

Practice Injury Rates in Collegiate Sports

Julie Agel, MA, ATC/L, and Jessica Schisel, BA

Objective: The objective of this article was to explore the differences in practice injury rates for select National Collegiate Athletic Association (NCAA) sports within and across sport by preseason, in-season, and postseason. This article will explore the relationship of practice injury rates by fall, winter, and spring sports as well as by Divisions I, II, and III.

Design: Descriptive epidemiology study.

Setting: NCAA schools.

Patients: NCAA athletes.

Main Outcome Measures: Injury.

Results: In all sports across all seasons, preseason practice injury rates [6.3 per 1000 athletic exposure (A-E)] were higher than in-season (2.3 per 1000 A-E). Fall sports had an overall preseason practice injury rate of 7.4 (per 1000 A-E) compared with 7.0 (per 1000 A-E) for winter and 3.5 (per 1000 A-E) for spring sports. Women's soccer had the highest preseason injury rate of 9.5 (per 1000 A-E). Men's football had the highest increased risk of injury comparing preseason with in-season practice injury (3.47 per 1000 A-E).

Conclusions: The recognition that preseason practice injury rates are higher compared with in-season and postseason practice injury rates can create an opportunity for athletes, coaches, and medical personnel to identify prevention strategies to reduce preseason injury risk.

Key Words: epidemiology, sporting injuries, college sports, practice injuries

(*Clin J Sport Med* 2013;23:33–38)

INTRODUCTION

Full participation in practice is integral to each competitive athlete's success. Injuries, traumatic or overuse in nature, are a common impediment to unrestricted practice. Published research on practice injuries has looked primarily at the timing of injury occurrence with an attempt to identify risk factors.^{1–13} These reports are usually specific to one sport and often part of an overall sport injury epidemiologic report. The physical demands expected of athletes at the beginning of

the season can result in higher injury rates and longer absences from in-season participation.⁶

Anderson et al¹ showed that in one women's collegiate basketball season, there was a sharp increase in injury rate sustained during the beginning of preseason practice that matched the onset of elevated training loads. These data demonstrated a significant causative link between training load and injury.

Feeley et al⁵ showed that the highest injury rate occurred in the first 2 weeks of preseason practices in National Football League (NFL) training camps from 1998 to 2007. This could be associated with the "make the team" mentality, where if athletes in training camp do not do well, they will not make the team and the fact that there are no limits to the amount of practice time during professional NFL training camps. In addition, injury rates went down as training camp continued; this demonstrates that there may be a relationship with conditioning and training.

Brooks et al² followed 11 rugby union clubs for 2 years and determined that the incidence of injury was significantly higher during the preseason practice period (2.5 per 1000 playing hours) compared with the rest of the season (average 1.2 per 1000 playing hours). They attributed this difference to the fact that during the preseason period more emphasis was placed on conditioning activities versus the emphasis on skill training during the season. Overall, they found that one-third of all injuries occurred during the preseason despite the preseason accounting for only 24% of the length of the season.

Woods focused on preseason injuries affecting English professional football. Data collected during 2 competitive seasons showed a higher risk of slight to minor preseason injuries related to physical conditioning, age, and experience.¹² The studies of Woods and others expressed the importance of conditioning and/or injury prevention programs that would provide athletes the physical and mental preparation to prevent injuries.^{7,9–13}

Elliott et al⁴ in a 10-year review of hamstring muscle strains in NFL players found that 51% of the hamstring strains occurred during preseason with the preseason practice injury rate [0.82 per 1000 athletic exposure (A-E)] significantly higher than the in-season practice injury rate (0.18 per 1000 A-E).

Published data representing all participation-related injuries resulting in time loss across the 15 sports, 3 divisions, and 16 years of the original National Collegiate Athletic Association (NCAA) Injury Surveillance System (ISS) indicated significantly elevated game injury rates (13.8 injuries per 1000 A-E) compared with overall practice injury rates [4.0 injuries per 1000 A-Es; rate ratio (π) = 2.2; 95% confidence interval (CI), 2.2–2.2].⁸ However, closer examination of these data demonstrated disparities within practice injury rates with preseason practice injury rates (6.3 injuries per 1000

Submitted for publication April 2, 2012; accepted August 28, 2012.

