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Epidemiology of Injuries in National Collegiate Athletic Association Men's Football: 2014–2015 Through 2018–2019

Avinash Chandran, PhD, MS*; Sarah N. Morris, PhD*; Jacob R. Powell, MS, LAT, ATC†‡; Adrian J. Boltz, MSH*; Hannah J. Robison, MS, LAT, ATC*; Christy L. Collins, PhD*

*Datalys Center for Sports Injury Research and Prevention, Indianapolis, IN; †Matthew Gfeller Sport-Related Traumatic Brain Injury Research Center, Department of Exercise and Sport Science, University of North Carolina at Chapel Hill; ‡Curriculum in Human Movement Science, Department of Allied Health Sciences, School of Medicine, The University of North Carolina at Chapel Hill

Context: Football is among the most popular collegiate sports in the United States, and participation in National Collegiate Athletic Association (NCAA) football has risen in recent years.

Background: Continued monitoring of football injuries is important for capturing the evolving burden of injuries in NCAA football. The purpose of this study was to describe the epidemiology of football-related injuries among men's NCAA football players during the 2014–2015 through 2018–2019 academic years.

Methods: Exposure and injury data collected in the NCAA Injury Surveillance Program were analyzed. Injury counts, rates, and proportions were used to describe injury characteristics, and injury rate ratios were used to examine differential injury rates.

Results: The overall injury rate was 9.31 per 1000 athlete-exposures. Most injuries occurred during general play (17.5%), blocking (15.8%), and tackling (14.0%). Concussions (7.5%), lateral ligament complex tears (6.9%), and hamstring tears (4.7%) were the most commonly reported injuries.

Conclusions: Results of this study were generally consistent with previous findings, though changes over time in rates of commonly reported injuries warrant attention. Continued monitoring of injury incidence is needed to appraise the effectiveness of recently implemented rules changes.

Key Words: collegiate, descriptive epidemiology, injury surveillance

Key Points

- Across the study period, the competition-related injury rate was higher than the practice-related injury rate; the preseason injury rate was also higher than regular and postseason injury rates.
- Knee, shoulder, and ankle injuries accounted for the largest proportions of all reported injuries, and injuries were most commonly classified as sprains and strains.
- The most commonly reported specific injuries were concussions, ankle sprains, and hamstring tears; rates of concussions remained stable throughout the study period whereas rates of hamstring tears and ankle sprains decreased between 2015/16 and 2016/17 and continued to increase thereafter.

Football is one of the most popular sports in the United States. The sport enjoys healthy participation at the high school and collegiate levels,[1] and participation in National Collegiate Athletic Association (NCAA) football continues to rise yearly.[2] Within the last decade, NCAA football participation has increased by approximately 12%, from 66 313 in 2009–2010 to 73 712 in 2018–2019.[2] Given the observed participation levels in NCAA football and increasing scrutiny of long-term health risks, continuous injury surveillance is necessary to identify emerging trends related to incidence and clinical outcomes.

In 1982, the NCAA formalized an injury surveillance system, now known as the NCAA Injury Surveillance Program (ISP).[3,4] The first authors studying NCAA football using data collected within the injury surveillance system (from 1988–1989 through 2003–2004) reported a practice injury rate of approximately 4 injuries per 1000 athlete-exposures (AEs) and a notably higher competition injury rate of approximately 36 injuries per 1000 AEs.[5] Similar findings were observed when this population was again studied using injury surveillance data collected during the 2004–2005 through 2013–2014 season.[6] Additionally, the hip/thigh/upper leg, knee, and ankle have been previously reported as among the most commonly injured body parts in this population, and it has been noted that injuries are most often attributed to player contact mechanisms.[5,6]

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Importantly, since the latest epidemiologic investigation of this population using surveillance data (reflecting data captured through the 2013–2014 academic year), rule changes (such as those associated with targeting, blocking below the waist, and kickoffs) and changing gameplay tactics have brought a natural evolution to the dynamics of football gameplay.[7–9] These evolutions may reasonably have also affected injury incidence in this population. Therefore, it is important to continue evaluating injury surveillance data to identify emerging injury incidence patterns, which may subsequently serve as a platform for the development of nuanced hypothesis and targeted studies. Accordingly, the purpose of this study is to describe the epidemiology of football-related injuries captured by the NCAA-ISP during the 2014–2015 through 2018–2019 athletic seasons.

