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

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Context: The National Collegiate Athletic Association has sponsored men's cross-country programs since 1938, and the sport has grown greatly in scope since then.

Background: Routine examinations of men's cross-country injuries are important for identifying emerging temporal patterns.

Methods: Exposure and injury data collected in the National Collegiate Athletic Association 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 were used to examine differential injury rates.

Results: The overall injury rate was 4.01 per 1000 athlete-exposures (AEs). Most reported injuries were inflammatory conditions (30.2%), strains (18.7%), and sprains (11.5%); rates of inflammatory conditions were highest in preseason. The most commonly reported injuries were lateral ligament complex tears (ankle sprains; 8.2%).

Summary: Findings of this study were not entirely consistent with existing evidence; continued monitoring of competition injury rates and rates of commonly reported injuries is needed beyond 2018–2019.

Key Words: collegiate, sport-related, surveillance

Key Points

- The overall competition injury rate was significantly higher than the practice injury rate, and under half of all reported injuries resulted in time loss of $\geq$ 1 day.
- The preseason injury rate was higher than the regular, and post season injury rates.
- Inflammatory conditions accounted for nearly one-third of all reported injuries; though the most commonly reported specific injury was lateral ligament complex tears.

Cross-country is a sport repetitive in nature that requires contestants to run great distances, traversing over various terrains (grass, wooden trails, and/or roads). Particularly in the United States, it is a popular sport among athletes of various ages,[1] and the National Collegiate Athletic Association (NCAA) competition level is among the most elite levels in which cross-country athletes compete in the United States. The NCAA has sponsored men's cross-country programs since 1938, and since then, sponsorship and participation have notably grown. Even in recent years, participation has continued to follow an upward trajectory—with the number of membership teams competing in NCAA men's cross country rising from 974 in 2014–2015 to 1000 in 2018–2019 (with over 14 000 student-athletes competing each year).[2] The above-mentioned dynamics of the sport result in a undeniable sport-related injury burden for this group. As such, it is important to routinely examine the incidence of injury among NCAA men's cross-country athletes in juxtaposition to previously reported data to identify dynamic evolutions in this unique injury burden.

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Surveillance systems are robust public health tools that are effectively leveraged in sports settings as well used to examine the burden of sports-related injuries. The NCAA directed the creation of an injury surveillance system, now called the Injury Surveillance Program (ISP), to capture injury characteristics sustained by college athletes.[3,4] Although the NCAA ISP has historically captured injury-related data among men's cross-country athletes, the epidemiology of men's cross-country is yet not well defined. In previous work within this population, Kerr et al. reported an overall injury rate of 4.66 per 1000 athlete-exposures (AEs) and no difference in injury rates between practice and competition.[5] It has also been noted that although collision or contact injuries are uncommonly reported in this group, distance runners commonly report noncontact mechanisms of injury related to overuse, sprains, and strains.[5] In addition, ankle sprain and lower leg tendonitis were observed to be among the most prevalently reported injuries in this population.[5]

Continual surveillance-based investigations directed at sports-injury incidence not only supply athletic trainers (ATs) and sports medical staff with the most up to date information but also allow these clinicians and researchers to hypothesize interventions of mechanisms aimed at reducing the risk and burden of injury. Given the paucity of research in this population, further epidemiological investigations are warranted, particularly given the continuously increasing participation in NCAA-sponsored programs. Thus, the purpose of this study was to describe the epidemiology of men's cross-country injuries captured by the NCAA ISP during the 2014–2015 through 2018–2019 academic years.