From the Department of Orthopaedic Surgery and Sports Medicine, Harborview Medical Center, Seattle, Washington.

The authors report no conflicts of interest.

Corresponding Author: Julie Agel, MA, ATC/L, Orthopaedic and Sports Medicine, Harborview Medical Center, Box 359798, 325 Ninth Ave, Seattle, WA 98104 (bagel@u.washington.edu).

Copyright © 2013 by Lippincott Williams & Wilkins

A-Es) significantly higher compared with both in-season (2.3 injuries per 1000 A-Es; $rr = 2.7$; 95% CI, 2.7-2.8) and post-season (1.3 injuries per 1000 A-Es; $rr = 4.7$; 95% CI, 4.4-5.0), warranting a reexamination of these data focusing on practice-related injuries because the existing literature does not address the disparity in injury rates across the competitive season for practice injuries. Recognition of these disparities in injury rates will provide opportunities for injury reduction by focusing attention on the structure of preseason practices.

Our *a priori* primary hypothesis was that there would be a seasonal difference across practice types with fall sports showing the largest differential rates in preseason practice compared with in-season practice injury rates. Our secondary hypothesis was that there would be divisional differences across practice types with Division I reporting higher rates of preseason practice injury rates compared with Division II and Division III. The result of this work will allow those responsible for the health of athletes to be aware of the disparities in practice injury rates and consider options to reduce the risk of injury.

MATERIALS AND METHODS

Data were evaluated using the NCAA ISS to determine within-season practice injury rates by sport and division for the years 1988 to 1989 through 2003 to 2004, the most currently available data. Specifics of how these data are collected, including sampling methodology and validation, have been published previously.^{3,14} Briefly, designated personnel at each participating school completed weekly logs indicating the number of athletes participating in each scheduled practice or game to allow for recording of athlete exposure as well as recording any injury resulting in time loss. Data collection by the schools is voluntary and participating schools represent approximately 10% of eligible schools each year. Men's and women's soccer as well as women's field hockey data were only available through 2002 to 2003 because of a change in NCAA data collection methodology. Women's ice hockey data were available only for the last 4 years of this project. This project received a waiver of institutional review board approval from the authors' institution because it entailed secondary analysis of a preexisting data set consisting of only de-identified data.

Classification by season was as follows: fall—women's field hockey, men's football, men's soccer, women's soccer, and women's volleyball; winter—men's basketball, women's basketball, women's gymnastics, men's ice hockey, women's ice hockey, and men's wrestling; spring—men's baseball, men's lacrosse, women's lacrosse, and women's softball in accordance with the NCAA regulations.³ Division was recorded based on their divisional status within the NCAA.

Practice seasons were categorized according to the NCAA definition as follows: preseason practice—any school sanctioned supervised full-team practice before the start of the first in-season game; in-season practice—any practice from the first regular season contest of the official competitive season to the last game of the regular season; postseason practice—any practice that occurred during the postseason. Any team not competing in the postseason was not eligible to have postseason practices; thus, this is a reduced sample.³

A practice injury, according to the NCAA ISS definition, was any injury that occurred while in a practice, that required an athletic trainer or physician evaluation, and where the athlete lost at least 1 day of participation in their sport. An A-E according to the NCAA ISS definition was 1 practice or competition that exposed an athlete to a possible athletic injury regardless of the amount of time the athlete participated.³

Practice injury rates were calculated by dividing the incidence of practice-related injuries by the practice athletic exposures. In the NCAA ISS, this injury rate was expressed per 1000 A-Es (injuries/exposure ($\times 1000$)) for a rate per 1000 A-E).³

Individual sport rate ratios were calculated by comparing preseason practice injury rates with in-season practice injury rates using Episheet.¹⁵ A comparison with postseason practice injury rates was not done because of the low number of injuries and exposures. The 95% CI were computed using large sample formulas.¹⁶

RESULTS

In all sports across all seasons and divisions, there were 60 026 injuries and 9 554 187 exposures in preseason practices, 37 148 injuries and 16 127 459 exposures in in-season practices, and 1069 injuries and 797 719 exposures in postseason injuries. Preseason practice injury rates (6.3 per 1000 A-E; 95% CI, 6.2-6.3) were higher than in-season (2.3 per 1000 A-E; 95% CI, 2.3-2.3) and postseason practice injury rates (1.3 per 1000 A-E; 95% CI, 1.3-1.4). In all but 4 sports (Tables 1–3), preseason practice injury rates were at least twice the in-season and postseason practice injury rates. Women's gymnastics, ice hockey, and lacrosse, as well as men's wrestling, had preseason practice injury rates that were higher than in-season practice injury rates but less than double.