METHODS

Study Data

Men's football-related exposure and injury data collected in the NCAA-ISP during the 2014–2015 through 2018–2019 academic years were analyzed in this study. The methods of the NCAA-ISP have been reviewed and approved as an exempt study by the NCAA Research Review Board. The methods of the surveillance program are described in a separate manuscript within this special issue. Briefly, athletic trainers (ATs) at participating institutions contributed relevant injury and exposure data using their clinical electronic medical record systems (the NCAA-ISP uses a common data element strategy to facilitate data submissions from electronic medical record systems). A reportable injury was one that occurred due to participation in an organized intercollegiate practice or competition and required medical attention by a team certified AT or physician (regardless of time loss [TL]). A TL injury was any injury in which the injured athlete returned to activity the day after or beyond with respect to the date of injury. Exposure events specifically identified as scheduled team practices and competitions (by the reporting AT) were considered reportable exposures for this study. Data from 30 participating programs (5% of membership) in 2014–2015, 23 (3% of membership) in 2015–2016, 27 (4% of membership) in 2016–2017, 45 (7% of membership) in 2017–2018, and 106 (16% of membership) in 2018–2019 qualified for inclusion in analyses (qualification criteria are detailed in the methods manuscript).[10]

Statistical Analysis

Injury counts and rates (per 1000 AEs; 1 AE was defined as 1 athlete participating in 1 exposure event) were evaluated across levels of event type (practice, competition), competition level (Division I, Division II, Division III), season segment (preseason, regular season, postseason), and TL (TL, non-time loss [NTL]). Post-stratification sample weights by sport and division are established within the surveillance system to compute national estimates of injury events based on the sampled teams; weighted and unweighted rates were estimated for this study, and results are presented in terms of unweighted rates unless otherwise specified. Temporal patterns in injury rates across the study period were evaluated using rate profile plots stratified across aforementioned variables. Similarly, temporal trends in rates of most commonly reported injuries were also examined across the study period. Injury counts and proportions were examined by TL, body parts injured, injury diagnoses, injury mechanism, playing positions, and activities (ie, the specific activity the athlete was engaged in at the time of injury as recorded by the reporting AT at their discretion). Injury rate ratios (IRRs) were used to examine differential injury rates across event types, competition levels, and season segments. IRRs with associated 95% CIs excluding 1.00 were considered statistically significant, and all analyses were conducted using SAS 9.4 (SAS Institute).

RESULTS

A total of 17 315 men's football injuries from 1 860 042 AEs were reported to the NCAA-ISP during the 2014–2015 through 2018–2019 academic years (Rate = 9.31 per 1000 AEs; 95% CI = 9.17, 9.45). This equated to a national estimate of 255 246 injuries overall (Table 1). During the study period, the competition injury rate was higher than the practice injury rate (IRR = 6.45; 95% CI = 6.26, 6.64). Competition and practice injury rates remained stable throughout the study period (Figure A). The overall Division I injury rate (Rate = 10.37 per 1000 AEs; 95% CI = 10.17, 10.57) was higher than the Division II (Rate = 8.43 per 1000 AEs; 95% CI = 8.15, 8.70) and Division III (Rate = 7.76 per 1000 AEs; 95% CI = 7.49, 8.02) injury rates. Statistically significant differences were observed between Division I and Division II rates (IRR = 1.23; 95% CI = 1.19, 1.28), as well as between Division II and Division III rates (IRR = 1.09; 95% CI = 1.04, 1.14).

Injuries by Season Segment

A total of 5453 preseason injuries (National Estimate = 83 068), 11 292 regular-season injuries (National Estimate = 163 499), and 570 postseason injuries (National Estimate = 8679) were reported during the study period (Table 2). The rate of preseason injuries was higher than the rates of regular-season injuries (IRR = 1.10; 95% CI = 1.07, 1.14) and postseason injuries (IRR = 1.52; 95% CI = 1.39, 1.65). Rates of preseason and regular-season injuries remained relatively stable throughout the study period (Figure B). In comparison, rates of postseason injuries were notably heterogeneous between 2014–2015 and 2018–2019 (Figure B).

Time Loss

Under half (41.2%) of all reported injuries were TL (resulting in $\geq$1 day of TL) injuries (37.7% were NTL injuries; TL information was missing or unknown in approximately 21% of all reported injuries). Over one-third of all TL injuries (36.4%) resulted in TL of 10 or more days. TL injuries accounted for a marginally higher proportion of practice injuries (43.9%) than competition injuries (37.8%). Rates of competition-related TL injuries consistently decreased between 2015–2016 and 2018–2019 (Figure C). In comparison, rates of practice-related TL injuries remained stable throughout the study period (Figure C).