METHODS

Study Data

Men's cross-country exposure and injury data collected in the NCAA ISP during the 2014–2015 through 2018–2019 athletic seasons 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 detail in separately within this special issue.[6] Briefly, ATs at participating institutions contributed exposure and injury data using their clinical electronic medical record systems. A reportable injury (or illness, inclusive of heat illnesses and respiratory conditions) 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]). Scheduled team practices and competitions were considered reportable exposures for this analysis. Data from 13 (1% of membership) participating cross-country programs in 2014–2015, 6 (~1% of membership) in 2015–2016, 14 (1% of membership) in 2016–2017, 19 (2% of membership) in 2017–2018, and 36 (4% of membership) in 2018–2019 qualified for inclusion in the analyses. Qualification criteria are detailed further in the methods manuscript.[6]

Statistical Analysis

Injury counts and rates per 1000 AEs (for which 1 AE was defined as 1 athlete participating in 1 exposure event) were assessed by event type (practice or competition), competition level (Division I, Division II, or Division III), season segment (preseason, regular season, or postseason), and TL (TL or non-TL [NTL]). Weighted and unweighted rates were estimated, and results are presented in terms of unweighted rates (due to low frequencies of injury observations across levels of certain covariates) unless otherwise specified. Temporal trends in injury rates across the study period were evaluated using stratified (by levels of abovementioned variables) rate profile plots. Injury counts and proportions were examined by TL, body part injured, mechanism of injury, injury diagnosis, and activity at the time of injury. Injury rate ratios (IRRs) were used to evaluate differential injury rates across event types, competition levels, and season segments. IRRs with associated 95% confidence intervals (CIs) excluding 1.00 were considered statistically significant, and all analyses were conducted using SAS (version 9.4; SAS Institute).

RESULTS

A total of 364 men's cross-country injuries were reported to the NCAA ISP from 90 723 AEs during 2014–2015 through 2018–2019 (rate = 4.01 per 1000 AEs). This equated to a national estimate of 22 056 injuries overall (Table 1). A relatively small number of competition-related injuries (55 injuries) were reported during the study period, although the competition injury rate was higher than the practice rate (IRR = 2.11; 95% CI = 1.59, 2.82). Competition injury rates decreased notably between 2014–2015 and 2015–2016, remained relatively stable thereafter until 2017–2018, and increased drastically between 2017–2018 and 2018–2019 (Figure A). In comparison, practice injury rates remained relatively stable across the study period (Figure A). The overall Division III injury rate (rate = 5.48 per 1000 AEs) was higher than Division I (3.86 per 1000 AEs), and Division II (3.14 per 1000 AEs) injury rates; statistically significant differences were observed between Division I and Division III rates (IRR = 0.70; 95% CI = 0.55, 0.89), as well as between Division II and Division III rates (IRR = 0.57; 95% CI = 0.44, 0.75).

Injuries by Season Segment

Overall, 99 preseason injuries (national estimate: 5504), 212 regular season injuries (national estimate: 13 856), and 53 postseason injuries (national estimate: 2696) were reported during 2014–2015 through 2018–2019 (Table 2). The preseason injury rate was higher than the regular season (IRR = 1.45; 95% CI = 1.14, 1.84) and postseason (IRR = 2.69; 95% CI = 1.92, 3.75) injury rates. Regular and postseason injury rates remained relatively stable across the study period, whereas preseason injury rates were notably more variable (Figure B). The preseason injury rate decreased considerably between 2014–2015 and 2015–2016 and then increased between 2016–2017 and 2018–2019 (Figure B). The most notable increase in the preseason injury rate was between 2017–2018 and 2018–2019.

Time Loss

Less than one-half (40.7%) of all reported injuries resulted in TL of greater than or equal to 1 day (TL was not reported in ~23% of all reported injuries). TL injuries accounted for a larger proportion of reported competition injuries (49.1%) than practice injuries (39.2%). Notably, competition-related TL injury rates consistently decreased between 2014–2015 and 2017–2018 and then increased slightly between 2017–2018 and 2018–2019 (Figure C). Rates of practice-related TL injuries remained relatively stable throughout the study period (Figure C).

Injury Characteristics

Lower leg injuries (29.1%) accounted for the largest proportion of all injuries reported during the study period. Knee injuries (14.6%), ankle injuries (12.1%), and foot injuries (12.1%) were also common overall. Although knee injuries and foot injuries accounted for notably larger proportions of practice injuries than competition injuries, ankle injuries accounted for comparable proportions of both practice and competition injuries (Table 3). Overuse (38.5%) and noncontact (32.1%) injuries accounted for most of all reported injuries; surface contact injuries also accounted for approximately 12% of all reported injuries (Table 3). Noncontact injuries accounted for comparable

Table 1. **Reported and National Estimates of Injuries, 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	150	9362	127	8118	23	1244
	38 886	2 354 077	36 085	2 182 119	2801	171 958
	3.86 (3.24, 4.47)	3.98 (3.36, 4.59)	3.52 (2.91, 4.13)	3.72 (3.11, 4.33)	8.21 (4.86, 11.57)	7.23 (3.88, 10.59)
II	94	3402	80	2833	14	569
	29 938	1 266 786	27 651	1 166 833	2287	99 953
	3.14 (2.51, 3.77)	2.69 (2.05, 3.32)	2.89 (2.26, 3.53)	2.43 (1.79, 3.06)	6.12 (2.91, 9.33)	5.69 (2.49, 8.90)
III	120	9292	102	7908	18	1385
	21 899	2 308 502	19 942	2 139 330	1957	169 173
	5.48 (4.50, 6.46)	4.03 (3.04, 5.01)	5.11 (4.12, 6.11)	3.70 (2.70, 4.69)	9.20 (4.95, 13.45)	8.19 (3.94, 12.44)
Overall	364	22 056	309	18 859	55	3198
	90 723	5 929 365	83 678	5 488 281	7045	441 084
	4.01 (3.60, 4.42)	3.72 (3.31, 4.13)	3.69 (3.28, 4.10)	3.44 (3.02, 3.85)	7.81 (5.74, 9.87)	7.25 (5.19, 9.31)

Abbreviation: AEs, athlete exposures.

[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 type. 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.

proportions of practice (32.4%) and competition injuries (30.9%), whereas overuse injuries accounted for a notably larger proportion of practice injuries (41.4%) than competition injuries (21.8%).

During the 2014–2015 through 2018–2019 academic years, inflammatory conditions (musculoskeletal pathologies with degenerative characteristics to the corresponding tissue, such as bursitis, capsulitis, osteochondritis, and tendinitis; 30.2%), strains (18.7%), and sprains (11.5%) accounted for most reported men's cross-country injuries. Inflammatory conditions (most commonly reported in the lower leg or Achilles, knee, and foot or toes) accounted for a larger proportion of practice injuries (33.3%) than competition injuries (12.7%). Inflammatory conditions also occurred at a markedly higher rate in preseason (rate = 2.07 per 1000 AEs) than in the regular season (rate = 1.20 per 1000 AEs) and postseason (rate = 0.64 per 1000 AEs). Conversely, strains (29.1%) accounted for larger proportions of competition injuries than practice injuries (16.8%). The most commonly reported injuries during the study

Table 2. **Reported and National Estimates of Injuries, 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	31	2012	95	6349	24	1001
	5913	380 216	23 003	1 488 479	9969	485 382
	5.24 (3.40, 7.09)	5.29 (3.45, 7.14)	4.13 (3.30, 4.96)	4.27 (3.43, 5.10)	2.41 (1.44, 3.37)	2.06 (1.10, 3.03)
II	31	1066	50	1872	13	464
	6257	270 670	15 214	742 689	8468	253 427
	4.95 (3.21, 6.70)	3.94 (2.19, 5.68)	3.29 (2.38, 4.20)	2.52 (1.61, 3.43)	1.54 (0.70, 2.37)	1.83 (1.00, 2.67)
III	37	2426	67	5635	16	1231
	4221	4236 43	12 535	1 295 298	5143	589 562
	8.77 (5.94, 11.59)	5.73 (2.90, 8.55)	5.35 (4.07, 6.62)	4.35 (3.07, 5.63)	3.11 (1.59, 4.64)	2.09 (0.56, 3.61)
Overall	99	5504	212	13 856	53	2696
	16 392	1 074 528	50 752	3 526 466	23 579	1 328 370
	6.04 (4.85, 7.23)	5.12 (3.93, 6.31)	4.18 (3.61, 4.74)	3.93 (3.37, 4.49)	2.25 (1.64, 2.85)	2.03 (1.42, 2.63)

Abbreviations: AEs, athlete exposures; CI, confidence interval.