Individual Sports

Women's soccer had the highest preseason practice injury rate (9.5 per 1000 A-E) followed by men's wrestling (8.3 per 1000 A-E). Men's soccer (8.0 per 1000 A-E) and women's gymnastics (8.0 per 1000 A-E) were the sports with the next highest preseason practice injury rates (Tables 1–3).

Preseason Versus In-Season

Table 4 demonstrates that men's football had the highest preseason practice injury rate compared with in-season practice injury rate ($rr = 3.5$) followed by men's soccer ($rr = 3.3$) and women's soccer ($rr = 3.3$). The sport with the lowest increased risk of injury during preseason practice compared with in-season practice was women's lacrosse ($rr = 1.7$) followed by men's wrestling ($rr = 1.8$).

Seasonal Differences Across Practice Types

Fall sports had an overall preseason practice injury rate of 7.4 (per 1000 A-E; 95% CI, 7.3-7.4) compared with 7.0 (per 1000 A-E; 95% CI, 6.9-7.2) for winter and 3.5 (per 1000 A-E; 95% CI, 3.4-3.6) for spring sports. Fall in-season practices had an overall injury rate of 2.2 (per 1000 A-E; 95% CI, 2.2-2.3) compared with 2.9 (per 1000 A-E; 95%

TABLE 1. Fall Rates With 95% CI of Practice Injuries Per 1000 A-E for NCAA Athletes From 1988-1989 Through 2003-2004

	Overall Total			Division I			Division II			Division III		
	N	Rate	95% CI	N	Rate	95% CI	N	Rate	95% CI	N	Rate	95% CI
Women's field hockey												
Preseason	1264	6.4	6.0-6.7	501	5.9	5.4-6.4	99	6.8	5.4-8.1	664	6.7	6.2-7.3
In-season	741	2.2	2.1-2.4	319	2.2	2.0-2.4	42	2.0	1.4-2.6	380	2.3	2.0-2.5
Postseason	38	1.6	1.1-2.2	22	2.2	1.3-3.1	0	0.0	0.0-0.0	16	1.3	0.7-1.9
Men's football												
Preseason	27133	7.2	7.2-7.3	12753	7.1	6.9-7.2	5302	6.8	6.6-7.0	9078	7.9	7.7-8.0
In-season	14857	2.1	2.1-2.1	7108	2.0	2.0-2.1	2706	1.9	1.8-2.0	5043	2.3	2.3-2.4
Postseason	332	1.4	1.2-1.4	263	1.7	1.5-1.9	29	0.8	0.5-1.0	40	0.8	0.5-1.0
Men's soccer												
Preseason	3987	8.0	7.7-8.2	1398	8.1	7.7-8.5	874	8.2	7.7-8.8	1715	7.8	7.4-8.1
In-season	2175	2.4	2.3-2.5	886	2.8	2.6-3.0	389	2.2	2.0-2.4	900	2.3	2.1-2.4
Postseason	79	1.6	1.3-2.0	35	1.9	1.3-2.6	28	2.4	1.5-3.3	16	0.8	0.4-1.2
Women's soccer												
Preseason	3727	9.5	9.2-9.8	1469	9.1	8.6-9.6	708	9.7	9.0-10.4	1550	9.9	9.4-10.4
In-season	2002	2.9	2.8-3.0	854	3.0	2.8-3.3	323	2.7	2.4-3.0	825	2.9	2.7-3.1
Postseason	49	1.5	1.0-1.9	26	1.9	1.2-2.7	8	1.5	0.5-2.5	15	1.0	0.5-1.5
Women's volleyball												
Preseason	2528	6.2	6.0-6.4	1080	6.3	5.9-6.7	728	6.5	6.0-6.9	720	5.8	5.4-6.2
In-season	1973	2.8	2.7-2.9	909	3.1	2.9-3.3	461	2.7	2.4-2.9	603	2.6	2.4-2.8
Postseason	52	1.2	0.9-1.5	27	1.5	0.9-2.1	10	0.9	0.3-1.4	15	1.0	0.5-1.5

N, number of injuries; rate, injury rate; 95% CI, 95% confidence interval around the injury rate.