Table 1. Reported and National Estimates of Injuries, Athlete-Exposures (AEs), and Rates per 1000 AEs by Event Type Across Divisions[a]

	Number AEs Rate per 1000 AEs (95% CI)					
	Overall		Practices		Competitions	
Division	Reported	National Estimate	Reported	National Estimate	Reported	National Estimate
I	10 301	134 745	5691	75 518	4610	59 227
	993 399	13 187 530	890 571	11 908 308	102 828	1 279 222
	10.37 (10.17, 10.57)	10.22 (10.02, 10.42)	6.39 (6.22, 6.56)	6.34 (6.18, 6.51)	44.83 (43.54, 46.13)	46.30 (45.01, 47.59)
II	3675	50 464	1968	26 667	1707	23 796
	436 171	7 113 413	379 940	6 222 508	56 231	890 904
	8.43 (8.15, 8.70)	7.09 (6.82, 7.37)	5.18 (4.95, 5.41)	4.29 (4.06, 4.51)	30.36 (28.92, 31.80)	26.71 (25.27, 28.15)
III	3339	70 038	1894	40 311	1445	29 727
	430 472	9 907 124	381 372	8 853 870	49 101	1 053 255
	7.76 (7.49, 8.02)	7.07 (6.81, 7.33)	4.97 (4.74, 5.19)	4.55 (4.33, 4.78)	29.43 (27.91, 30.95)	28.22 (26.71, 29.74)
Overall	17 315	255 246	9553	142496	7762	112 750
	1 860 042	30 208 068	1 651 883	26 984 687	208 160	3 223 381
	9.31 (9.17, 9.45)	8.45 (8.31, 8.59)	5.78 (5.67, 5.90)	5.28 (5.16, 5.40)	37.29 (36.46, 38.12)	34.98 (34.15, 35.81)

[a] Data presented in the order of reported number, followed by athlete exposures (AEs), estimated injury rates, and associated 95% Confidence Intervals (CIs) for each cross-tabulation of division and event types. Data pooled association-wide are presented overall, and separately for practices and competitions. National estimates were produced using sampling weights estimated on the basis of sport, division, and year. All CIs were constructed using variance estimates calculated on the basis of reported data. A reportable injury was one that occurred due to participation in an organized intercollegiate practice or competition and required medical attention by a team Certified Athletic Trainer or physician (regardless of time loss). Only scheduled team practices and competitions were retained in this analysis

Injury Characteristics

Knee injuries (15.5%), shoulder injuries (13.5%), and ankle injuries (12.5%) accounted for the largest proportions of all injuries reported during the study period. Head/face injuries (9.2%) were also commonly reported during the study period. Knee injuries accounted for comparable proportions of competition (16.8%) and practice (14.4%) injuries. In comparison, shoulder injuries and ankle injuries accounted for marginally larger proportions of competition than practice injuries (Table 3). Approximately half of all reported injuries (50.9%) were attributable to player contact. Noncontact (18.1%) and surface contact injuries (12.2%) also accounted for notable proportions of all reported injuries. Player contact injuries accounted for a larger proportion of competition (62.6%) than practice injuries (41.4%). Conversely, noncontact injuries accounted for a larger proportion of practice (23.8%) than competition injuries (11.0%).

Overall, most men's football injuries reported during the 2014–2015 through 2018–2019 academic years were sprains

Table 2. Reported and National Estimates of Injuries, Athlete-Exposures (AEs), and Rates per 1000 AEs by Season Segment Across Divisions[a]

	Number AEs Rate per 1000 AEs (95% CI)					
	Preseason		Regular Season		Post Season	
Division	Reported	National Estimate	Reported	National Estimate	Reported	National Estimate
I	3122	41 759	6757	86 909	422	6077
	277 111	3 720 169	656 197	8 663 189	60 091	804 172
	11.27 (10.87, 11.66)	11.23 (10.83, 11.62)	10.30 (10.05, 10.54)	10.03 (9.79, 10.28)	7.02 (6.35, 7.69)	7.56 (6.89, 8.23)
II	1193	17 028	2401	32 672	81	764
	129 311	2 157 823	295 733	4 813 122	11 127	142 468
	9.23 (8.70, 9.75)	7.89 (7.37, 8.41)	8.12 (7.79, 8.44)	6.79 (6.46, 7.11)	7.28 (5.69, 8.86)	5.36 (3.78, 6.95)
III	1138	24 280	2134	43 919	67	1838
	133 844	3 040 646	282 183	6 405 235	14 445	461 244
	8.50 (8.01, 9.00)	7.99 (7.49, 8.48)	7.56 (7.24, 7.88)	6.86 (6.54, 7.18)	4.64 (3.53, 5.75)	3.98 (2.87, 5.10)
Overall	5453	83 068	11 292	163 499	570	8679
	540 266	8 918 638	1 234 114	19 881 546	85 662	1 407 884
	10.09 (9.83, 10.36)	9.31 (9.05, 9.58)	9.15 (8.98, 9.32)	8.22 (8.05, 8.39)	6.65 (6.11, 7.20)	6.16 (5.62, 6.71)

