

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

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**Context:** The first men's wrestling National Collegiate Athletic Association (NCAA) Championship was sponsored in 1928; since then, participation has increased.

**Background:** Continued study of wrestling injury data is essential to identify areas for intervention based on emerging trends.

**Methods:** Exposure and injury data collected in the NCAA Injury Surveillance Program during 2014–2015 through 2018–2019 were analyzed. Injury counts, rates, and proportions were used to describe injury characteristics, and injury rate ratios (IRRs) were used to examine differential injury rates.

**Results:** The overall injury rate was 8.82 per 1000 athlete exposures. The competition injury rate was significantly higher than practice injury rate (IRR = 4.11; 95% CI = 3.72, 4.55). The most commonly injured body parts were the knee (21.4%), shoulder (13.4%), and head/face (13.3%), and the most prevalently reported specific injury was concussion.

**Summary:** These findings provide the most current update to injury incidence and outcomes in NCAA men's wrestling. We identify notable trends that warrant consideration in future research.

**Key Words:** NCAA wrestling, injury surveillance, descriptive epidemiology

## Key Points

- The overall competition injury rate during this time period was significantly higher than the overall practice injury rate; competition injury rates fluctuated throughout the study period while practice injury rates remained relatively stable.
- Over half of all reported injuries resulted in time loss of  $\geq 1$  day, and the diagnoses most frequently reported during the reporting period were sprains and strains.
- The most commonly reported specific injuries across the study period were concussions and partial or complete lateral collateral ligament tears.

Wrestling is an ancient combat sport that has been contested since the earliest Olympic Games.<sup>1</sup> Although multiple styles of wrestling exist internationally, American high schools and colleges primarily compete in folkstyle wrestling. Under this rule set, points are scored for advances in position, back exposure, or can be immediately won via pin.<sup>2</sup> Despite reported decreasing participation through the early 2000s,<sup>3</sup> National Collegiate Athletic Association (NCAA) men's wrestling participation across all divisions has gradually increased from 2003 to 2004 to the present with a total of 7300 student-athletes participating in 2018–2019.<sup>4</sup> Further, while wrestling may have fewer participants than other collegiate sports, it is a physically demanding contact sport with higher injury risk. In recent years, NCAA rules and regulations limited total daily wrestling matches in

tournament competition with the intention to reduce bout-related injuries. In addition to these acute injuries, wrestlers are also at risk for infections and illnesses, as well as dehydration, overtraining, disordered eating, and other diagnoses associated with weight-cutting practices.<sup>5,6</sup> Current evaluation of men's wrestling injury trends and outcomes is warranted due to the relatively high rate of time loss (TL) injuries<sup>7</sup> and recent rule changes.<sup>8</sup> Updated information can contextualize the temporal stability of previous findings and reveal clinically relevant information necessary to guide injury prevention strategies.

Epidemiological surveillance systems are important tools used to observe trends among populations. The NCAA recognized the need to deploy these instruments in 1982, establishing what is now the NCAA Injury Surveillance Program (ISP) to record exposures and details related to sports injuries.<sup>9,10</sup> This repository of de-identified data has been previously used by researchers to describe injuries and identify areas for injury prevention initiatives. Previous

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research into men's wrestling injuries using ISP data have revealed notable trends. Agel et al,<sup>3</sup> using data collected between 1988–1989 and 2003–2004, observed markedly higher injury rates in match situations than practices. They also note that the most common mechanism of injury in both practices and matches was player contact. Time loss injuries were also observed to be of particular burden as 34% of match injuries and 28% of practice injuries resulted in TL of at least 10 days.<sup>3</sup> Kroshus et al<sup>11</sup> built upon this study by describing the epidemiology of men's high school and NCAA wrestling from 2005–2006 through 2013–2014. Their findings were consistent with previous literature reporting that lower extremity sites were particularly vulnerable, with knee injuries accounting for 16.7% of practice and 30.4% of competition injuries. They also reported the head or face was the next most frequently injured body part, making up 12.1% of practice and 14.6% of competition injuries.<sup>11</sup>

