

# DESCRIPTIVE STUDY

## Patterns of Lower Extremity Injury in USA Male Collegiate Rugby Club Players

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### ABSTRACT

**Study Design:** a prospective descriptive study. **Objective:** The purpose of this study was to describe frequency, nature and circumstance of lower extremity injuries at the collegiate club sport level for rugby in the United States. **Background:** The majority of rugby injury reports focus on Australian footballers and British elite rugby teams, but the research involving collegiate level rugby club players in the United States is very limited. **Methods and Measures:** Twenty-nine male collegiate rugby club players (18-35 years of age) were recruited for participation. The McManus Rugby Union Injury Report form was used to collect data regarding injuries that prevented participation in practices and games throughout the rugby season. A descriptive analysis of the data gathered was performed. **Results:** Eighty percent of all injuries occurred during the first full month of the regular playing season. The ankle was the most commonly injured body part (40 % of all injuries). Two-thirds of all injuries occurred in the non-dominant lower extremity and during contact with another player. The forward position was found to be most vulnerable (72% of all injuries). The majority of injuries occurred on hard terrain (87%) and during the second half of play (71%). **Conclusions:** US collegiate rugby club players demonstrate lower extremity injury patterns similar to that of elite rugby athletes. US collegiate rugby clubs should consider field terrain and avoidance of fatigue as two modifiable variables to prevent injury.

### Background

Rugby is a high impact sport involving tackling, colliding, sprinting, kicking, twisting and turning. Explosive sprinting and high impact body contact have been shown to expose elite players to many lower extremity strain injuries and hamstring injuries alone have resulted in 20% of all missed games.<sup>1</sup> A recent audit of injuries performed by Premiership Rugby, the Rugby Players' Association and the Rugby Football Union in the UK revealed the most common match injuries experienced in the 2009-2010 season to be thigh hematoma, hamstring strain, ankle lateral sprain, concussion and calf strain.<sup>2</sup> Training injuries reported by the audit revealed

the majority of injuries to be ankle lateral sprains that occurred during contact, and lower extremity muscle strains that occurred during non-contact conditioning.<sup>2</sup>

The game of rugby can be compared to that of Australian football because similar gameplay is used in each: running, kicking, sprinting and tackling. There are a total of 15 players on each team and players 1 - 8 are considered "forwards", while players 9 – 15 are considered "backs". Rugby play begins with a kick-off. A team advances the ball by lateral or backward passing, kicking the ball forward, or carrying the ball through contact. After being tackled, the offensive player must pass or place the ball on the ground. A physical

contest for possession of a ball placed on the ground after a tackle is called a ruck. The ruck is won by driving the opponent(s) off the ball allowing the victors' team to advance the ball. Any time an in-bound play is stopped, game play is then resumed by use of a scrum which involves all 8 players in the forward position bound together in effort to drive the opponent away from the ball to win possession. Australian football does not involve ruck and scrum, but is similar enough to rugby in other aspects of play, that it is often compared.

Orchard and Seward<sup>3</sup> found that muscle strain is the most common injury in male Australian football players and most of these muscle strains happen in the thigh. Bathgate and colleagues<sup>4</sup> reported that over a 6-year period, 53% of thigh injuries in Aussie footballers were hamstring strains and tears while 10% were quadriceps femoris strains. A larger number of injuries have also been reported in the dominant lower extremity as compared to the non-dominant extremity.<sup>5</sup>

An epidemiological comparison of school-aged (less than 18 years of age) and senior club rugby (greater than 18 years of age) in Scotland showed that senior club injury prevalence and severity were much higher than school-aged boys with the majority of injuries happening early in the season while tackling.<sup>6</sup> In New Zealand, the Rugby Injury and Performance Project study was designed to identify risk and protective factors prospectively in male and female club players. The study found higher injury rates at the start of rugby season, but no differences were found for position played, gender, age, ethnicity, health or fitness.<sup>7</sup> Terrain and weather conditions were not addressed in these studies. Colleges and universities in the United States do not sponsor rugby as an organized sport and therefore many rugby clubs are formed across US campuses for those who wish to play while attending college. The demographics of college clubs may be similar to those of the Scottish and New Zealand clubs, but little is

known about the comparisons that can be made because injury reports involving club players in the United States are lacking. One recent comparison of high school rugby club players in the United States found lower injury rates than those reported in other countries.<sup>8</sup> We do not know whether the same is true at the college club level.