CI, 2.8-2.9) for winter sports and 1.61 (per 1000 A-E; 95% CI, 1.6-1.7) for spring sports.

The rate ratio of preseason practice compared with in-season practice injury was highest for fall sports (rr = 3.3; 95% CI, 3.2-3.4) followed by winter sports (rr = 2.5; 95% CI, 2.4-2.5) and spring (rr = 2.2; 95% CI, 2.1-2.3).

Division I winter preseason practice had the highest injury rate (8.3 per 1000 A-E; 95% CI, 8.0-8.4) followed by Division III fall preseason practice (7.8 per 1000 A-E; 95% CI, 7.7-7.9). The increased risk of preseason practice compared with in-season practice injury by division was highest for Division II fall sports (3.5 per 1000 A-E; 95% CI, 3.3-3.6), followed by Division III fall sports (3.3 per 1000 A-E; 95% CI, 3.2-3.4) and Division I (3.2 per 1000 A-E; 95% CI, 3.17-3.33). Winter Division I (2.7 per 1000 A-E; 95% CI, 2.6-2.8) and spring Division II (2.4 per 1000 A-E; 95% CI, 2.2-2.7) demonstrated the next highest increases.

Divisional Differences Across Practice Types

The overall preseason practice injury rate for Division I was 6.8 (per 1000 A-E), for Division II was 6.1 (per 1000 A-E), and for Division III was 6.0 (per 1000 A-E). The in-season practice injury rate for Division I was 2.4 (per 1000 A-E), for Division II was 2.2 (per 1000 A-E), and for Division III was 2.3 (per 1000 A-E). The post-season practice injury rate for Division I was 1.5 (per 1000 A-E), for Division II was 0.8 (per 1000 A-E), and for Division III was 1.0 (per 1000 A-E). The sport by division with the highest injury rate was Division III women's preseason soccer (9.9 per 1000 A-E), followed by Division II women's preseason soccer (9.7 per

1000 A-E). Division I men's preseason wrestling had the third highest injury rate (9.2 per 1000 A-E).

Division II women's ice hockey had the highest preseason practice injury rate compared with in-season practice injury rate (rr = 5.0; 95% CI, 1.6-16.0) followed by Division II men's soccer (rr = 3.7; 95% CI, 3.3-4.2) and women's soccer (rr = 3.6; 95% CI, 3.2-4.1).

DISCUSSION

This article examines the practice injury rates throughout the competitive season across 16 years and 15 sports with an in-depth exploration of the data that demonstrates preseason practice injury rates are higher than any other part of the competitive season. Preseason practices are responsible for a disproportionate share of overall practice injuries. It is important to recognize that preseason practice injury rates are higher compared with in-season and postseason practice injury rates across all sports. These data do not explain the findings but rather document the differences that future research can explore and substantiates some findings of earlier research. Depending on the level of competition, preseason practice may be a time to develop basic skills as a new sport is introduced, to review basic skills for knowledgeable players, or to achieve appropriate physical fitness for competition for many athletes.^{2,17} New coaches may bring new training regimens that require a different skill set or exploit a conditioning weakness of athletes. It is also a time for unproven athletes to demonstrate their skills and mental toughness as they audition for a team spot. Psychological stress has been identified as a risk factor for injury as documented by

TABLE 2. Winter Rates With 95% CI of Practice Injuries Per 1000 AE for NCAA Athletes From 1988-1989 Through 2003-2004