[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 segment. 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.

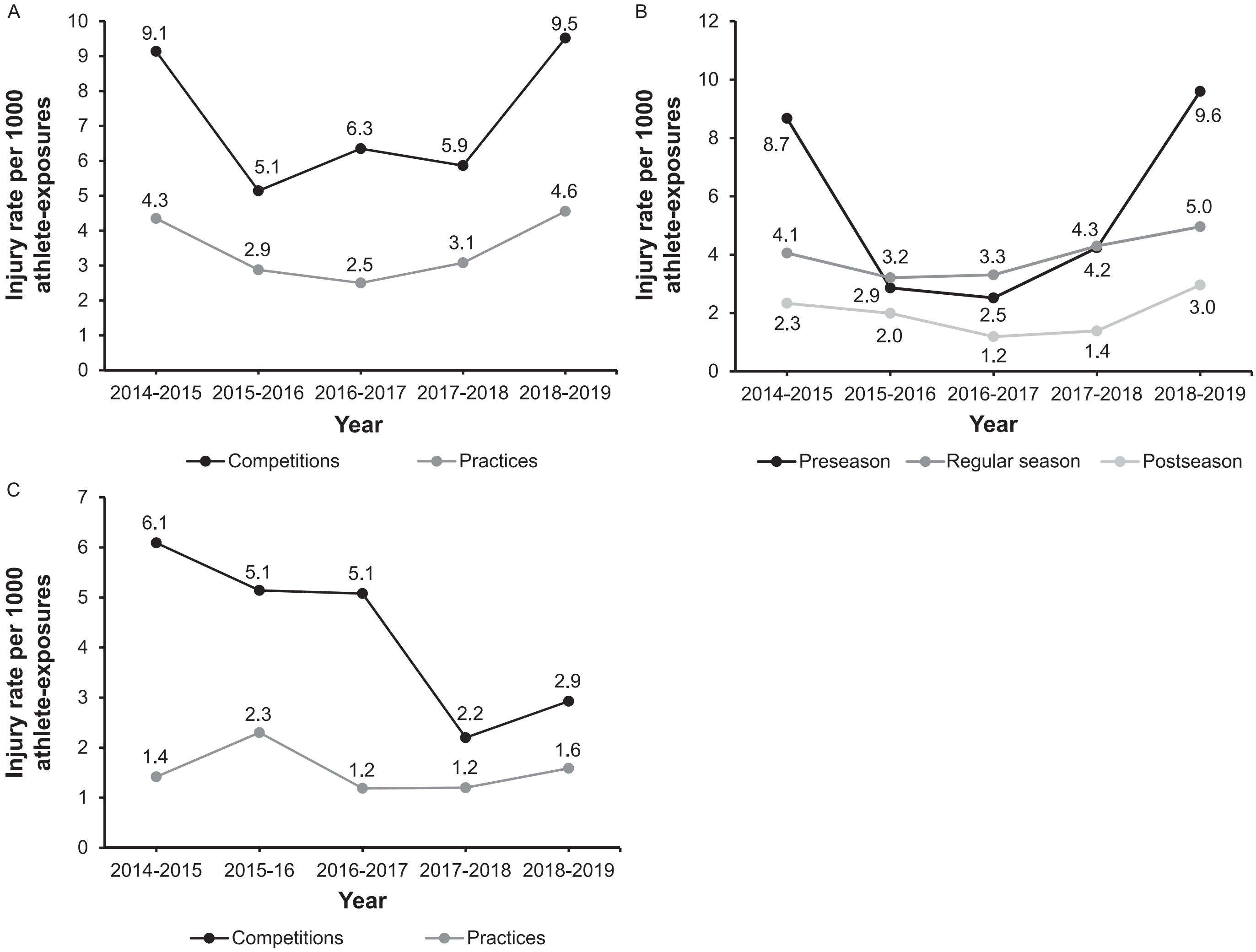

Figure. Temporal patterns in injury rates between 2014–2015 and 2018–2019. A, Overall injury rates (per 1000 AEs) stratified by event type (practices, competitions). B, Injury rates (per 1000 AEs) stratified by season segment. C, Rates (per 1000 AEs) of time loss injuries stratified by event type (practices,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

period were partial or complete lateral ligament complex tears (ankle sprains) (8.2%) and medial tibial stress syndrome (shin splints) (6.6%). During the study period, the overall rate of lateral ligament complex tears was 3.31 per 10 000 AEs (95% CI = 2.12, 4.49), and the overall rate of medial tibial stress syndrome was 2.65 per 10 000 AEs (95% CI = 1.59, 3.70).

Injuries by Cross-Country-Specific Activities

Most injuries in men's cross-country between 2014–2015 and 2018–2019 occurred during 800-m to 10 000-m distance running (70.3%). Fitness or conditioning and running 10 000-m (6 mile) events were other notable activities to which injuries were attributed (Table 4).

SUMMARY

We aimed to describe the epidemiology of NCAA men's cross-country injuries during the 2014–2015 through 2018–2019 athletic seasons. Across the study period, the competition injury rate was higher than the practice injury rate. Importantly, this result had not been observed previously in NCAA men's cross-country athletes; and particularly, the competition injury rate observed in this study was notably higher than the competition rates previously reported in this population.[5] Given the trajectory of competition injury rates during the final years of this study, it may be important to closely monitor the incidence of competition injuries after 2018–2019 to better understand the burden of such injuries to this population. Similar results were observed when we examined injury rates by season segment. The overall preseason injury rate was higher than regular and postseason injury rates across the study period. However, the preseason injury rate was notably more variable than the regular and postseason rates. Although preseason and regular season rates were comparable between 2015–2016 and 2017–2018, the preseason injury rate increased sharply between 2017–2018 and 2018–2019. Much akin to competition injuries, this trajectory of preseason injury rates indicates the need to closely monitor preseason injury incidence and outcomes after 2018–2019. This may be particularly important given the notable increase in ISP participation observed during 2018–2019. NCAA ISP recruitment tactics have evolved

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

	Overall, (%)		Competitions, (%)		Practices, (%)	
	Reported	National Estimate	Reported	National Estimate	Reported	National Estimate
Injury site						
Head/face	5 (1.37)	195 (0.88)	3 (5.45)	136 (4.25)	2 (0.65)	60 (0.32)
Arm/elbow	1 (0.27)	36 (0.16)	0 (0.0)	0 (0.0)	1 (0.32)	36 (0.19)
Hand/wrist	2 (0.55)	123 (0.56)	1 (1.82)	64 (2.00)	1 (0.32)	59 (0.31)
Trunk	31 (8.52)	2230 (10.11)	5 (9.09)	144 (4.50)	26 (8.41)	2086 (11.06)
Hip/groin	30 (8.24)	1629 (7.39)	6 (10.91)	303 (9.47)	24 (7.77)	1326 (7.03)
Thigh	34 (9.34)	1886 (8.55)	6 (10.91)	336 (10.51)	28 (9.06)	1550 (8.22)
Knee	53 (14.56)	2980 (13.51)	3 (5.45)	177 (5.53)	50 (16.18)	2803 (14.86)
Lower leg	106 (29.12)	6546 (29.68)	15 (27.27)	1275 (39.87)	91 (29.45)	5271 (27.95)
Ankle	44 (12.09)	2263 (10.26)	7 (12.73)	314 (9.82)	37 (11.97)	1949 (10.33)
Foot	44 (12.09)	3371 (15.28)	3 (5.45)	147 (4.60)	41 (13.27)	3224 (17.10)
Other	14 (3.85)	797 (3.61)	6 (10.91)	301 (9.41)	8 (2.59)	496 (2.63)
Mechanism						
Player contact	2 (0.55)	111 (0.50)	0 (0.0)	0 (0.0)	2 (0.65)	111 (0.59)
Surface contact	43 (11.81)	2529 (11.47)	10 (18.18)	502 (15.70)	33 (10.68)	2027 (10.75)
Other contact	6 (1.65)	284 (1.29)	1 (1.82)	35 (1.09)	5 (1.62)	249 (1.32)
Noncontact	117 (32.14)	6779 (30.74)	17 (30.91)	897 (28.05)	100 (32.36)	5883 (31.19)
Overuse	140 (38.46)	9181 (41.63)	12 (21.82)	952 (29.77)	128 (41.42)	8229 (43.63)
Other/unknown	56 (15.38)	3172 (14.38)	15 (27.27)	813 (25.42)	41 (13.27)	2359 (12.51)
Diagnosis						
Abrasion/laceration	2 (0.55)	83 (0.38)	2 (3.64)	83 (2.60)	0 (0.0)	0 (0.0)
Concussion	2 (0.55)	60 (0.27)	1 (1.82)	36 (1.13)	1 (0.32)	24 (0.13)
Contusion	5 (1.37)	284 (1.29)	0 (0.0)	0 (0.0)	5 (1.62)	284 (1.51)
Dislocation/subluxation	1 (0.27)	76 (0.34)	0 (0.0)	0 (0.0)	1 (0.32)	76 (0.40)
Fracture	16 (4.40)	889 (4.03)	1 (1.82)	36 (1.13)	15 (4.85)	853 (4.52)
Illness/infection	1 (0.27)	36 (0.16)	0 (0.0)	0 (0.0)	1 (0.32)	36 (0.19)
Inflammatory condition	110 (30.22)	6640 (30.11)	7 (12.73)	373 (11.66)	103 (33.33)	6267 (33.23)
Spasm	25 (6.87)	1362 (6.18)	4 (7.27)	119 (3.72)	21 (6.80)	1243 (6.59)
Sprain	42 (11.54)	2064 (9.36)	6 (10.91)	308 (9.63)	36 (11.65)	1756 (9.31)
Strain	68 (18.68)	4791 (21.72)	16 (29.09)	1252 (39.15)	52 (16.83)	3539 (18.77)
Other	92 (25.27)	5771 (26.17)	18 (32.73)	991 (30.99)	74 (23.95)	4780 (25.35)

[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.

over time, and the improvements in participation during 2018–2019 in particular reflects the success of recently used recruitment strategies (for instance, support and communication from the NCAA Sport Science Institute). Consequently, although it is reasonable to suggest that the injury rates and characteristics reported during the latter years of the study period more closely represent the larger population of interest (as compared with the earlier years) due to greater participation in the ISP, continued monitoring during sustained periods of healthy participation is needed. Closer monitoring of offseason and preseason training routines may be warranted if comparable preseason injury rates are observed beyond 2018–2019.

Most injuries reported among men's NCAA cross-country athletes during 2014–2015 through 2018–2019 were inflammatory conditions, sprains, and strains. The

Table 4. Distribution of Injuries by Men's Cross-Country-Specific Activities[a]

	Overall, (%)		Competitions, (%)		Practices, (%)	
	Reported	National Estimate	Reported	National Estimate	Reported	National Estimate
Fitness/conditioning	22 (6.04)	1183 (5.36)	0 (0.0)	0 (0.0)	22 (7.12)	1183 (6.27)
(10000 m/6 mile)	27 (7.42)	2370 (10.75)	7 (12.73)	758 (23.70)	20 (6.47)	1612 (8.55)
Distance running	256 (70.33)	15 583 (70.65)	39 (70.91)	2009 (62.82)	217 (70.23)	13 574 (71.98)
Sprints	7 (1.92)	454 (2.06)	0 (0.0)	0 (0.0)	7 (2.27)	454 (2.41)
Other/unknown	52 (14.29)	2466 (11.18)	9 (16.36)	430 (13.45)	43 (13.92)	2036 (10.80)

[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. Distance running category includes 800 m – 10000 m events.

prevalence of inflammatory conditions (delineated as musculoskeletal pathologies with degenerative characteristics to the tissue involved) is particularly noteworthy, and the relatively higher rate of such injuries in preseason (as compared with regular and postseason) suggests that inflammatory-related injuries, especially in preseason, warrant further attention in this population. In a sport in which the body's largest muscle groups are recruited to perform at maximal exertion for long periods of time, exercise-induced muscle damage (nonpathophysiological) is arguably expected given the physiological mechanisms involved in the recovery process.[7,8] This suggested trend may be attributable to the nature of the sport, as athletes are required to undergo repetitive movements for long periods of time. These movements cause the body's largest muscle groups to perform in a high intensity capacity for long periods of time. This exercise-induced muscle damage is arguably expected given the physiological mechanism involved in the recovery process[7,8] but may become pathological if appropriate recovery is not allowed.[9] The current trend observed may suggest that cross-country athletes may not always be implementing the requisite recovery practices to prevent these conditions. Given the higher injury incidence during the preseason and time constraints that may hamper the athlete's ability to fully recover, implementation of preventative programs before athletic participation may serve as an effective intervention strategy and is an important avenue for future researchers.[10] Furthermore, it is important to note that given the nature of sports injury surveillance, inflammatory conditions are made up of several potential injury diagnoses in the ISP (such as bursitis, capsulitis, osteochondritis, and tendinitis). As such, it is difficult to discuss these records in greater detail than in terms of commonly reported body parts or rates by season segment (as noted above) in this context. In future studies directed toward studying inflammatory conditions in this population, researchers may not only target specific types of inflammatory conditions but also capture physiological characteristics of athletes at various times during the season to expand the understanding of such injuries among NCAA men's cross-country athletes. Future study of training and recovery practices that are associated with a higher prevalence of such conditions may also be important.

The most commonly reported specific injuries were (partial or complete) lateral ligament complex tears (ankle sprains) and medial tibial stress syndrome (shin splints). Particularly with regards to medial tibial stress syndrome, prior research in collegiate athletes has suggested that potential etiological elements of this injury include weak hip abductors, restrictive hip musculature, and long durations of rearfoot eversion during stance.[11] In addition, it has also been noted that greater hip external rotation (in males), prior orthotic use, fewer years of running experience, increased body mass index, navicular drop, and navicular drop greater than 10 millimeters are all factors associated with a higher risk of medial tibial stress syndrome.[12] Importantly, we did not examine temporal patterns in rates of commonly observed injuries due to low injury frequencies (of both lateral ligament complex tears and medial tibial stress syndrome) observed per year. The observed frequencies are at least partially attributable to low ISP participation among men's cross-country programs, particularly during the earlier years of this study. Therefore, continued monitoring of commonly reported injuries is needed through a period of healthy and stable ISP participation among NCAA men's cross-country programs. Given the results observed here, it may be important to discuss the development injury prevention strategies for commonly observed injuries, while continuing to closely monitor the incidence (and associated outcomes) of such injuries after 2018–2019.

The juxtaposition of the results we observed here to those reported by previous researchers examining this population reveal stark differences, particularly with regard to competition injury incidence. With that said, it is important to acknowledge the rapid growth in the number of NCAA men's cross-country athletes nationwide, as well as the growth in ISP participation among men's cross-country programs during 2016–2017 through 2018–2019. Taking such factors into consideration, continuous and routine monitoring of NCAA men's cross-country injuries is critical for providing insight into injury incidence and outcomes within this population.

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