The majority of injury reports focus on Australian footballers, British elite rugby teams, or other athletes, but there is a dearth of research involving rugby club players in the United States. To our knowledge, there is no documentation of patterns of injury for collegiate club players in the United States. Therefore the purpose of this study was to describe the conditions in which lower extremity injury occurs throughout a full season of play in a sample of male collegiate rugby club players.

## Methods

Following approval by the University Institutional Review Board for protection of human subjects, twenty-nine members of the university male rugby club, between the ages of 18 and 35 were recruited to participate in this study. All members were informed through word of mouth at the initial rugby club meeting 1 week prior to the start of the regular season (August through November). Any injury preventing participation in practices and games excluded the subject from this study. Also, subjects who participated in less than 20 hours of combined game and practice time during the season were excluded.

Each subject gave informed consent prior to participation and then completed a questionnaire to ascertain previous and current injury status, years of rugby experience, rugby position and dominant lower extremity. For the purpose of this study, the dominant lower extremity was defined as the kicking leg.

The McManus Rugby Union Injury Report Form (Appendix) was developed to record

rugby injuries in practice and games in order to track data regarding rugby injury during the season. This tool was chosen due to its excellent inter-rater reliability (0.98), intra-rater reliability (0.98) and established criterion validity.<sup>9</sup> Injury was recorded as defined on the McManus form as “minor” if the subject returned to the game or training in which the injury occurred, “mild” if the subject missed one week, “moderate” if the subject missed two weeks, and “severe” if the subject missed greater than two weeks. The McManus form was also used to track site of injury, mechanism of injury, environmental conditions such as weather and terrain, subject’s position, phase of play, and relationship of the ball to the subject at the time of injury. Each injury throughout the season was recorded using this instrument by a licensed physical therapist that was onsite for all practices and games. Descriptive statistics were used to describe data collected from the questionnaire (Microsoft excel, Office 97) and McManus Rugby Union Injury Report Form on all injured subjects.

## Results

Of the twenty-nine rugby club players originally recruited, six were excluded due to an insufficient number of combined game and practice hours, resulting in 23 participants. The average age of the participants in this study was  $20.3 \pm 1.3$  years (range: 18-23 years). The average height of the participants was  $175.3 \pm 6.8$  centimeters (range: 157.5-190.5 cm). The average weight of the participants was  $91.5 \pm 15.2$  kilograms (range: 63.5-124.5 kg). The average game time was  $405.5 \pm 221.3$  minutes and average practice time was  $1716 \pm 774$  minutes per season. Throughout the rugby season, 12 of the 23 subjects presented with injuries. Four subjects obtained multiple injuries, resulting in a total of 16 injuries. Seventy-three percent of the

injuries were minor, 20% were severe, and 6.7% were mild as defined by the McManus form.

