55	0.61
Practice	0.79	0.65	0.98	0.72	0.85	0.69	1.16	0.73	0.93	0.65	0.87	1.21	0.24

*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, 2005/06-2016/17 School Years (continued on next page)

	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Overall total	**1,442,533**	**1,472,849**	**1,419,723**	**1,248,126**	**1,359,897**	**1,195,815**	**1,392,262**	**1,361,986**	**1,427,315**	**1,196,479**	**1,393,566**	**1,160,321**
Competition	**759,334**	**766,512**	**763,034**	**690,525**	**754,091**	**711,642**	**740,493**	**779,055**	**790,966**	**708,150**	**801,156**	**699,410**
Practice	**683,199**	**706,337**	**656,689**	**557,601**	**605,805**	**484,173**	**651,769**	**582,931**	**636,349**	**488,329**	**592,410**	**460,911**
Boys' football total	516,150	574,367	616,665	527,321	581,414	483,016	559,064	616,209	624,470	529,483	568,789	444,281
Competition	280,919	292,316	311,780	288,637	322,801	296,199	287,710	344,097	324,354	286,421	316,308	252,462
Practice	235,231	282,051	304,885	238,684	258,614	186,817	271,354	272,112	300,116	243,062	252,481	191,819
Boys' soccer total	218,760	171,874	159,351	149,229	153,485	138,974	172,070	149,049	149,278	133,919	174,811	145,215
Competition	119,703	93,295	99,785	87,082	83,985	81,238	97,540	89,429	90,683	89,091	111,720	98,031
Practice	99,058	78,579	59,566	62,147	69,500	57,736	74,530	59,620	58,595	44,828	63,091	47,184
Girls' soccer total	185,770	230,769	215,850	192,108	181,159	180,254	222,679	190,382	227,172	217,546	209,027	190,436
Competition	122,803	149,231	146,102	123,312	129,754	124,674	145,469	141,339	167,975	158,078	142,722	146,696
Practice	62,967	81,538	69,748	68,796	51,405	55,580	77,210	49,043	59,197	59,468	66,305	43,740
Girls' volleyball total	81,813	80,493	72,261	56,609	67,760	50,711	52,662	44,064	45,144	46,807	58,127	46,601
Competition	32,677	27,423	26,539	19,764	21,728	21,416	24,439	19,150	16,430	19,373	25,300	23,886
Practice	49,136	53,069	45,722	36,845	46,032	29,295	28,223	24,914	28,714	27,434	32,827	22,715

Table 13.2 Nationally Estimated Number of Injuries by Sport, Type of Exposure, and Year, High School Sports-Related Injury Surveillance Study, US, 2005/06-2016/17 School Years (continued)

	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Boys' basketball total	100,058	96,670	82,612	79,230	85,063	79,762	75,872	85,819	84,455	55,980	81,240	88,927
Competition	44,826	46,109	36,766	40,152	46,787	41,252	41,978	44,095	42,504	32,534	45,596	46,251
Practice	55,232	50,561	45,846	39,078	38,276	38,510	33,894	41,724	41,951	23,446	35,644	42,676
Girls' basketball total	103,566	102,831	73,283	64,933	78,709	83,033	67,280	83,107	89,451	64,491	99,598	70,700
Competition	53,812	53,703	45,236	38,277	44,026	53,931	37,213	45,645	50,864	38,803	56,786	44,660
Practice	49,753	49,128	28,047	26,656	34,684	29,102	30,067	37,462	38,587	25,688	42,812	26,040
Boys' wrestling total	105,542	101,139	91,625	88,996	80,390	80,569	107,992	85,485	91,203	60,253	91,642	67,834
Competition	36,259	38,750	40,698	39,029	37,742	36536	40,235	35,016	39,378	32,728	38,430	34,405
Practice	69,283	62,389	50,927	49,967	42,647	44,033	67,757	50,469	51,825	27,525	53,212	33,429
Boys' baseball total	67,560	60,296	44,760	39,869	64,053	46,796	43,590	49,747	62,493	44,208	44,760	36,395
Competition	33,639	33,494	22,803	25,584	36,502	29,789	20,818	24,807	37,682	27,129	25,581	21,458
Practice	33,922	26,802	21,957	14,285	27,551	17,008	22,772	24,940	24,811	17,079	19,179	14,937
Girls' softball total	63,313	54,411	63,316	49,831	67,862	52,700	91,053	58,124	53,649	43,792	65,572	69,932
Competition	34,696	32,191	33,325	28,688	30,767	26,607	45,091	35,477	21,096	23,993	38,713	31,561
Practice	28,618	22,220	29,991	21,143	37,096	26,093	45,962	22,647	32,553	19,799	26,859	38,371

Table 13.3 Body Site of Injury by Year, High School Sports-Related Injury Surveillance Study, US, 2005/06-2016/17 School Years* (continued on next page)