	Overall Total			Division I			Division II			Division III		
	N	Rate	95% CI	N	Rate	95% CI	N	Rate	95% CI	N	Rate	95% CI
Men's basketball												
Preseason	4365	6.9	6.7-7.1	1904	8.6	8.3-9.0	1072	7.4	7.0-7.8	1389	6.6	6.2-6.9
In-season	3345	2.6	2.5-2.7	1399	2.8	2.7-3.0	876	3.0	2.8-3.2	1070	2.8	2.6-2.9
Postseason	99	1.4	1.1-1.7	42	1.3	0.9-1.7	18	1.1	0.6-1.6	39	2.1	1.5-2.7
Women's basketball												
Preseason	3420	6.8	6.5-7.0	1589	8.0	7.6-8.4	818	6.5	6.0-6.9	1013	5.6	5.3-6.0
In-season	3126	2.8	2.7-2.9	1479	3.2	3.0-3.4	727	2.7	2.5-2.9	920	2.5	2.3-2.6
Postseason	80	1.5	1.2-1.8	41	1.6	1.1-2.1	23	1.6	1.0-2.3	16	1.1	0.6-1.7
Women's gymnastics												
Preseason	1633	8.0	7.6-8.3	1316	8.8	8.3-9.3	206	7.0	6.1-8.0	111	4.2	3.4-5.0
In-season	568	3.9	3.6-4.3	412	4.2	3.8-4.6	90	4.4	3.5-5.3	66	2.7	2.0-3.3
Postseason	41	2.1	1.5-2.8	30	2.2	1.4-3.0	7	3.2	0.8-5.8	4	1.2	0.0-2.3
Men's ice hockey												
Preseason	807	4.7	4.4-5.0	371	5.2	4.7-5.7	73	4.6	3.5-5.6	363	4.3	3.8-4.7
In-season	1117	1.5	1.4-1.5	630	1.5	1.4-1.6	83	1.5	1.2-1.8	404	1.3	1.2-1.5
Postseason	40	0.7	0.5-0.9	22	0.7	0.3-1.0	0	0.0	N/A	18	0.7	0.4-1.0
Women's ice hockey												
Preseason	48	4.2	3.0-5.4	19	4.0	2.2-5.9	5	8.1	1.0-15.3	24	4.0	2.4-5.6
In-season	117	2.3	1.9-2.7	53	2.1	1.5-2.6	7	1.6	0.4-2.8	57	2.6	1.9-3.3
Postseason	2	0.7	0.0-1.6	2	1.1	0.0-2.6	0	N/A	N/A	0	N/A	N/A
Men's wrestling												
Preseason	3095	8.3	8.0-8.5	1758	9.2	8.7-9.6	641	7.3	6.7-7.8	696	7.3	6.8-7.9
In-season	3399	4.7	4.6-4.9	1644	4.9	4.6-5.1	781	4.8	4.4-5.1	974	4.4	4.2-4.7
Postseason	126	1.8	1.5-2.1	58	1.9	1.4-2.4	32	1.6	1.0-2.1	36	1.9	1.3-2.6

N, number of injuries; rate, injury rate; 95% CI, 95% confidence interval around the injury rate.

Wiese-Bjornstal.¹⁸ Athletes' performance expectations from either themselves or the staff are higher than any other part of their sport season. Most athletes participate for the full preseason practice session that involves longer sustained

activity and more intense practices than may be seen routinely during the season.

Our hypothesis that fall sports would have the highest differential in practice injury rates than winter and/or spring

TABLE 3. Spring Rates With 95% CI of Practice Injuries Per 1000 AE for NCAA Athletes From 1988-1989 Through 2003-2004

	Overall Total			Division I			Division II			Division III		
	N	Rate	95% CI	N	Rate	95% CI	N	Rate	95% CI	N	Rate	95% CI
Men's baseball												
Preseason	2715	2.6	2.5-2.7	1266	3.5	3.3-3.6	514	2.2	2.0-2.4	935	2.2	2.0-2.3
In season	1142	1.1	1.1-1.2	610	1.5	1.3-1.6	187	0.8	0.7-0.9	345	1.0	0.9-1.1
Postseason	35	0.7	0.5-0.9	9	0.5	0.2-0.8	9	0.8	0.3-1.3	17	0.8	0.4-1.2
Men's lacrosse												
Preseason	1868	4.9	4.7-5.1	738	5.1	4.8-5.5	146	4.4	3.7-5.1	984	4.8	4.5-5.1
In-season	967	2.0	1.9-2.1	442	2.2	2.0-2.4	69	1.7	1.3-2.1	456	1.9	1.7-2.1
Postseason	50	1.6	1.1-2.0	23	1.7	1.0-2.4	3	2.0	0.0-4.3	24	1.4	0.8-1.9
Women's lacrosse												
Preseason	1471	4.2	4.1-4.5	733	5.2	4.8-5.6	102	3.1	2.5-3.7	636	3.5	3.3-3.8
In-season	809	2.5	2.3-2.6	431	2.7	2.5-3.0	60	2.4	1.8-3.1	318	2.2	2.0-2.4
Postseason	23	1.1	0.7-1.6	12	1.4	0.6-2.2	4	3.0	0.1-6.0	7	0.6	0.2-1.1
Women's softball												
Preseason	1965	3.7	3.5-3.8	736	4.4	4.1-4.7	557	3.9	3.6-4.2	672	2.9	2.7-3.2
In-season	810	1.7	1.6-1.8	326	1.8	1.6-2.0	216	1.8	1.5-2.0	268	1.5	1.4-1.7
Postseason	23	0.8	0.5-1.1	10	1.2	0.5-1.9	8	0.9	0.3-1.5	5	0.5	0.1-0.9

N, number of injuries; rate, injury rate; 95% CI = 95% confidence interval around the injury rate.

TABLE 4. Individual Sport Rate Ratios Comparing Preseason to In-Season Injury Rates With 95% CI

Sport	Rate Ratio (95% CI)
Women's lacrosse	1.7 (1.6-1.8)
Men's wrestling	1.8 (1.7-1.8)
Women's ice hockey	1.9 (1.3-2.6)
Women's gymnastics	2.0 (1.8-2.2)
Women's softball	2.2 (2.0-2.4)
Women's volleyball	2.2 (2.1-2.3)
Men's baseball	2.4 (2.2-2.5)
Women's basketball	2.4 (2.3-2.5)
Men's lacrosse	2.5 (2.3-2.7)
Men's basketball	2.7 (2.5-2.8)
Women's field hockey	2.9 (2.6-3.2)
Men's ice hockey	3.2 (3.0-3.6)
Women's soccer	3.3 (3.1-3.5)
Men's soccer	3.3 (3.1-3.5)
Men's football	3.5 (3.4-3.5)

sports was substantiated. This hypothesis was based on the assumption that fall collegiate sports are not officially under supervision compared with the supervised preseason conditioning program that winter and spring sports have, as fall sport athletes are not under supervision of the college during summer while other season athletes have the ability to train and condition under appropriate supervision. These fall collegiate athletes may be more vulnerable to injuries because they are not physically or mentally prepared for the intensity of the preseason training program. Coaches, divisional institutions, and athletes may not be aware of their physical limitations because of the summer break even if they are physically active during the summer. Athletes who sustained previous injuries might not have received or pursued adequate rehabilitative care at home. The sports in this review with the highest preseason practice injury rates do not consistently mirror the sports with the highest overall game or practice injury rates as detailed by the NCAA ISS.¹⁹ Women's gymnastics has the highest overall practice injury rate (6.0 per 1000 A-E) but the fourth highest preseason practice injury rate. Men's wrestling has the second highest overall practice injury rate (5.7 per 1000 A-E) similar to its ranking of preseason practice injury rates. Men's football has the highest game injury rate (36.0 per 1000 A-E) but an overall practice injury rate of 3.8 (per 1000 A-E).

Divisional difference was anticipated because of the theorized higher practice intensity and demands but was not consistently demonstrated by these data. Division I is considered the most competitive of the 3 divisions by NCAA definition and thus we had felt they might have higher injury rates.²⁰

Women's soccer had the highest rate of preseason practice injury (9.5 per 1000 A-E) as well as the largest increase over in-season practice injury rates (6.6 per 1000 A-E), but football demonstrated the highest increase in risk of preseason practice injury compared with their in-season practice injury rate (rr = 3.5 per 1000 A-E; 95% CI, 3.4-3.5). Football has taken great efforts to ramp up their preseason practices with

regulations concerning temperature, use of pads, and time of practice permitted. The specific nature of preseason practice injuries in football needs to be evaluated in the face of these findings to determine if other adjustments to preseason practices can be made. We did not address the severity of injury resulting from these injuries to determine if preseason practice injuries, while more frequent, might be less severe. This was beyond the scope of this article but would make an important addition for future work.

This data set represents approximately 250 schools within an academic year with a target sample of 10% of participating schools per sport. These goals were not always met and may affect the generalizability of the data. A limitation of these data is the definition of exposure. It only accounts for participation regardless of length of time. This may affect all the rates presented here but the recording of actual "at-risk" exposure is beyond the capability of this data set. In addition, women's ice hockey numbers should be interpreted with caution because the number of participating institutions was low and only 4 years reported were in the database because of the newness of the sport in NCAA competition 2000-2001 to 2003-2004.

Consideration should be given to the findings presented here to ensure that practices are conducted in a safe manner for the athletes and all options to prevent injury are used. With this information, athletes, coaches and institutions can adjust practices to prevent or possibly reduce preseason practice injuries. Possible explanations for these differences that can be explored are conditioning and fitness of the athlete, skill of the athlete, duration of the practice, and difficulty of the practice.¹²

REFERENCES

- Anderson L, Triplett-McBride T, Foster C, et al. Impact of training patterns on incidence of illness and injury during a women's collegiate basketball season. *J Strength Cond Res.* 2003;17:734-738.
- Brooks J, Fuller C, Kemp S, et al. Epidemiology of injuries in English professional rugby union: part 2 training injuries. *Br J Sports Med.* 2005;39:767-775.
- Dick R, Agel J, Marshall S. National Collegiate Athletic Association Injury Surveillance System commentaries: introduction and methods. *J Athl Train.* 2007;42:173-182.
- Elliott M, Zarins B, Powell J, et al. Hamstring muscle strains in professional football players: a 10-year review. *Am J Sports Med.* 2011;39:843-850.
- Feeley B, Kennelly S, Barnes R, et al. Epidemiology of National Football League training camp injuries from 1998 to 2007. *Am J Sports Med.* 2008;36:1597-1603.
- Gabbett T. Incidence of injury in semi-professional rugby league players. *Br J Sports Med.* 2003;37:36-44.
- Gabbett T. Reductions in pre-season training loads reduce training injury rates in rugby league players. *Br J Sports Med.* 2004;38:743-749.
- Hootman J, Dick R, Agel J. Epidemiology of collegiate injuries for 15 sports: summary and recommendations for injury prevention initiatives. *J Athl Train.* 2007;42:311-319.
- Powell J, Barber-Foss K. Injury patterns in selected high school sports: a review of the 1995-1997 seasons. *J Athl Train.* 1999;34:227-284.
- Quarrie K, Alsop J, Waller A, et al. The New Zealand rugby injury and performance project. VI. A prospective cohort study of risk factors for injury in rugby union football. *Br J Sports Med.* 2001;35:157-166.
- Witvrouw E, Danneels L, Asselman P, et al. Muscle flexibility as a risk factor for developing muscle injuries in male professional soccer players: a prospective study. *Am J Sports Med.* 2003;31:41-46.
- Woods C, Hawkins R, Mulse M, et al. The football association medical research programme: an audit of injuries in professional football—analysis of preseason injuries. *Br J Sports Med.* 2002;36:436-441.

13. Yeung S, Suen A, Yeung E. A prospective cohort study of hamstring injuries in competitive sprinters: preseason muscle imbalance as a possible risk factor. *Br J Sports Med*. 2009;43:589–594.
14. Kucera K, Marshall S, Bell D, et al. Validity of soccer injury data from the National Collegiate Athletic Association's Injury Surveillance System. *J Athl Train*. 2011;46:489–499.
15. Rothman K. EpiSheet: spreadsheets for the analysis of epidemiologic data. <http://www.drugapi.info/links/downloads/episheet.xls>. Accessed February 29, 2010.
16. Rothman K, Greenland S. *Modern Epidemiology*. 2nd ed. Philadelphia, PA: Lippincott; 1998.
17. Brooks M, Schiff M, Koepsell T, et al. Prevalence of preseason conditioning among high school athletes in two spring sports. *Med Sci Sports Exerc*. 2007;39:241–247.
18. Wiese-Bjornstal D. Psychology and socioculture affect injury risk, response, and recovery in high-intensity athletes: a consensus statement. *Scand J Med Sci Sports*. 2010;20:103–111.
19. National Athletic Trainers' Association. *Journal of Athletic Training*. Vol 42. Dallas, TX: National Athletic Trainers' Association, Inc; 2007.
20. Differences among the three divisions: Division I. [NCAA Web site]. 2011. <http://ncaa.org/wps/wcm/connect/public/NCAA/About+the+NCAA/Who+We+Are/Differences+Among+the+Divisions>. Accessed May 23, 2012.