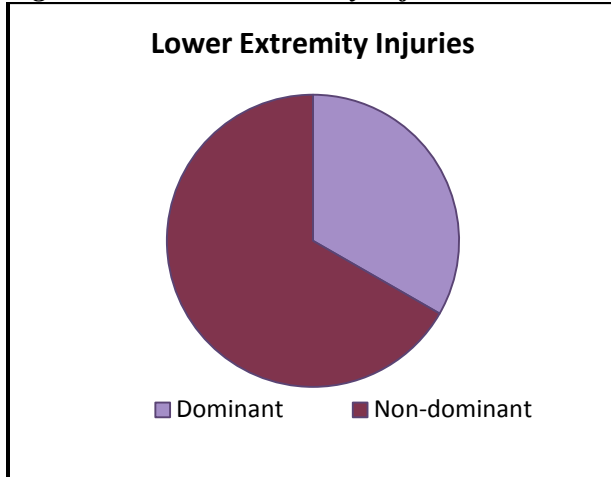
Eighty percent of lower extremity injuries occurred during September, which was the first full month of actual games played. The remaining 20% occurred during October. The ankle (40%) and the thigh (33.3%) were the most common body parts injured, followed by the knee (20%) and the pelvis (6.7%). *Figure 1* shows that the majority of injuries occurred on the non-dominant lower extremity (66.7%). Contact with another player accounted for 67.7% of all injuries (*Figure 2*).

*Figure 3* illustrates the various phases of play during which injuries occurred. The majority of injuries occurred during the tackling phase of play (40%). Several injuries occurred during running (26.7%) or rucking (26.7%). There were also no injuries that occurred with player collisions. The remaining 6.6% of injuries happened during kicking of the ball.

An overwhelming majority of injuries occurred while playing on hard (86.7%), rather than soft terrain (13.3%). Most injuries occurred during mild weather (60%) with 30% occurring during hot weather and 10% during cold weather. As illustrated in *Figure 4*, injuries occurring during the game (46.7%) accounted for slightly fewer injuries than training injuries.

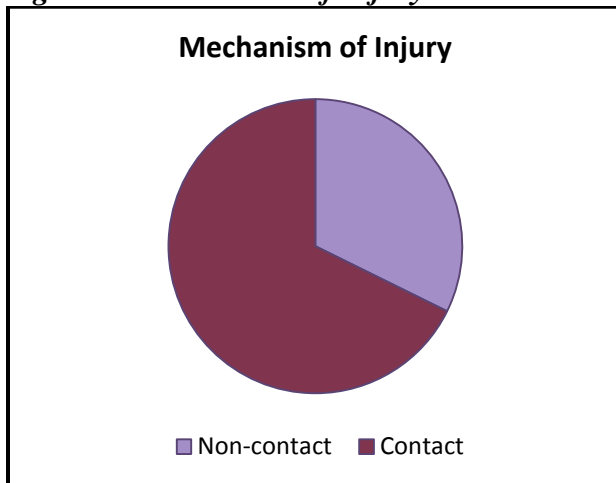
The majority of the injuries occurred during the second half (71.4%) as opposed to the first half of play (28.6%). All of the game injuries occurred with the player near the ball rather than behind the play. The majority of injuries were recorded for players in the forward position (71.4%), with 28.6% occurring in the back position.

**Figure 1: Lower Extremity Injuries**



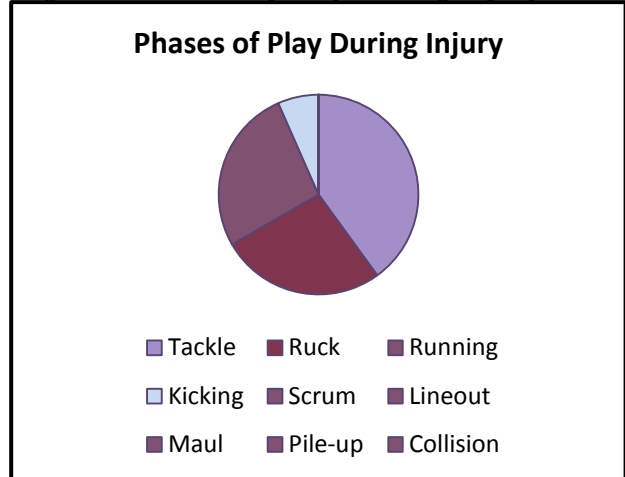
*Figure 1: Injured Lower Extremity.* The majority of injuries occurred in the non-dominant lower extremity (66.7%). Dominant lower extremity injuries = 33.3%