	2005-06 n=1,442,048	2006-07 n=1,464,926	2007-08 n=1,411,621	2008-09 n=1,248,126	2009-10 n=1,359,897	2010-11 n=1,194,319	2011-12 n=1,391,577
Body Site							
Ankle	22.7%	19.8%	18.5%	16.4%	17.5%	17.7%	16.1%
Knee	14.2%	16.6%	14.6%	14.8%	15.7%	14.2%	13.4%
Head/face	12.3%	12.4%	12.4%	15.3%	17.2%	23.3%	25.1%
Hip/thigh/upper leg	10.8%	10.5%	10.2%	10.3%	9.2%	8.3%	9.8%
Shoulder	7.9%	8.0%	10.1%	9.3%	8.4%	7.0%	6.6%
Hand/wrist	8.0%	7.5%	9.1%	8.5%	10.3%	8.9%	8.5%
Trunk	6.2%	6.7%	6.5%	6.6%	5.8%	4.7%	4.9%
Lower leg	4.6%	5.2%	5.7%	5.8%	4.7%	5.0%	4.5%
Arm/elbow	4.1%	3.9%	4.6%	4.1%	4.0%	3.1%	4.0%
Foot	4.0%	4.0%	4.2%	5.0%	4.1%	4.0%	3.4%
Neck	2.2%	1.9%	1.8%	1.9%	1.9%	1.8%	1.7%
Other	3.2%	3.6%	2.4%	2.1%	1.2%	2.1%	2.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

*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 13.3 Continued: Body Site of Injury by Year, High School Sports-Related Injury Surveillance Study, US, 2005/06-2016/17 School Years*

	2012-13 n=1,361,584	2013-14 n=1,427,315	2014-15 n=1,196,398	2015-16 n=1,393,565	2016-17 n = 1,160,321
Body Site					
Ankle	15.5%	16.9%	15.1%	16.6%	17.8%
Knee	14.8%	14.4%	13.7%	14.9%	13.4%
Head/face	25.7%	25.3%	27.4%	27.3%	27.2%
Hip/thigh/upper leg	9.5%	8.7%	9.0%	8.0%	9.0%
Shoulder	6.5%	8.5%	7.2%	6.8%	6.4%
Hand/wrist	7.4%	7.8%	7.4%	7.8%	7.7%
Trunk	5.2%	4.1%	4.3%	4.0%	4.3%
Lower leg	3.9%	4.9%	4.0%	4.3%	4.4%
Arm/elbow	3.5%	3.1%	3.7%	3.4%	3.7%
Foot	3.2%	2.8%	3.9%	3.6%	2.5%
Neck	2.3%	1.2%	1.9%	1.3%	1.4%
Other	2.5%	2.4%	2.5%	2.1%	2.3%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

*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, 2005/06-2016/17 School Years

	2005-06, n=1,444,172	2006-07, n=1,466,398	2007-08 n=1,414,139	2008-09 n=1,248,126	2009-10 n=1,359,897	2010-11 n=1,191,484
Diagnosis						
Strain/sprain	52.0%	48.2%	48.3%	45.7%	44.7%	43.2%
Contusion	12.2%	13.7%	12.4%	11.5%	14.0%	9.6%
Fracture	9.8%	8.9%	10.2%	10.9%	9.9%	10.2%
Concussion	9.1%	8.4%	9.2%	11.8%	14.0%	20.0%
Other	16.8%	20.9%	19.9%	20.2%	17.5%	17.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	2011-12 n=1,392,262	**2012-13 n=1,360,701**	**2013-14 n=1,427,315**	**2014-15 n=1,194,932**	**2015-16 n=1,391,729**	**2016-17 n=1,157,001**
Diagnosis						
Strain/sprain	42.2%	42.3%	41.7%	39.8%	40.4%	40.2%
Contusion	10.8%	10.6%	9.4%	9.3%	9.2%	9.6%
Fracture	7.7%	7.8%	7.6%	9.4%	8.6%	8.5%
Concussion	22.2%	23.1%	21.9%	24.6%	24.6%	24.8%
Other	17.1%	16.2%	19.4%	16.9%	17.1%	16.9%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 13.5 Most Common Injury Diagnoses by Year, High School Sports-Related Injury Surveillance Study, US, 2005/06-2016/17 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	2009-10 n=1,359,897	2010-11 n=1,189,985
Diagnosis						
Ankle strain/sprain	20.6%	17.8%	17.3%	15.0%	16.0%	16.3%
Head/face concussion	9.0%	8.4%	9.2%	11.7%	13.9%	20.0%
Knee strain/sprain	7.6%	8.8%	7.8%	7.9%	8.0%	7.7%
Hip/thigh/upper leg strain/sprain	7.9%	7.7%	7.3%	7.7%	6.5%	6.4%
Knee other	4.3%	4.9%	4.7%	4.5%	5.2%	4.8%
Shoulder other	3.1%	3.7%	4.1%	4.0%	3.3%	3.7%
Hand/wrist fracture	3.2%	3.3%	4.0%	4.0%	4.2%	4.0%
Shoulder strain/sprain	3.4%	2.9%	3.4%	3.7%	3.3%	2.2%
Trunk strain/sprain	2.8%	2.7%	3.2%	2.8%	2.5%	2.4%
Hand/wrist strain/sprain	3.1%	2.5%	3.8%	2.9%	2.8%	2.8%
	2011-12 n=1,388,873	**2012-13 n=1,360,303**	**2013-14 n=1,426,018**	**2014-15 n=1,194,848**	**2015-16 n=1,391,729**	**2016-17 n = 1,157,003**
Diagnosis						
Ankle strain/sprain	14.7%	14.5%	15.6%	14.2%	15.7%	16.5%
Head/face concussion	22.2%	23.1%	21.9%	24.5%	24.6%	24.8%
Knee strain/sprain	7.6%	8.2%	7.8%	7.3%	8.1%	6.9%
Hip/thigh/upper leg strain/sprain	6.9%	6.7%	6.6%	6.9%	5.7%	6.4%
Knee other	3.9%	4.1%	4.7%	4.5%	5.2%	4.9%
Shoulder other	3.1%	3.4%	4.6%	4.0%	3.3%	3.4%
Hand/wrist fracture	3.7%	3.2%	3.3%	3.5%	3.6%	3.5%
Shoulder strain/sprain	2.9%	2.6%	3.3%	2.6%	2.9%	2.7%
Trunk strain/sprain	1.9%	2.3%	1.7%	1.9%	1.5%	1.9%
Hand/wrist strain/sprain	3.0%	2.5%	2.8%	1.9%	2.5%	2.0%

Table 13.6 Time Loss of Injuries by Year, High School Sports-Related Injury Surveillance Study, US, 2005/06-2015/16 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	2009-10 n= 1,359,897	2010-11 n=1,195,815
Time Loss						
1-2 days	22.5%	26.6%	22.8%	13.7%	14.7%	12.8%
3-6 days	30.0%	28.5%	28.8%	28.5%	27.3%	25.2%
7-9 days	15.3%	14.7%	15.8%	17.7%	16.1%	16.7%
10-21 days	14.9%	14.1%	16.7%	19.7%	16.9%	19.2%
≥22 days or other	17.2%	16.1%	15.9%	20.3%	25.0%	26.1%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	2011-12 n=1,392,262	**2012-13 n=1,361,986**	**2013-14 n=1,427,312**	**2014-15 n=1,196,479**	**2015-16 n=1,393,565**	**2016-17 n= 1,160,321**
Time Loss						
1-2 days	15.9%	12.6%	14.9%	11.0%	16.3%	12.6%
3-6 days	23.3%	23.6%	21.8%	22.0%	21.9%	22.0%
7-9 days	16.1%	16.3%	16.7%	15.6%	12.9%	16.1%
10-21 days	19.6%	21.3%	21.1%	22.1%	21.1%	21.6%
≥22 days or other	25.0%	26.2%	25.5%	29.3%	27.8%	27.8%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 13.7 Injuries Requiring Surgery by Year, High School Sports-Related Injury Surveillance Study, US, 2005/06-2015/16 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	2009-10 n= 1,359,897	2010-11 n=1,169,423
Required surgery	5.3%	6.4%	6.1%	6.7%	8.0%	8.2%
Did not require surgery	94.7%	93.6%	93.9%	93.3%	92.0%	91.8%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	2011-12 n=1,392,262	**2012-13 n=1,337,403**	**2013-14 n=1,407,594**	**2014-15 n=1,186,938**	**2015-16 n=1,380,731**	**2016-17 n = 1,147,090**
Required surgery	6.7%	7.3%	7.6%	7.3%	6.1%	7.1%
Did not require surgery	93.3%	92.7%	92.4%	92.7%	93.9%	92.9%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

XIV. Reporter Demographics & Compliance

During the 2016-17 school year, ATs were invited to participate in the study at the beginning of the school year. ATs were expected to report for every week in which they were enrolled. For example, an AT who joined the study as a replacement school in week 10 was not expected to report for weeks 1-9. Overall, 98 enrolled ATs reported an average of 38 study weeks. Internal validity checks during the 2014-15 academic year yielded 82.6% sensitivity, 98.2% specificity, a positive predictive value of 90.5%, and a negative predictive value of 96.4%.

Prior to the start of the 2016-17 High School RIO™ study, participating ATs were asked to complete a short demographics survey. Over three-quarters (85.4%) of participating high schools were public schools, with the remainder being private. All ATs provided services to athletes of their high school on 5 or more days each week. Over 90% of ATs participating during the 2016-17 study year had previously participated in the High School RIO™ study.

An online "End of Season" survey gave all participating ATs (both in the original study as well as in the expanded study including those ATs who did not report any data) the opportunity to provide feedback on their experiences with High School RIO™. This survey was completed by 98 ATs (52.6%). Average reporting time burdens were 24 minutes for the weekly exposure report and 9 minutes for the injury report form. Using a 5 point Likert scale, RIO™ was overwhelmingly reported to be either very easy (53.1%) or somewhat easy (33.7%) to use (5 and 4 on the Likert scale, respectively), with ATs being either very satisfied (56.1%) or somewhat satisfied (34.7%) with the study (5 and 4 on the Likert scale, respectively). Suggestions provided by ATs, 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 2017-18 school year.

XV. 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.