[a] Data presented in the order of reported number, followed by athlete exposures (AEs), estimated injury rates, and associated 95% Confidence Intervals (CIs) for each cross-tabulation of division and season segments. Data pooled association-wide are presented overall, and separately for preseason, regular season, and post season. National estimates were produced using sampling weights estimated on the basis of sport, division, and year. All CIs were constructed using variance estimates calculated on the basis of reported data. A reportable injury was one that occurred due to participation in an organized intercollegiate practice or competition and required medical attention by a team Certified Athletic Trainer or physician (regardless of time loss). Only scheduled team practices and competitions were retained in this analysis.

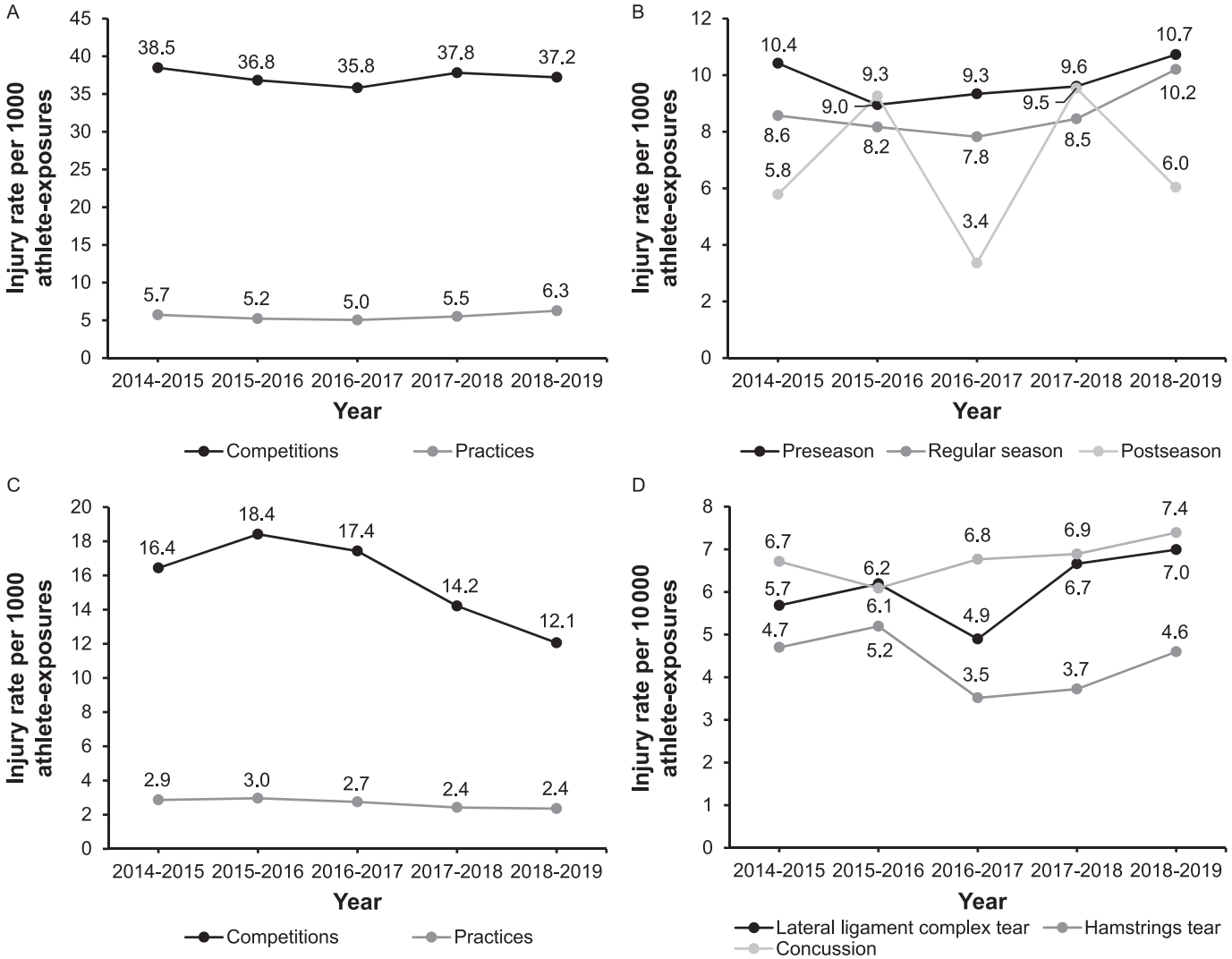

Figure. Temporal patterns in injury rates between 2014–2015 and 2018–2019. A, Overall injury rates (per 1000 athlete-exposures [AEs]) stratified by event type (practices, competitions). B, Injury rates (per 1000 AEs) stratified by season segment. C, Rates of time-loss injuries (per 1000 AEs) stratified by event type (practices, competitions). D, Rates (per 10 000 AEs) of most commonly reported injuries. Rates presented in all figures are unweighted and based on reported data.

