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Injuries in American Collegiate Club Rugby: A Prospective Study

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Abstract

Background: Rugby is associated with a high risk of injury, because it is a full-contact sport with limited use of protective gear. The popularity of rugby in the United States is growing, but the vast majority of epidemiologic studies reports injury data from rugby organizations in other countries.

Purpose: To report game and practice injury rates in American collegiate club rugby, specified by body part and type of injury.

Methods: A licensed medical professional tracked attendance and injuries during games and practice in 60 collegiate club rugby players of a Division I University during the fall seasons of 2012 and 2013. Injury rates were compared between games and practices, and specified by type and location of injury.

Results: Twenty-five injuries were sustained in 1946 exposures for an overall injury rate (IR) of 12.9 injuries per 1000 exposures (95% confidence interval (CI) =8.50-18.7). The game injury rate (IR=26.0, 95%CI=14.4-43.3) was more than three times higher (p=0.006) than the practice injury rate (IR=8.30, 95%CI=4.50-14.1). The lower extremity was the most commonly injury body part (IR=5.65 injuries/1000 exposures; 95%CI=2.97-9.83), and sprains were the most common types of injury (IR=6.68 injuries/1000 exposures; 95%CI=3.72-11.1). The overall concussion rate was 2.57 per 1000 exposures (95%CI=0.94-5.70), and 80% of the concussions occurred during games. Most injuries (76%) were sustained via direct contact with another player, while 24% of injuries occurred via a non-contact mechanism.

Conclusion: The results of this study indicate that rugby players are at substantial risk of injury, especially during games. The lower extremity was the most frequently injured body region, the head was the most frequently injured specific body part, and sprains were the most common type of injury. The injury rates in American collegiate rugby are lower than previously reported in international rugby, but higher than in many other American collegiate sports.

INTRODUCTION

Rugby is one of the most popular sports worldwide, with 117 member unions comprised of an estimated 5.5 million players [1]. In the United States (US) in 2012, there were over 115,000 players across all levels, and 900 collegiate rugby teams registered with USA Rugby [2]. A growing number of universities are sponsoring rugby as a club sport. In fact, the National Collegiate Athletic Association (NCAA) has listed women's rugby as an "Emerging Sport" since 2002 [3]. Overall, there was a 350% increase in American rugby participation between 2004 and 2011 [4]. Rugby is a full contact team sport, and the use of protective equipment is limited. As rugby's popularity grows, it is important to know the prevalence and type of injuries that occur during participation in rugby.

Williams and colleagues recently conducted a meta-analysis and reported an overall game injury rate of 81 per 1000 player hours versus a practice injury rate of 3 per 1000 player hours in senior men's professional rugby union [5]. The vast majority of studies included in this review were conducted on rugby unions outside the US. Within the US, rugby was ranked 23rd in terms

of the number of participating athletes among men's collegiate sports during the 2009-2010 academic year [6]. This relative lack of popularity of American rugby compared to other sports may contribute to the paucity of injury data originating from the US.

Currently published studies that report American rugby injury data include retrospective epidemiological surveys [7], research examining high school injuries [8], and studies looking at a particular type of injury [9-11]. Kerr and colleagues (2008) studied a prospective cohort of rugby players participating in the New England Rugby Football Union and reported substantially lower injury rates than those reported in international rugby leagues [12]. A limitation of that study is that injury data were collected and reported on a voluntary basis by a designated person from each team rather than by a licensed medical professional. For this reason, more high quality studies are needed to gain a better understanding of types and rates of injuries sustained in US collegiate rugby. Studies such as this one can aid coaches, trainers, and healthcare providers in developing injury prevention and early treatment programs.

The purpose of this study was to obtain detailed information about the incidence and type of injuries in a collegiate club rugby team at a single NCAA Division I University during the fall seasons in 2012 and 2013. Based on previous studies [5, 12] it was hypothesized that the rugby injury rate is higher during games than during practice, and that the majority of injuries is sustained at the lower extremity.

MATERIALS AND METHODS

This study represents the initial phase of an ongoing prospective longitudinal cohort study designed to identify injury risk factors in NCAA Division I collegiate rugby athletes. The protocol was approved by the institutional review board for human research at the sponsoring institution.

All athletes on two sides of a single men's club rugby team at a single Division I university who were included on the team roster the first day of practice were invited to participate in this study. The two sides (A and B) of the rugby team are similar to a varsity (A) and junior varsity (B), although a few of the players played for both sides depending on skill level and need for additional players to complete a team for a given match. In both seasons there were on average three practices (on Tuesday, Wednesday and Thursday) and one game (on Friday or Saturday) per week.

Thirty-five players in the 2012 season and 25 players in the 2013 season provided informed consent to be enrolled, for a total of 60 athletes. Six players participated in both seasons, so 54 unique athletes participated in this study. All athletes were eligible to play collegiate rugby according to the USA Rugby eligibility criteria [13]. Athletes had an average age of 19.8 ± 1.8 years, height of 1.79 ± 0.09 m, weight of 85.9 ± 10.6 kg and BMI of 26.8 ± 3.1 kg/m^2. Daily attendance for the enrolled athletes was tracked over the course of the fall 2012 and 2013 seasons, which occurred from late August to early November. An exposure was defined as a practice session or a game in which the athlete was cleared to participate by a licensed team physician.

All athletes were evaluated at the field after practices and games by the team athletic trainer or physician for injuries. An injury was defined using the NCAA Injury Surveillance System (ISS) definition, which is an injury that (1) occurred as a result of participation in an organized intercollegiate practice or competition *and* (2) required medical attention by a team certified athletic trainer or physician *and* (3) resulted in restriction of the student-athlete's participation or performance for one or more calendar days beyond the day of injury [14]. Injury data was further broken down by the type of injury, body region affected, and mechanism of injury (contact versus non-contact). Consistent with the NCAA definition, a concussion was defined as a complex patho physiological process affecting the brain, induced by traumatic biomechanical forces. Data collection procedures and injury classifications were compliant with the consensus statement for injury studies in rugby union [15]. Injury details, as well as game and practice exposures, were collected on a daily basis by the athletic trainer who was a licensed medical professional.

Practice and game injuries were reported per 1000 athletic exposures (AE). Injury incidence rates (IR) with 95% confidence intervals (CIs) and injury rate ratios (IRR) were computed in Open Epi (Version 3.0.1; Atlanta, GA). Injury rates were compared between games and practices, and between A and B teams using Mid-P exact tests. This test is highlighted as the recommended output for this type of comparisons in the Open Epi software, and Hwang and Yang's theory strongly supports the Mid-P values [16]. The level of significance was set at $\alpha<0.05$.

RESULTS

Over two fall seasons, 25 injuries were sustained in 1946 AE for an overall injury rate (IR) of 12.9 injuries per 1000 AE (95%CI: 8.5-18.7). The total number of practices was 66 (34 in 2012 and 32 in 2013), and the total number of games was 23 (12 in 2012 and 11 in 2013). (Table 1) summarizes the attendance and injury details for the A and B teams in both seasons. The IRs for practices and matches were 8.3 (95%CI: 4.5-14.1) and 26.0 (95%CI: 14.4-43.3) injuries per 1000 AE, respectively, and this difference was significant (IRR = 3.13; 95%CI: 1.41-7.00; p = 0.006). Of all injuries, 24% was sustained by a non-contact mechanism, whereas 76% occurred by contact with another player.

The overall IRs for A and B team players were 11.6 (95%CI: 6.3-19.7) and 14.3 (95%CI: 7.9-23.8) injuries per 1000AE, respectively, and this difference was not significant (p = 0.61). Similarly, no difference was observed between injury rates in the 2012 (IR: 12.3; 95%CI: 7.0-20.2) and 2013 (IR: 13.6; 95%CI: 7.2-23.6) seasons (p=0.80). Therefore, subsequent analyses were performed with the pooled data of the A and B teams over both seasons.

When broken down by body region, the lower extremity was the most frequently injured with 44% of all injuries. The head and the upper body were injured equally often; each accounted for 28% of all injuries. When further broken down by specific body parts (Figure 1), the head was the most frequently injured body part (28% of all injuries; IR: 3.60 injuries/1000AE; 95%CI: 1.6 – 7.1), followed by the knee (20% of injuries, IR: 2.57 injuries/1000AE, 95%CI: 0.94 – 5.70).

Figure 2 shows the overall, game and practice injury rates for

Table 1: Exposure and injury details for the A and B teams in both seasons.