Updating these epidemiological studies is necessary to aid injury prevention by identifying risk factors and describing the range and severity of sports injuries.<sup>12</sup> It is clinically important to report temporal trends in injury incidence among NCAA men's wrestling athletes to guide sports medicine staff, particularly athletic trainers (ATs), with regard to injury prevention and management. Therefore, the purpose of this study was to describe the epidemiology of men's wrestling-related injuries captured by the NCAA ISP during the 2014–2015 through 2018–2019 academic years.

## METHODS

### Study Data

Men's wrestling-related exposure and injury data collected in the NCAA ISP during 2014–2015 through 2018–2019 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 detailed separately within this special issue. Briefly, ATs at participating institutions contributed relevant injury and exposure data using their clinical 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 AT or physician (regardless of TL). Scheduled team practices and competitions were considered reportable exposures for this study. Data from 6 (3% of membership with sponsored programs) participating programs in 2014–2015, 4 (2% of membership with sponsored programs) in 2015–2016, 9 (4% of membership with sponsored programs) in 2016–2017, 10 (4% of membership with sponsored programs) in 2017–2018, and 28 (11% of membership with sponsored programs) 2018–2019 qualified for inclusion in analyses. Qualification criteria are detailed in the Methods paper.<sup>13</sup>

### Statistical Analysis

Injury counts and rates (per 1000 athlete exposures [AEs]) where 1 AE was defined as 1 athlete participating in 1 exposure event) were evaluated by event type (practice, competition), competition level (Division I, Division II,

Division III), season segment (preseason, regular season, postseason), and TL or nontime loss (NTL). Poststratification 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 (due to low frequencies of injury observations across levels of certain covariates), unless otherwise specified. The computation of national estimates is further described in the Methods paper within this issue. Temporal patterns in injury rates across the study period were evaluated using rate profile plots stratified across the variables. Similarly, temporal trends in rates of most reported injuries were also examined across the study period. Injury counts and proportions were examined by TL, body parts injured, injury mechanism, injury diagnoses, playing positions, and activities. Injury rate ratios (IRRs) were used to examine differential injury rates across event types, competition levels, and season segments. Injury rate ratios with associated 95% confidence intervals (CIs) excluding 1.00 were considered statistically significant. All analyses were conducted using SAS (version 9.4; SAS Institute).

## RESULTS

A total of 1684 men's wrestling injuries were reported from 190 862 AEs to the NCAA ISP during 2014–2015 through 2018–2019 (rate = 8.82 per 1000 AEs). This equated to a national estimate of 36 341 injuries overall (Table 1). The competition injury rate was significantly higher than the practice injury rate during this period (IRR = 4.11; 95% CI = 3.72, 4.55). Competition injury rates fluctuated across the study period and notably decreased between 2015–2016 to 2016–2017 and again between 2017–2018 to 2018–2019 (Figure A). In contrast, practice injury rate trends appear to be similar throughout the study period (Figure A). The overall Division I injury rate during the study period was 9.63 per 1000 AEs, the Division II injury rate was 6.31 per 1000 AEs, and the Division III injury rate was 8.75 per 1000 AEs. The Division I injury rate was significantly higher than the Division II injury rate (IRR = 1.53; 95% CI = 1.28, 1.81). Similarly, the Division III injury rate was significantly higher than the Division II injury rate (IRR = 1.39; 95% CI = 1.17, 1.65).

### Injuries by Season Segment

During 2014–2015 through 2018–2019, 375 preseason injuries (national estimate: 9048), 1209 regular season (national estimate: 25 508), and 100 postseason injuries (national estimate: 1785) were reported in men's wrestling (Table 2). The overall postseason injury rate was lower than the preseason (IRR = 0.41; 95% CI = 0.33, 0.51) and regular season (IRR = 0.39; 95% CI = 0.32, 0.48) injury rates. Preseason injury rates varied throughout the study period, with fluctuations observed particularly between 2014–2015 and 2016–2017 (Figure B). In comparison, regular season injury rates remained relatively stable between 2014–2015 and 2016–2017 but varied during the latter years of the study period (Figure B).

**Table 1. Reported and National Estimates of Injuries, Athlete Exposures (AEs), and Rates per 1000 AEs by Event Type Across Divisions<sup>a</sup>**

Division	Number AEs Rate per 1000 AEs (95% CI)					
	Overall		Practices		Competitions	
	Reported	National Estimate	Reported	National Estimate	Reported	National Estimate
I	808	16213	512	10118	296	6095
	83939	1566103	76977	1436659	6962	129443
	9.63 (8.96, 10.29)	10.35 (9.69, 11.02)	6.65 (6.08, 7.23)	7.04 (6.47, 7.62)	42.52 (37.67, 47.36)	47.09 (42.24, 51.93)
II	153	1490	99	1000	54	490
	24264	302898	20931	256668	3333	46231
	6.31 (5.31, 7.30)	4.92 (3.92, 5.92)	4.73 (3.80, 5.66)	3.90 (2.96, 4.83)	16.20 (11.88, 20.52)	10.60 (6.28, 14.92)
III	723	18638	485	12821	238	5817
	82659	2083672	70934	1771289	11725	312383
	8.75 (8.11, 9.38)	8.94 (8.31, 9.58)	6.84 (6.23, 7.45)	7.24 (6.63, 7.85)	20.30 (17.72, 22.88)	18.62 (16.04, 21.20)
Overall	1684	36341	1096	23938	588	12402
	190862	3952673	168842	3464616	22020	488057
	8.82 (8.40, 9.24)	9.19 (8.77, 9.62)	6.49 (6.11, 6.88)	6.91 (6.52, 7.29)	26.70 (24.54, 28.86)	25.41 (23.25, 27.57)

<sup>a</sup> 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.

**Time Loss**

Over half (52.2%) of all reported injuries resulted in TL of greater than or equal to 1 day (TL was not reported in 17% of all injuries). Time loss injuries accounted for comparable proportions of both practice (51.5%) and competition (53.6%) injuries. Injuries that resulted in greater than 3 weeks of TL accounted for greater proportions of competition-related TL injuries (27.9%) than practice-related TL injuries (15.7%). Competition-related TL injury rates decreased consistently across the study period (Figure C). In comparison, rates of practice-

related TL injuries remained relatively stable during 2014–2015 to 2018–2019.

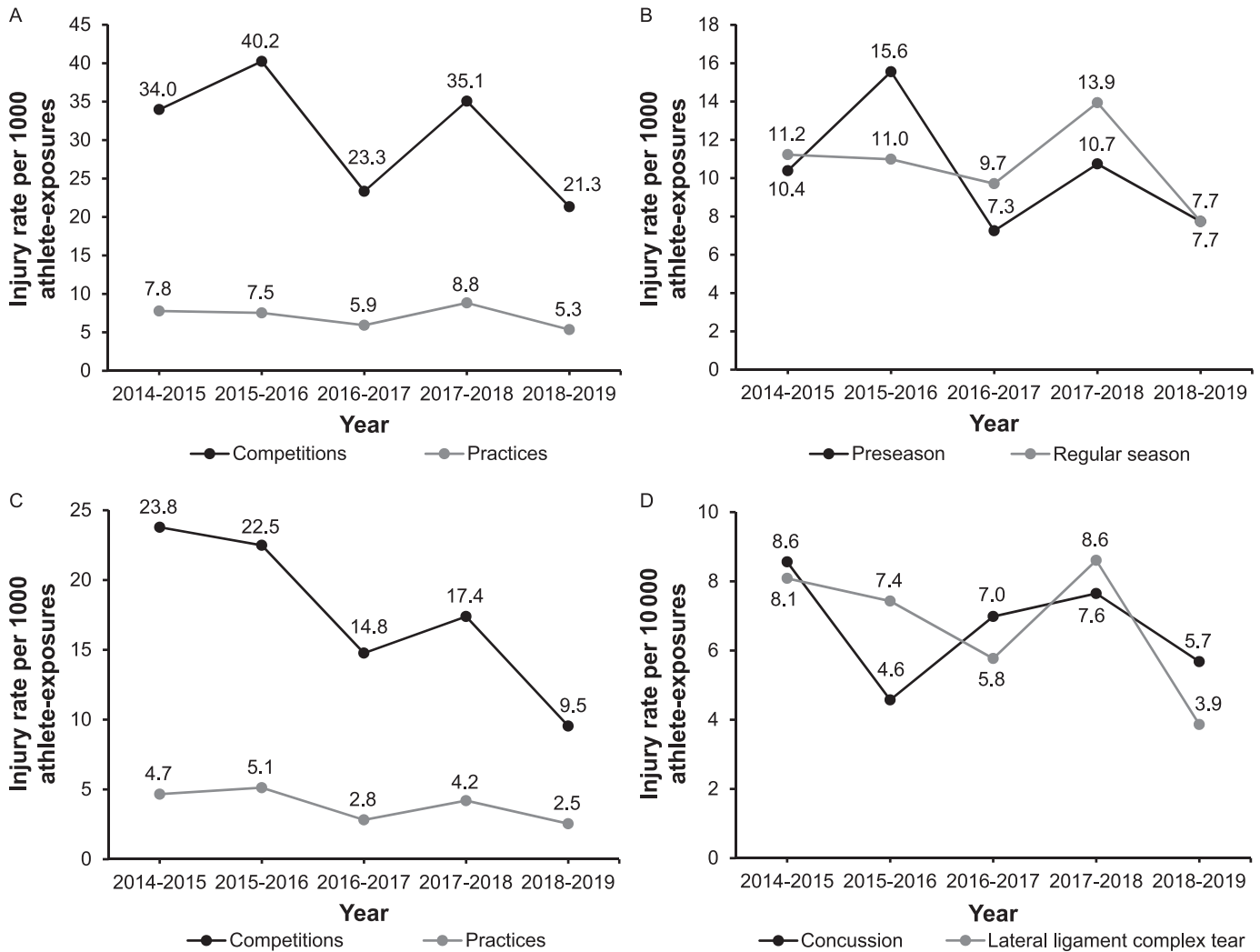
**Injury Characteristics**

Knee injuries (21.4%), shoulder injuries (13.4%), and head or face injuries (13.2%) accounted for the largest proportions of all men’s wrestling injuries reported during 2014–2015 through 2018–2019 (Table 3). Injuries to the trunk (8.0%) were also relatively common. While knee injuries and shoulder injuries accounted for larger propor-

**Table 2. Reported and National Estimates of Injuries, Athlete Exposures (AEs), and Rates per 1000 AEs by Season Segment Across Divisions<sup>a</sup>**

Division	Number AEs Rate per 1000 AEs (95% CI)					
	Preseason		Regular Season		Postseason	
	Reported	National Estimate	Reported	National Estimate	Reported	National Estimate
I	169	3589	582	11633	57	991
	16342	321659	55822	1030095	11775	214349
	10.34 (8.78, 11.90)	11.16 (9.60, 12.72)	10.43 (9.58, 11.27)	11.29 (10.45, 12.14)	4.84 (3.58, 6.10)	4.62 (3.37, 5.88)
II	34	362	112	1042	7	86
	4468	59398	16299	198054	3497	45446
	7.61 (5.05, 10.17)	6.09 (3.54, 8.65)	6.87 (5.60, 8.14)	5.26 (3.99, 6.53)	2.00 (0.52, 3.48)	1.89 (0.41, 3.38)
III	172	5098	515	12833	36	708
	19644	523847	52040	1284178	10975	275646
	8.76 (7.45, 10.06)	9.73 (8.42, 11.04)	9.90 (9.04, 10.75)	9.99 (9.14, 10.85)	3.28 (2.21, 4.35)	2.57 (1.50, 3.64)
Overall	375	9048	1209	25508	100	1785
	40454	904904	124161	2512327	26247	535442
	9.27 (8.33, 10.21)	10.00 (9.06, 10.94)	9.74 (9.19, 10.29)	10.15 (9.60, 10.70)	3.81 (3.06, 4.56)	3.33 (2.59, 4.08)

<sup>a</sup> 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 (postseason rates not displayed due to low annual reported injury frequencies). **C,** Rates of time loss injuries (per 1000 AEs) stratified by event type (practices, competitions). **D,** Rates (per 10000 AEs) of most reported injuries. Rates presented in all figures are unweighted and based on reported data.

tions of competition injuries than practice injuries, head or face injuries accounted for comparable proportions of both competition and practice injuries (Table 3). Nearly half (45.7%) of all reported injuries were attributed to player contact mechanisms of injury, and injuries caused by player contact accounted for a larger proportion of competition injuries than practice injuries (Table 3). Surface contact injuries were also prevalent among all reported injuries (15.5%) and accounted for larger proportions of competition injuries than practice injuries (Table 3).

The diagnoses most frequently reported in men's wrestling during 2014–2015 through 2018–2019 were sprains (25.5%) and strains (15.6%). Concussions (7.3%) and illnesses or infections (7.3%) also accounted for noteworthy proportions of injury diagnoses reported during the study period. Sprains and strains accounted for larger proportions of competition injuries than practice injuries, while illnesses or infections were more common in practices than in competitions (Table 3). In comparison, concussions accounted for comparable proportions of practice (6.8%) and competition (8.3%) injuries. The most

commonly reported specific injuries across the study period were concussions (7.3%) and partial or complete lateral collateral ligament tears (6.5%). While concussion rates varied across the study period, rates of lateral collateral ligament tears decreased during the early years of the study before fluctuating between 2016–2017 and 2018–19 (Figure D).

### Injuries by Wrestling-Specific Activities and Weight Classes

Injuries in men's wrestling during 2014–2015 through 2018–2019 were most often reported as occurring during takedowns (27.4%) and sparring (16.8%). A larger proportion of competition injuries (34.7%) than practice injuries (23.5%) occurred during takedowns. Comparable proportions of competition and practice injuries occurred during sparring (Table 4). A noteworthy proportion of all reported injuries (39.7%) also occurred during unclassified (other or unknown: weights, fitness, other, unknown)

**Table 3. Distribution of Injuries by Body Part, Mechanism, and Injury Diagnosis; Stratified by Event Type<sup>a</sup>**

	Overall		Competitions		Practices	
	Injuries Reported (%)	National Estimate (%)	Injuries Reported (%)	National Estimate (%)	Injuries Reported (%)	National Estimate (%)
<b>Injury site</b>						
Head/face	223 (13.24)	4651 (12.80)	79 (13.44)	1596 (12.87)	144 (13.14)	3055 (12.76)
Neck	52 (3.09)	1178 (3.24)	16 (2.72)	360 (2.90)	36 (3.28)	818 (3.42)
Shoulder	225 (13.36)	4618 (12.71)	100 (17.01)	1943 (15.67)	125 (11.41)	2676 (11.18)
Arm/elbow	74 (4.39)	1489 (4.10)	34 (5.78)	787 (6.35)	40 (3.65)	702 (2.93)
Hand/wrist	78 (4.63)	1543 (4.25)	23 (3.91)	418 (3.37)	55 (5.02)	1126 (4.70)
Trunk	135 (8.02)	2765 (7.61)	36 (6.12)	680 (5.48)	99 (9.03)	2085 (8.71)
Hip/groin	32 (1.90)	843 (2.32)	13 (2.21)	366 (2.95)	19 (1.73)	477 (1.99)
Thigh	44 (2.61)	986 (2.71)	24 (4.08)	532 (4.29)	20 (1.82)	454 (1.90)
Knee	361 (21.44)	7137 (19.64)	175 (29.76)	3452 (27.83)	186 (16.97)	3685 (15.39)
Lower leg	23 (1.37)	680 (1.87)	4 (0.68)	185 (1.49)	19 (1.73)	495 (2.07)
Ankle	116 (6.89)	2328 (6.41)	40 (6.80)	746 (6.02)	76 (6.93)	1582 (6.61)
Foot	24 (1.43)	498 (1.37)	5 (0.85)	105 (0.85)	19 (1.73)	393 (1.64)
Other	297 (17.64)	7625 (20.98)	39 (6.63)	1234 (9.95)	258 (23.54)	6392 (26.70)
<b>Mechanism</b>						
Player contact	770 (45.72)	15 962 (43.92)	320 (54.42)	6353 (51.23)	450 (41.06)	9609 (40.14)
Surface contact	261 (15.50)	5713 (15.72)	110 (18.71)	2461 (19.84)	151 (13.78)	3252 (13.59)
Equipment contact	13 (0.77)	349 (0.96)	4 (0.68)	115 (0.93)	9 (0.82)	234 (0.98)
Noncontact	155 (9.20)	3127 (8.60)	42 (7.14)	762 (6.14)	113 (10.31)	2366 (9.88)
Overuse	61 (3.62)	1738 (4.78)	9 (1.53)	379 (3.06)	52 (4.74)	1359 (5.68)
Other/unknown	424 (25.18)	9452 (26.01)	103 (17.52)	2334 (18.82)	321 (29.29)	7118 (29.74)
<b>Diagnosis</b>						
Abrasion/laceration	64 (3.80)	1196 (3.29)	21 (3.57)	409 (3.30)	43 (3.92)	787 (3.29)
Concussion	123 (7.30)	2778 (7.64)	49 (8.33)	986 (7.95)	74 (6.75)	1791 (7.48)
Contusion	88 (5.23)	2065 (5.68)	29 (4.93)	659 (5.31)	59 (5.38)	1406 (5.87)
Dislocation/subluxation	81 (4.81)	1703 (4.69)	36 (6.12)	751 (6.06)	45 (4.11)	951 (3.97)
Fracture	26 (1.54)	578 (1.59)	10 (1.70)	293 (2.36)	16 (1.46)	285 (1.19)
Illness/infection	123 (7.30)	3444 (9.48)	19 (3.23)	528 (4.26)	104 (9.49)	2916 (12.18)
Inflammatory condition	87 (5.17)	1728 (4.75)	24 (4.08)	498 (4.02)	63 (5.75)	1230 (5.14)
Spasm	25 (1.48)	455 (1.25)	6 (1.02)	98 (0.79)	19 (1.73)	357 (1.49)
Sprain	430 (25.53)	8478 (23.33)	201 (34.18)	3921 (31.62)	229 (20.89)	4557 (19.04)
Strain	262 (15.56)	5791 (15.94)	107 (18.20)	2243 (18.09)	155 (14.14)	3548 (14.82)
Other/unknown	375 (22.27)	8126 (22.36)	86 (14.63)	2017 (16.26)	289 (26.37)	6109 (25.52)

<sup>a</sup> 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.

activities. Injuries were relatively evenly distributed among athletes in the various weight classes (Table 4).

## SUMMARY

The purpose of this study was to describe the epidemiology of injuries among NCAA men's wrestling athletes during 2014–2015 through 2018–2019. The overall competition injury rate (26.7 per 1000 AEs) during this period was significantly higher than the overall practice injury rate (6.5 per 1000 AEs; Table 1). These results were like previous findings reported in this population.<sup>11,14</sup> However, competition injury rates were more variable than practice injury rates across the study period. With that said, when examining the injury rates presented here, it is important to consider how exposure time has been quantified in this study (and generally in studies using sports injury surveillance data). Due to the mechanics of the NCAA ISP, at-risk exposure time has been expressed in the form of AEs for these analyses. However, in individual sports such as wrestling, traditional methods of expressing AEs may potentially inflate the observed injury incidence. Wrestling

practices may last multiple hours, while regulation-length wrestling matches last 7 minutes, sometimes less. Tournament participation, in which an athlete may wrestle up to 6 bouts in a day, is also recorded as a single exposure. Improving exposure ascertainment in sports injury surveillance to include more precise measurements of at-risk exposure time (total bouts participated in a season, outcome of the bout, and period in which the injury occurred) may reveal target areas for injury prevention. Similarly, unclassified (unknown or other) injury-attributed activities (sparring, reversal, takedown, etc) accounted for nearly 40% of all wrestling injuries reported during this period. It is reasonable to suggest that this may be due to injuries occurring in transitions between positions or activities or due to reported illnesses or skin infections that are not associated with an activity. Future studies may consider using video analysis methodology or techniques to ascertain such nuances of the sport to better expand upon the unspecified injuries.

Over half of all reported injuries during the study period resulted in some TL, and TL injuries accounted for comparable proportions of practice and competition injuries

**Table 4. Distribution of Injuries by Men's Wrestling Specific Activities and Player Position<sup>a</sup>**

Activity	Overall		Competitions		Practices	
	Injuries Reported (%)	National Estimate (%)	Injuries Reported (%)	National Estimate (%)	Injuries Reported (%)	National Estimate (%)
Conditioning	26 (1.54)	532 (1.46)	2 (0.34)	28 (0.23)	24 (2.19)	504 (2.11)
Escape	67 (3.98)	1360 (3.74)	38 (6.46)	698 (5.63)	29 (2.65)	662 (2.77)
Fall	32 (1.90)	676 (1.86)	18 (3.06)	420 (3.39)	14 (1.28)	256 (1.07)
Near fall	22 (1.31)	426 (1.17)	14 (2.38)	279 (2.25)	8 (0.73)	147 (0.61)
Reversal	34 (2.02)	718 (1.98)	15 (2.55)	304 (2.45)	19 (1.73)	414 (1.73)
Riding	91 (5.40)	2059 (5.67)	44 (7.48)	952 (7.68)	47 (4.29)	1107 (4.62)
Sparring	282 (16.75)	5827 (16.03)	95 (16.16)	1808 (14.58)	187 (17.06)	4020 (16.79)
Takedown	462 (27.43)	9868 (27.15)	204 (34.69)	4388 (35.38)	258 (23.54)	5479 (22.89)
Other/unknown	668 (39.67)	14874 (40.93)	158 (26.87)	3524 (28.41)	510 (46.53)	11350 (47.41)
Position						
125 lbs	133 (7.90)	2950 (8.12)	52 (8.84)	977 (7.88)	81 (7.39)	1973 (8.24)
133 lbs	118 (7.01)	2362 (6.50)	46 (7.82)	864 (6.97)	72 (6.57)	1499 (6.26)
141 lbs	155 (9.20)	3665 (10.09)	52 (8.84)	1192 (9.61)	103 (9.40)	2473 (10.33)
149 lbs	188 (11.16)	4083 (11.24)	68 (11.56)	1509 (12.17)	120 (10.95)	2575 (10.76)
157 lbs	171 (10.15)	3727 (10.26)	69 (11.73)	1489 (12.01)	102 (9.31)	2238 (9.35)
165 lbs	174 (10.33)	3755 (10.33)	52 (8.84)	1179 (9.51)	122 (11.13)	2576 (10.76)
174 lbs	177 (10.51)	4035 (11.10)	67 (11.39)	1510 (12.18)	110 (10.04)	2525 (10.55)
184 lbs	194 (11.52)	4219 (11.61)	59 (10.03)	1226 (9.89)	135 (12.32)	2993 (12.50)
197 lbs	152 (9.03)	3056 (8.41)	44 (7.48)	906 (7.31)	108 (9.85)	2150 (8.98)
Heavyweight	156 (9.26)	3534 (9.72)	63 (10.71)	1365 (11.01)	93 (8.49)	2169 (9.06)
Other/unknown	66 (3.92)	954 (2.63)	16 (2.72)	186 (1.50)	50 (4.56)	768 (3.21)

<sup>a</sup> 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.

during the study period. Competition-related TL injury rates consistently decreased across the study period, while rates of practice-related TL injury rates remained relatively stable. Between 2009–2010 and 2014–2015, NCAA men's wrestling had the highest severe (*severe* defined as injuries resulting in  $\geq 21$  days lost) injury rate of any NCAA sport.<sup>15</sup> The decreasing rate of TL injuries in competition may be attributed to recent rule changes improving the safety of wrestling. Beginning in 2017, several major rules changes were introduced, including changes to limit the number of matches in which a wrestler can compete to 6 in a single day and mandating 30 minutes of rest between each match.<sup>8</sup> However, while examining these results, it is important to note that TL data were not captured for all reported injuries. This may be an inherent limitation of sports injury surveillance data, and the prevalence of TL injuries may indeed be higher than what was observed in this or similar studies. This is a salient inferential limitation given the high prevalence of TL injuries noted above. Targeted studies capturing complete and specific TL data after injuries in this population are needed to better appraise the burden of injuries sustained by NCAA wrestling athletes.

Several trends in the data collected over the reporting period present opportunities for further investigation and intervention. Most injuries among NCAA wrestling athletes during 2014–2015 through 2018–2019 were sprains and strains. Illnesses or infections were also commonly reported in this population during the study period. Notably, illnesses or infections were more commonly observed in practice (Table 3) as their detection (via precompetition screening) in competition is often a disqualifying factor.<sup>5</sup> The prevalence of preventable illness or infection remains

concerning and warrants intervention through more stringent sanitization, personal hygiene, and prophylactic measures as outlined in the National Athletic Trainers' Association position statement.<sup>5</sup> The most reported specific injuries were concussions and (partial or complete) lateral collateral ligament (LCL) tears. Wrestling, unlike other contact sports, exposes participants to unique forces at the knee<sup>16</sup> via opponent and playing surface contact which traditional knee injury prevention programs and preventative interventions may not adequately address. While this may explain the LCL injury rates observed in this study, future researchers should determine the prevalence of LCL injuries in wrestling in juxtaposition to other NCAA sports and seek to determine how these knee injuries may be prevented. Although concussions remain prevalent, the injury incidence rate is lower than previously reported in this population.<sup>11</sup> Several steps have been taken to improve concussion management in wrestling in recent years. For example, in 2016, rule changes allowed medical personnel unlimited and unimpeded time for concussion evaluation<sup>17</sup> without interference from the coaching staff.<sup>18</sup> These rule changes may explain the increase in concussion injury rates from 2015–2016 to 2017–2018; however, continued monitoring of concussion incidence post-2018–2019 is needed to further reveal the effectiveness of these rule changes.

In summary, while the results of this study provide a stable platform upon which to build further targeted examinations, it is important to note that participation in the NCAA ISP among men's wrestling programs was notably low during the early years of this study and drastically increased during 2018–2019. Therefore, the

external validity of data captured during the early years of the study may be particularly limited. As such, continued monitoring of NCAA men's wrestling injuries through periods of stable participation in injury surveillance will be critical to determine whether these epidemiological patterns are maintained and to understand the etiology of the observed patterns.

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