**Figure 2: Mechanism of Injury**



*Figure 2: Mechanism of Injury.* The majority of injuries occurred with contact (67.7%). Non-contact injuries = 32.3%

**Figure 3: Phases of Play During Injury**



*Figure 3: Phase of Play During Injury.* Most injuries occurred during tackle (40%), followed by ruck (26.7%) and running (26.7%), and kicking (6.6%). No injuries occurred with scrum, lineout, maul, pile-up or collision. Scrum = formation used to restart play and involves both packs of forwards (positions 1-8) bound together in effort to drive the opponent away from the ball to win possession; Lineout = used to restart play after the ball travels out of bounds and involves coordinated lifting and jumping by the opposing forwards in positions 1 through 8; Ruck = a physical contest for possession of a ball placed on the ground after a tackle; Maul = maul occurs when additional teammates bind themselves to the ball carrier in order to advance the ball against the opposition. This allows for ball distribution after the ball is taken into contact without taking the ball to ground and necessitating a ruck.

**Figure 4: Training vs Game Injuries**



*Figure 4: Injured During Game or Practice.* More injuries occurred during training (53.3%) than during games (46.7%)

## Discussion

This study helps to describe conditions of lower extremity injury in male collegiate rugby club players in the United States. Eighty percent of all injuries occurred during the first full month of games played during the season. This finding was very similar to that found in rugby clubs in other countries.<sup>6,7</sup> The majority of these injuries occurred on hard terrain and during the second half of play. The results of this study suggest that modifications should be made in terrain and possible training, as fatigue may be a factor in injury during second half of play. The club did not organize a conditioning program for players outside of regular practice. Therefore injury location, severity and rates that may have occurred during these times are unknown. Outside training routines were also unknown and most likely were highly variable among players. In the future, adding formal conditioning may further understanding of why injuries occur in collegiate club athletes in the USA.

Two-thirds of all injuries occurred during contact with another player. The ankle was the body part most commonly injured. Studies of elite rugby athletes suggest that most injuries occur during tackling plays.<sup>2,10,11</sup> Our findings in collegiate rugby club players were similar with 40% of injuries occurring during a tackle, and 26.7% during both ruck and running. A larger sample size may help reveal more frequent injuries occurring during the tackle phase and provide a more broad distribution of injuries throughout the various phases of play.

Research has also demonstrated that rugby position is important in predicting injury.<sup>10</sup> In our study, forwards (71.4%) sustained greater lower extremity injuries than backs. This finding was consistent with research of elite or Australian football players suggesting that the forward position is a more likely position for injury.<sup>10,12-15</sup>

This is secondary to more direct contact that occurs during forward play. Furthermore, forwards are often slightly larger but less agile than backs.

Physiological fatigue has been suggested to play a part in the incidence of injury.<sup>1,15-18</sup> In our study the majority of injuries occurred during the second half of the game (71.4%), suggesting that fatigue may have been a significant factor in sustaining an injury. This is also similar to what has been reported in the annual audit of elite players in England.<sup>2</sup> No injuries occurring during the first and last months of the season. This could be related to practice and tournament times in the first and last months of the season. Also, it is probable that the athletes' conditioning improved throughout the season, making injury less likely after the first full month of game play (September). This is in agreement with the findings of Lee and colleagues<sup>19</sup> that the risk of injury decreased as rugby training increased. Other research also suggests that most rugby sport injuries occur during games as opposed to practice.<sup>10</sup> However, in our study slightly more injuries occurred during practice than in games. This could be attributed to more structured play during games, rather than practices. Attempting new techniques and plays during practice may increase the risk of injury in practice, compared to performing the techniques in a game after gaining confidence in those skills. On the other hand, athletes often play at a higher intensity during a competition, which could increase the likelihood of injury during game play.