			Fall 2012			Fall 2013			Total
			A	B	combined	A	B	combined	
Attendance									
# players at start of season			18	17	35	11	14	25	**60**
Athletic exposures (AE)			644	493	1137	390	419	809	**1946**
Game exposures (GE)			167	123	290	104	107	211	**501**
Practice exposures (PE)			477	370	847	286	312	598	**1445**
Injuries									
# injuries			6	8	14	6	5	11	**25**
# athletes with injuries			6	7	13	5	5	10	**23**
Location and type of injury									
Head			*0*	*4*	*4*	*0*	*3*	*3*	***7***
	Skull	Concussion	0	3	3	0	2	2	**5**
		Fracture	0	1	1	0	0	0	**1**
	Nose	Fracture	0	0	0	0	1	1	**1**
Upper extremity			*3*	*1*	*4*	*3*	*0*	*3*	***7***
	Shoulder	Sprain	1	1	2	2	0	2	**4**
	Wrist/hand	Fracture	2	0	2	0	0	0	**2**
		Sprain	0	0	0	1	0	1	**1**
Lower extremity			*3*	*3*	*6*	*3*	*2*	*5*	***11***
	Knee	Sprain	1	1	2	1	0	1	**3**
		ACL rupture	0	0	0	1	0	1	**1**
		Contusion	0	0	0	1	0	1	**1**
	Lower leg	Strain	0	1	1	0	0	0	**1**
		Fracture	1	0	1	0	0	0	**1**
	Ankle	Sprain	1	1	2	0	2	2	**4**
Mechanism of injury									
Contact			5	6	11	5	3	8	**19**
Non-contact			1	2	3	1	2	3	**6**

the different types of injury. The most common type of injury was a sprain (52% of all injuries; IR: 6.68 sprain injuries/1000AE; 95%CI: 3.71-11.14), and one of these sprains was an ACL rupture (IR: 0.51 injuries/1000AE; 95%CI: 0.03 – 2.53). The next most common types of injuries were concussions and fractures, both accounting for 20% of all injuries. The overall concussion rate was 2.57 injuries/1000AE (95%CI: 0.94 – 5.70). None of the players suffered multiple concussions during the surveillance period of this study. All concussions were sustained by B team players, of which 80% occurred during competitive matches at a rate of 7.98 (95%CI: 2.54 – 19.26) concussions per 1000 game exposures.

Eighteen players sustained one injury, and three players had multiple injuries. Specifically, one player sustained two injuries in the 2012 season, one player sustained one injury in the 2012 season and one in the 2013 season, and one other player suffered one injury in the 2012 season as well as two injuries in the 2013 season. Therefore, the epidemiologic incidence proportion (IP), which reflects the average risk of injury by dividing the number of injured athletes by the total number of athletes at risk in two fall seasons [17], was 0.35 (21/60). The clinical incidence, which is a hybrid measure (neither a risk nor a rate) that represents the average number of injuries per athlete [17], was 0.42 (25/60).

CONCLUSION AND DISCUSSION

Our objective was to report the incidence, location, and type of injuries that collegiate male rugby players at a Division I university sustain during the fall season. This study is unique because it is one of the first studies to follow an American collegiate rugby team throughout two entire fall seasons, with attendance and injuries reported by a licensed medical professional. The primary findings are an overall rate of about 13 injuries per 1000AE, with a practice injury rate of about 8 injuries per 1000 practice exposures and a significantly (>3 times) higher match injury rate of 26 injuries per 1000 game exposures. The lower extremity was the most commonly injured body region, and sprains were the most common type of injury. The head was the most commonly injured specific body part, and the game concussion rate was 8 concussions per 1000 game exposures.

Both practice and game injury rates in this study were similar to previously reported injury rates in collegiate rugby union players [12]. While injury rates in that study were

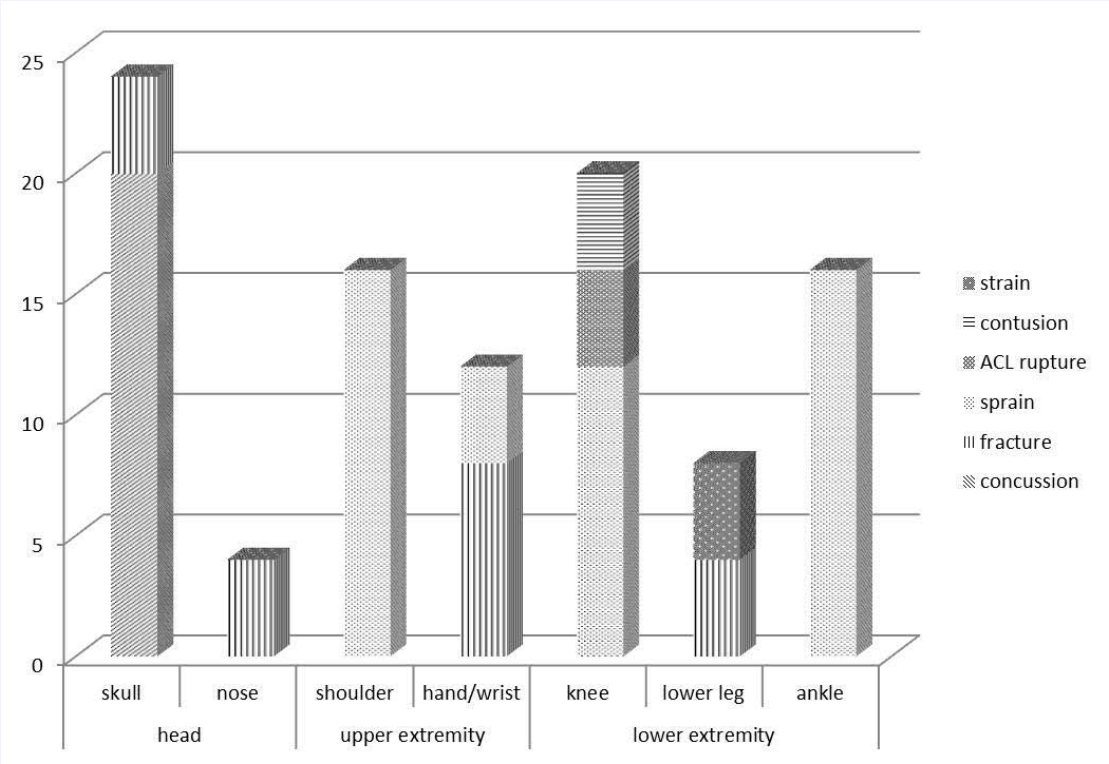


Figure 1 Percentages of all injuries stratified by location and type of injury.

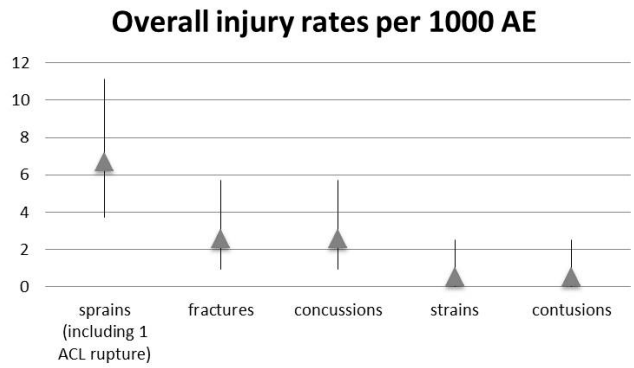
slightly lower (game IR: 22.5/1000AE; 95%CI: 20.2 – 25.0 and practice IR: 5.5/1000AE; 95%CI: 4.7 – 6.5), the difference with our injury rates was not significant (both p≥0.189). Our results support the findings of Kerr and colleagues that the game injury rate in collegiate rugby is lower than that in international male professional rugby players [12]. A potential explanation for this finding is that American collegiate rugby is generally played on a lower level than many international clubs, and previous studies have reported a positive correlation between advancing skill level and injury rates [18,19]. Additionally, the injury rates reported internationally may include injuries that did not result in time loss, while we used a time loss definition of injury consistent with NCAA injury surveillance. Together with the lower skill level this may explain the lower injury rates in US collegiate rugby compared to international rugby.

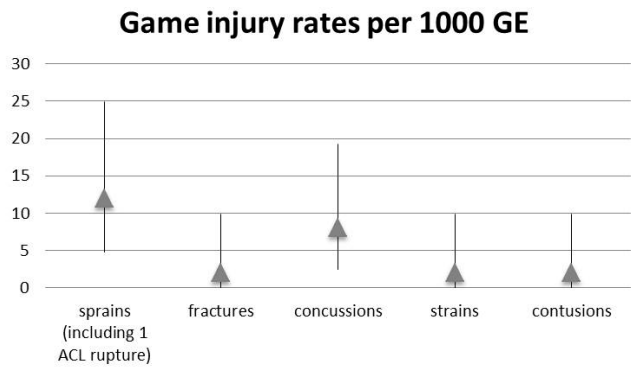
When compared to male collegiate sports included in the NCAA injury surveillance system, only football (35.9) and wrestling (26.4) had higher game injury rates per 1000AE [20] than observed in this rugby team (26.0). For practice injury rates, only spring football injury rates (9.6) per 1000AE [20] were higher than we observed in this rugby team (8.3). So, according to our findings, male rugby players are at a higher risk of injury compared to most other collegiate sports [20], including basketball [21], soccer [22], hockey [23], and lacrosse [24].

This relatively high risk of injury may be due to the nature of rugby, with collisions as a regular part of the sport, and a lack of protective equipment. However, it may also be related to the organization of rugby in the US. Because rugby is a non-scholarship club sport, its athletes may not have access to the resources and support that many NCAA scholarship athletes have. Unstructured conditioning programs and decreased access to athletic training and physical rehabilitation resources may also lead to increased risk of primary and secondary injuries.

The lower extremity was the most frequently injured body part, and this supports previous findings in collegiate rugby [12], international rugby [5,25] and other American collegiate sports [20]. Also similar to previous findings [12], sprains were the most common type of injury. Interestingly, only one muscle/tendon injury (strain) occurred in our study sample, while strains are typically reported as relatively common injuries in rugby [5,12,25]. When broken down by specific body parts, we found the head to be the most commonly injured body part, which is also in line with previous findings in collegiate rugby [12]. The overall concussion rate of 2.6 per 1000AE that we observed in collegiate rugby was about 10 times higher than on average in other collegiate sports over 16 years of NCAA injury surveillance data [20]. In that study, the highest concussion rate in male sports was 0.54 per 1000AE in spring football, which is about one fifth of the rate that we observed in rugby. The high risk of concussion in rugby is likely secondary to the unique type of collisions that occur during rugby during the scrum, the ruck, and the maul, while players do not wear helmets. All concussions in the current study occurred in B-side players, which suggest that they may be related to relatively limited rugby experience and/or level of play. Interestingly, a recent review reported that concussions account for 29% of all injuries associated with illegal play, but only 9% of all injuries sustained in legal play [26].

One of the limitations of this study is that we reported injury





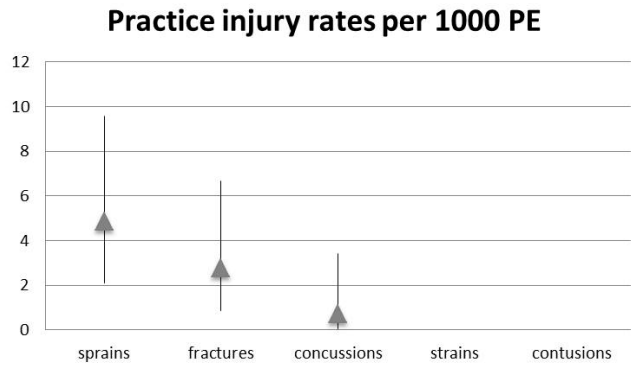


Figure 2 Overall, game and practice injury rates with 95% confidence intervals.

rates in terms of athletic exposures (AE) rather than in player hours, as we did not prospectively record the exposure time for each practice and game. In general, practice sessions were 120 minutes (including 30 minutes warm-up time), so our practice injury rate would be about twice as low when expressed in player practice hours. Most game exposures ('fifteens') lasted 80 minutes, while some other game exposures ('sevens') only lasted 14 up to 56 minutes, for an average game duration of about 70 minutes. Therefore, the game injury rate would be somewhat lower when expressed in player game hours, and consequently the injury rate ratio between game and practice injury rates would be higher than currently reported based on athletic exposures. It is important to consider the unit of injury rates when comparing results from different studies. For instance, a recent review on concussions in international rugby league reported concussion rates between 8.0 and 17.5 concussions per 1000 game hours [26]. Our game injury rate of 8 concussions per 1000 game exposures in collegiate rugby falls just below that range, as the average game duration exceeded one hour.

Another limitation may be that six of the rugby players who participated in the 2012 season also participated in the 2013 season. Also, some players dropped out of the team during the season for reasons other than injury. While this does not affect our main outcome measures (injury rates expressed in athletic exposures), it is important to note that the epidemiologic injury proportion and the clinical incidence (both calculated with the number of athletes at risk in the denominator) would be higher if only unique players who participated in a full season were taken into consideration. Moreover, these findings are based on injury data from one single institution. The advantage of this relatively small sample is that one individual was designated to report all attendance and injury details, which ensured reliability and consistency of the data collection. The disadvantage is that this could limit the generalizability of the results, as injury rates may be affected by playing surface, training variation, coaching staff and other center-specific factors. Nevertheless, this study contributes to the currently limited body of literature on injuries in US collegiate rugby, by providing insight in the prevalence and type of injuries that occurred over two fall seasons.

In summary, collegiate club rugby players are at substantial risk of injury, especially during games. Collegiate rugby injury rates were lower than those reported in international rugby, but higher than most collegiate sports in the NCAA surveillance system. Understanding the types of injuries that American rugby players sustain will help guide policies tailored towards injury prevention and first aid provision in this growing sport. In addition, our ongoing prospective studies will seek to define independent risk factors for athletic injuries and will help to develop and optimize injury prevention protocols for collegiate rugby.

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