(28.5%) and strains (18.7%). Contusions (13.7%) and concussions (7.5%) also accounted for notable proportions of all reported injuries. Sprains accounted for a larger proportion of competition (34.4%) than practice injuries (23.7%), whereas strains accounted for a larger proportion of practice (22.3%) than competition injuries (14.2%). The most commonly reported specific injuries during the study period were concussions (7.5%), partial or complete lateral ligament complex tears (ankle sprains; 6.9%), and partial or complete hamstring tears (4.7%). Rates of concussions remained relatively stable throughout the study period (Figure D). In comparison, rates of lateral ligament complex tears and hamstring tears mirrored each other, sharply decreasing between 2015–2016 and 2016–2017 and following an upward trajectory thereafter (Figure D).

Injuries by Football-Specific Activities and Playing Positions

Over the study period, most injuries in football occurred during general play (17.5%), blocking (15.8%), and tackling (14.0%). Running also accounted for a notable proportion of all injuries (11.8%). General play accounted for a marginally larger proportion of practice injuries as compared with competition injuries (Table 4). In comparison, tackling accounted for a notably larger proportion of competition injuries than practice injuries, whereas blocking accounted for comparable proportions of practice and competition injuries (Table 4). Defensive backs, offensive linemen, and defensive linemen accounted for the largest proportions of all injured football athletes (Table 4).

SUMMARY

We aimed to describe the epidemiology of football-related injuries among men's NCAA football players during the 2014–2015 through 2018–2019 academic years. During the study period, the competition injury rate was markedly higher than the practice injury rate. This is consistent with previous findings in this population, and the magnitude of the observed difference in rates between event types was also consistent with previous reports.[5,6]

Table 3. Distribution of Injuries by Body Part, Mechanism, and Injury Diagnosis, Stratified by Event Type[a]

	Overall		Competitions		Practices	
	Injuries Reported, No. (%)	National Estimate, No. (%)	Injuries Reported, No. (%)	National Estimate, No. (%)	Injuries Reported, No. (%)	National Estimate, No. (%)
Injury site						
Head/face	1594 (9.21)	24 299 (9.52)	703 (9.06)	10 404 (9.23)	891 (9.33)	13 896 (9.75)
Neck	458 (2.65)	6615 (2.59)	228 (2.94)	3263 (2.89)	230 (2.41)	3352 (2.35)
Shoulder	2329 (13.45)	33 864 (13.27)	1192 (15.36)	17 172 (15.23)	1137 (11.90)	16 692 (11.71)
Arm/elbow	580 (3.35)	8005 (3.14)	308 (3.97)	4163 (3.69)	272 (2.85)	3842 (2.70)
Hand/wrist	1513 (8.74)	21 417 (8.39)	741 (9.55)	10 099 (8.96)	772 (8.08)	11 318 (7.94)
Trunk	1112 (6.42)	15 815 (6.20)	488 (6.29)	6978 (6.19)	624 (6.53)	8837 (6.20)
Hip/groin	1031 (5.95)	14 878 (5.83)	318 (4.10)	4373 (3.88)	713 (7.46)	10 504 (7.37)
Thigh	1546 (8.93)	22 905 (8.97)	504 (6.49)	7212 (6.40)	1042 (10.91)	15 694 (11.01)
Knee	2679 (15.47)	40 890 (16.02)	1307 (16.84)	20 091 (17.82)	1372 (14.36)	20 798 (14.60)
Lower leg	707 (4.08)	10 194 (3.99)	294 (3.79)	4110 (3.65)	413 (4.32)	6084 (4.27)
Ankle	2166 (12.51)	33 013 (12.93)	1134 (14.61)	17 278 (15.32)	1032 (10.80)	15 735 (11.04)
Foot	917 (5.30)	13 807 (5.41)	414 (5.33)	6108 (5.42)	503 (5.27)	7699 (5.40)
Other	683 (3.94)	9544 (3.74)	131 (1.69)	1500 (1.33)	552 (5.78)	8045 (5.65)
Mechanism						
Player contact	8820 (50.94)	133 236 (52.20)	4861 (62.63)	72 012 (63.87)	3959 (41.44)	61 225 (42.97)
Surface contact	2117 (12.23)	30 921 (12.11)	1039 (13.39)	15 510 (13.76)	1078 (11.28)	15 410 (10.81)
Equipment/out of bounds	274 (1.58)	3972 (1.56)	67 (0.86)	893 (0.79)	207 (2.17)	3080 (2.16)
Overuse	1036 (5.98)	14 060 (5.51)	198 (2.55)	2318 (2.06)	838 (8.77)	11 743 (8.24)
Illness/infection	293 (1.69)	4225 (1.66)	25 (0.32)	340 (0.30)	268 (2.81)	3885 (2.73)
Noncontact	3127 (18.06)	4 7791 (18.72)	851 (10.96)	12 752 (11.31)	2276 (23.82)	35 039 (24.59)
Other/unknown	1648 (9.52)	21 040 (8.24)	721 (9.29)	8926 (7.92)	927 (9.70)	12 114 (8.50)
Diagnosis						
Abrasion/laceration	112 (0.65)	1598 (0.63)	52 (0.67)	707 (0.63)	60 (0.63)	891 (0.63)
Concussion	1301 (7.51)	20 398 (7.99)	594 (7.65)	9119 (8.09)	707 (7.40)	11 279 (7.92)
Contusion	2366 (13.66)	33 100 (12.97)	1380 (17.78)	18 972 (16.83)	986 (10.32)	14 129 (9.92)
Dislocation/subluxation	760 (4.39)	11 691 (4.58)	348 (4.48)	5135 (4.55)	412 (4.31)	6557 (4.60)
Fracture	496 (2.86)	8326 (3.26)	271 (3.49)	4500 (3.99)	225 (2.36)	3826 (2.68)
Illness/infection	88 (0.51)	1368 (0.54)	5 (0.06)	84 (0.07)	83 (0.87)	1284 (0.90)
Inflammatory condition	827 (4.78)	12 073 (4.73)	232 (2.99)	3235 (2.87)	595 (6.23)	8838 (6.20)
Spasm	455 (2.63)	5731 (2.25)	134 (1.73)	1753 (1.55)	321 (3.36)	3978 (2.79)
Sprain	4936 (28.51)	75 681 (29.65)	2670 (34.40)	41 062 (36.42)	2266 (23.72)	34 619 (24.29)
Strain	3233 (18.67)	47 733 (18.70)	1104 (14.22)	15 754 (13.97)	2129 (22.29)	31 979 (22.44)
Other	2741 (15.83)	37 546 (14.71)	972 (12.52)	12 430 (11.02)	1769 (18.52)	25 116 (17.63)

[a] Data presented in the order of reported number, followed by the proportion of all injuries attributable to a given category. Data pooled across event types are presented overall, and separately for practices and competitions. National estimates were produced using sampling weights estimated on the basis of sport, division, and year. A reportable injury was one that occurred due to participation in an organized intercollegiate practice or competition and required medical attention by a team Certified Athletic Trainer or physician (regardless of time loss). Only scheduled team practices and competitions were retained in this analysis.

Both practice and competition rates remained stable throughout the study period. The temporal stability in practice and competition injury rates is noteworthy, and it is important to juxtapose patterns in injury incidence with concurrently implemented rule changes and other policies, as such changes are implemented with the intention of improving athlete health and safety.[11] For instance, notable rule changes related to blocking below the waist, fair catch of free kicks, 2-man wedge blocks, and blind-side blocking have been implemented in NCAA football between 2016 and 2019.[7–9] Given that blocking and tackling accounted for a notable proportion of all injuries (and the largest proportions of competition injuries) examined in this study, the findings of this study indicate that continued monitoring of overall injury incidence trajectories is needed to appraise the effectiveness of these changes in reducing injury risk within this population, as their true effect is likely manifested over a period of time. In addition, continued monitoring of temporal patterns (such as in the present study) should also be coupled with targeted studies of blocking- and tackling-related injuries that involve specific research questions and hypotheses, as seen previously to study rule changes in this context.[12]

Incidence trajectories across the study period varied by season segment. Postseason injury rates in NCAA men's football fluctuated drastically during the 2014–2015 through 2018–2019 academic years. The heterogeneity in postseason injury rates may be a function of comparatively fewer teams contributing postseason exposures and injuries to the ISP (as compared with preseason and regular season), coupled with the yearly variation in teams involved in postseason competition. Preseason and regular-season injury rates remained relatively stable across the study period, albeit an upward incidence trajectory in both were observed during the latter years of the study. The increase in regular-season injury rates between 2017–2018 and 2018–2019 was noteworthy, likely the result of a multitude of factors, and warrants targeted attention. This may be particularly salient as estimates associated with the latter years of this study offer a more stable representation of

Table 4. Distribution of Injuries by Men's Football Specific Activities and Player Position

	Overall		Competitions		Practices	
	Injuries Reported, No. (%)	National Estimate, No. (%)	Injuries Reported, No. (%)	National Estimate, No. (%)	Injuries Reported, No. (%)	National Estimate, No. (%)
Activity						
Being blocked	1537 (8.88)	23 454 (9.19)	764 (9.84)	11 668 (10.35)	773 (8.09)	11 786 (8.27)
Being tackled	1577 (9.11)	24 488 (9.59)	1064 (13.71)	16 123 (14.30)	513 (5.37)	8365 (5.87)
Blocking	2732 (15.78)	39 702 (15.55)	1275 (16.43)	18 081 (16.04)	1457 (15.25)	21 621 (15.17)
Weights/conditioning	178 (1.03)	2848 (1.12)	10 (0.13)	166 (0.15)	168 (1.76)	2682 (1.88)
General play	3037 (17.54)	47 519 (18.62)	1168 (15.05)	18 131 (16.08)	1869 (19.56)	29 388 (20.62)
Kicking	158 (0.91)	2299 (0.90)	45 (0.58)	705 (0.63)	113 (1.18)	1594 (1.12)
Chasing/Diving	275 (1.59)	3878 (1.52)	95 (1.22)	1528 (1.36)	180 (1.88)	2350 (1.65)
Passing	55 (0.32)	865 (0.34)	32 (0.41)	509 (0.45)	23 (0.24)	356 (0.25)
Running	2037 (11.76)	30 129 (11.80)	611 (7.87)	8484 (7.52)	1426 (14.93)	21 646 (15.19)
Catching/receiving	864 (4.99)	12 358 (4.84)	245 (3.16)	3766 (3.34)	619 (6.48)	8592 (6.03)
Tackling	2427 (14.02)	36 197 (14.18)	1553 (20.01)	22 590 (20.04)	874 (9.15)	13 606 (9.55)
Throwing	82 (0.47)	1167 (0.46)	28 (0.36)	394 (0.35)	54 (0.57)	773 (0.54)
Other/unknown	2356 (13.61)	30 343 (11.89)	872 (11.23)	10 605 (9.41)	1484 (15.53)	19 738 (13.85)
Position						
Defensive back	3083 (17.81)	44 792 (17.55)	1428 (18.40)	20 552 (18.23)	1655 (17.32)	24 239 (17.01)
Defensive lineman	2660 (15.36)	39 388 (15.43)	1125 (14.49)	15 894 (14.10)	1535 (16.07)	23 494 (16.49)
Kicker/punter	177 (1.02)	2452 (0.96)	56 (0.72)	729 (0.65)	121 (1.27)	1723 (1.21)
Linebacker	2031 (11.73)	30 578 (11.98)	966 (12.45)	14 267 (12.65)	1065 (11.15)	16 311 (11.45)
Offensive lineman	2698 (15.58)	39 399 (15.44)	1117 (14.39)	15 831 (14.04)	1581 (16.55)	23 568 (16.54)
Quarterback	633 (3.66)	9247 (3.62)	426 (5.49)	6125 (5.43)	207 (2.17)	3122 (2.19)
Running back	1772 (10.23)	27 149 (10.64)	843 (10.86)	12 946 (11.48)	929 (9.72)	14 202 (9.97)
Special teams	594 (3.43)	8865 (3.47)	458 (5.90)	6950 (6.16)	136 (1.42)	1915 (1.34)
Tight end	817 (4.72)	11 979 (4.69)	314 (4.05)	4517 (4.01)	503 (5.27)	7461 (5.24)
Wide receiver	1940 (11.20)	28 181 (11.04)	715 (9.21)	10 332 (9.16)	1225 (12.82)	17 849 (12.53)
Other/unknown	910 (5.26)	13 217 (5.18)	314 (4.05)	4605 (4.08)	596 (6.24)	8611 (6.04)

[a] Data presented in the order of reported number, followed by the proportion of all injuries attributable to a given category. Data pooled across event types are presented overall, and separately for practices and competitions. National estimates were produced using sampling weights estimated on the basis of sport, division, and year. A reportable injury was one that occurred due to participation in an organized intercollegiate practice or competition and required medical attention by a team Certified Athletic Trainer or physician (regardless of time loss). Only scheduled team practices and competitions were retained in this analysis.

injury incidence in comparison with the earlier years, given the sharp increase in participation observed during the 2016–2017 through 2018–2019 academic years. NCAA ISP recruitment strategies have evolved over time, and the improvements in participation during these years reflect the success of recently used recruitment strategies (for instance, support and communication from the NCAA Sport Science Institute). With that said, it is yet important to note that there exist limitations to the external validity of the results observed here, and these data do not represent the overall membership as not all membership programs participate in the ISP. Akin to the preseason and regular-season incidence trajectories, the incidence trajectory of competition-related TL injuries during the 2016–2017 through 2018–2019 academic years is also particularly noteworthy. Although overall competition-related injury rates remained relatively stable throughout this window, rates of competition-related TL injuries decreased considerably. This indicates a decreasing pattern in the overall burden of competition-related injuries in this population, as a smaller fraction of competition-related injuries appear to have resulted in TL over the course of the study period. However, sports injury surveillance is limited in its capacity to comprehensively capture TL, as indicated by the missingness in TL data reported above (which also varied from year-to-year across the study period). This is an inherent limitation of data collection methods used in sports injury surveillance and may contribute to an underestimation of TL injury prevalence in the present study. Future studies examining competition-related TL injuries in this population may consider alternative methods for more completely capturing TL data, and may also use TL to examine recovery trajectories after commonly reported injuries (ie, sprains and contusions), or after injuries resultant of activities that are commonly associated with injury (such as blocking or tackling).[13]

The knee, shoulder, and ankle were the most commonly injured body parts among NCAA men's football athletes during the 2014–2015 through 2018–2019 academic years. This may be unsurprising given the dynamics of the sport and recent epidemiologic reports in this population noting comparable distributions of practice and competition injuries, particularly with knee, shoulder, and ankle injuries accounting for similar proportions of all reported injuries.[6] Given this observed consistency across time periods, it is difficult to contextualize these findings with recent injury prevention efforts and adaptations in game play (such as, for instance, changes in tackling techniques that encourage leading with the shoulder). Nonetheless, as injuries to these body parts together account for over 40% of all reported injuries in this study, further attention may be directed towards better understanding the etiology of knee, shoulder, and ankle injuries among NCAA football athletes. Notably, previous researchers studying football athletes have shown

prevention strategies to be particularly effective in reducing the burden of injuries to these sites.[14–16] As such, in considering the long-term musculoskeletal health of football athletes across their life span, continued attention to the secondary prevention and clinical management of these injuries remains prudent.

The most commonly reported injuries during this time period were concussions, partial or complete lateral ligament complex tears (ankle sprains), and partial or complete hamstring tears. Once again, the incidence trajectories of these injuries during the latter years of the study (2016–2017 through 2018–2019) were particularly notable. Although a slight upward trajectory was observed in concussion rates, concussion incidence remained relatively stable between 2016–2017 and 2018–2019, whereas sharper increases in rates of lateral ligament complex tears and hamstring tears were noted during the same window. Concussion incidence in football remains an important topic for consideration, and much attention has been recently directed towards not only better understanding the burden of concussions in this population, but also in developing effective prevention strategies.[11,17] Playing rule changes and efforts to improve knowledge and awareness, as well as adaptations to clinical protocols, have been used in recent years to address concussion incidence in NCAA football.[12,18–20] Concussion rates after 2018–2019 should be routinely monitored, particularly in light of recent playing rule changes. In juxtaposition to concussion incidence, the sharply increasing rates of lateral ligament complex tears, particularly during the latter years of the study, are noteworthy. Lateral ligament complex tears are among the most common ankle injuries across youth, high school, and college football players.[21] Moreover, this injury occurs frequently following player contact and during general play and blocking in this population.[21] As such, the situational and biomechanical nuances of the sport may be important considerations as lateral ligament complex tears among football athletes are examined further and primary prevention strategies are refined for this population. Importantly, while discussing the injury rates presented here, it is salient to consider the mode of exposure ascertainment in sports injury surveillance. The expression of exposures in terms of AEs does not represent at-risk exposure time in the most precise manner, as it fails to account for overall or athlete-specific playing time (every athlete who participated in any part of the competition was equivalently weighted in AE estimation). This may be a particular limitation in men's football, considering the large playing squads involved and the dynamic nature of playing time. For instance, place kickers and linemen are involved in drastically different amounts of time during a competition event, although they are accounted for equivalently in the current measurement scheme. Future studies examining competition-related injury risk in particular may consider more sensitive measures of at-risk exposure time in order to estimate injury incidence more precisely.

Continued monitoring of NCAA men's football injuries is important for understanding the evolving burden of injury in this population. Routine injury surveillance should also involve monitoring trajectories of most commonly reported specific injuries. Although surveillance-based studies such as the present work are important in identifying emerging patterns and highlighting areas that warrant further attention, targeted studies are needed to reconcile observed patterns and to develop effective injury prevention strategies.

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Address correspondence to Avinash Chandran, PhD, MS, Datalys Center for Sports Injury Research and Prevention, 6151 Central Avenue, Suite 117, Indianapolis, IN 46202. Address email to avinashc@datalyscenter.org.