Orchard<sup>5</sup> found higher rates of quadriceps femoris strain in the dominant leg in Australian rugby amateur athletes. The non-dominant leg was injured more frequently in our small cohort of US collegiate male club players, with injuries occurring in the non-dominant leg 66.7% of the time when compared with the dominant leg. The reason for this is not known.

This is the first study to look at conditions of injury such as terrain and weather in collegiate male rugby club players in the US. Hard terrain was less favorable for the club players as well as mild weather conditions according to our study. The finding of no injuries during wet conditions was surprising considering that Lee and Garraway<sup>20</sup> reported an association between injury and wet weather in rugby club players in Scotland.

The primary limitation to our study is the relatively small sample size. Limitations also existed secondary to lack of control over practices, routines, warm-ups, and pre-season training. The McManus Rugby Union Injury Report Form is a validated and useful tool to begin to gather injury data on college club athletes. However, a recent consensus statement on injury definitions and data collection procedures in rugby unions has been created by the International Rugby Board Rugby Injury Consensus Group (RICG).<sup>21</sup> This consensus did not include the McManus form. In order to provide valuable comparisons between college level rugby club playing injuries to rugby union injuries, future studies of college clubs should involve the use of the RICG report form.

## Conclusion

Male collegiate rugby club players demonstrated lower extremity injury patterns similar to that of elite rugby athletes except for having a greater number of injuries in the non-dominant lower extremity. US collegiate male clubs should consider field terrain and avoidance of fatigue as two modifiable risk factors for injury. Future investigation should include a close examination of off-season training and specific training routines used for forward and back field positions.

## References

1. Bottini E, Poggi E, Luzuriaga F, Secin F. Incidence and nature of the most common rugby injuries sustained in Argentina. *Br J Sports Med.* 2000;34(2):94-97.
2. Rugby Football Union. England Rugby Premiership Injury and Training Audit 2009-2010 season. Retrieved from Rugby Players Association website February 2011. <http://www.therpa.co.uk/news/1365.php>
3. Orchard J, Seward H. Epidemiology of injuries in the Australian football league, seasons 1997-2000. *Br J Sports Med.* 2002;36(1):39-44.
4. Bathgate A, Best J, Craig G, Jamieson M. A prospective study of injuries to elite Australian rugby union players. *Br J Sports Med.* 2002;36(4):265-269.
5. Orchard JW. Intrinsic and extrinsic risk factors for muscle strains in Australian football. *Am J Sports Med.* 2001;29(3):300-303.
6. Lee AJ, Garraway WM. Epidemiological comparison of injuries in school and senior club rugby. *Br J Sports Med.* 1996;30(3):213-217.
7. Alsop JC, Chaimers DJ, Williams SM, et al. Temporal parameters of injury during a rugby season. *J Sci Med Sport.* 2000;3(2):97-106.
8. Collins CL, Micheli LJ, Yard EE, Comstock D. Injuries sustained by high school rugby players in the United States, 2005 – 2006. *Arch Pediatr Adolesc Med.* 2008;162(1):49-54.
9. McManus A. Validation of an instrument for injury data collection in rugby union. *Br J Sports Med.* 2000;34(5):342-347.
10. Bird Y, Waller A, Marshall S et al. The New Zealand rugby injury and performance project. V. epidemiology of a season of rugby injury. *Br J Sports Med.* 1998;32(4):319-325.
11. Garraway WM, Lee AJ, Hutton S, et al. Impact on professionalism on injuries in rugby union. *Br J Sports Med.* 2000;34(5):348-351.
12. Devlin L. Recurrent posterior thigh symptoms detrimental to performance in rugby union. *Sports Med.* 2000;29(4):273-287.
13. Gabbe BJ, Finch C, Wajswelner HM, Bennell KL. Predictors of lower extremity injuries at the community level of Australian football. *Clin J Sport Med.* 2004;14(2):56-63.
14. Gabbe BJ, Finch CF, Bennell KL, Wajswelner HM. Risk factors for hamstring injuries in community level Australian football. *Br J Sports Med.* 2005;39(2):106-110.
15. Sharp J, Murray G, Macleod D. A unique insight into the incidence of rugby injuries using referee replacement reports. *Br J Sports Med.* 2001;35(1):34-37.

16. Gabbett TJ. Incidence, site, and nature of injuries in amateur rugby league over three consecutive seasons. *Br J Sports Med.* 2000;34(2):98-103.
17. Gabbett TJ, Domrow N. Risk factors for injury in subelite rugby league players. *Am J Sports Med.* 2005;33(3):428-434.
18. Wekesa M, Asembo JM, Njororai WWS. Injury surveillance in a rugby tournament. *Br J Sports Med.* 1996;30(1):61-63.
19. Lee AJ, Garraway WM, Arneil D.W. Influence of preseason training, fitness, and existing injury on subsequent rugby injury. *Br J Sports Med.* 2001;35(6):412-417.
20. Lee AJ, Garraway WM. The influence of environmental factors on rugby football injuries. *J Sports Sci.* 2000;18(2):91-95.
21. Fuller CW, Molloy MG, Bagate C, Bahr R, et al. Consensus statement on injury definitions and data collection procedures for studies of injuries in rugby union. *Br J Sports Med.* 2007;41(5):328-331.

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## Statement of financial disclosure and conflict of interest

There is no known conflict of interest. No money received for the work done presented in this research report.

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## Appendix:

### McManus Rugby Union Injury Report Form

Player: \_\_\_\_\_

1. Year in School \_\_\_\_\_
2. Date (xx/xx/xx) \_\_\_\_\_
3. Age in years \_\_\_\_\_
4. Site of injury (circle):  
Head / face / neck / shoulder / upper arm / lower arm / wrist / hand / fingers / thumb /  
chest / abdomen / spine / back / pelvis / upper leg / lower leg / knee / ankle / foot / toes /  
other \_\_\_\_\_
5. Severity of injury (circle): minor / mild / moderate / severe    Grade of injury: \_\_\_\_\_
6. Mechanism of injury (circle): extrinsic / intrinsic
7. Where (circle): game / training
8. Phase of play or aspect of training (circle):  
scrum / lineout / ruck / maul / tackle / kicking / pileup / collision / other \_\_\_\_\_
9. Is terrain a factor of injury? (circle): hard / soft / muddy / other \_\_\_\_\_
10. Is weather a factor of injury? (circle): hot / cold / wet / other \_\_\_\_\_

If injured at a game, continue. If at training, go to Question 16 on the reverse.

11. Time of game (circle): 1<sup>st</sup> half / 2<sup>nd</sup> half / time on
12. Relationship of ball and injured player: near ball / behind play
13. Play (circle): legal / illegal
14. Position played (circle):  
LHP / H / THP / LL / RL / LF / RF / 8 / HB / 5/8 / LW / IC / OC / RW / FB
15. Back or forward (circle): back / forward

<p>NOTE: SEVERITY OF INJURY - require treatment but: MINOR - if able to return to game/training in which injury occurred MILD - if missed one week MODERATE - if missed two weeks SEVERE - if missed more than two weeks</p>
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<p>POSITION PLAYED - 1. LHP - loosehead prop, 2. H - hooker, 3. THP - tighthead prop, 4. LL - left lock, 5. RL - right lock, 6. LF - left flanker, 7. RF - right flanker, 8. No. 8, 9. HB - half back, 10. 5/8 - five eight, 11. LW - left wing, 12. IC - inside centre, 13. OC - outside centre, 14. RW - right wing, 15. FB - full back</p>
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16. Classification of Injury

Assessment:

Treatment:

Instruction to player/carer:

Referred to:

Other information: