Epidemiology of Injury in Elite English Schoolboy Rugby Union: A 3-Year Study Comparing Different Competitions

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Context: Injury risks in professional and community rugby union have been extensively described; however, less is known about injury epidemiology at the schoolboy level.

Objective: To investigate the injury risk in English schoolboy rugby union matches, comparing an elite competition (Achieving Academic and Sporting Excellence [AASE]) with subelite matches (non-AASE).

Design: Retrospective cohort study.

Setting: Rugby union academy, consisting of 16- to 19-year-old males, based at an elite sports college in England.

Patients or Other Participants: A total of 132 participants (mean age = 17.5 years) were included in the study; 64 athletes experienced a total of 103 time-loss injuries over a 3-season period (2012–2015). All injuries were assessed and recorded by the team therapist using consensus statement definitions.

Main Outcome Measure(s): Injury characteristics were recorded and compared between groups. Primary outcome measures were injury incidence (per 1000 h match exposure) and injury burden (days absent/1000 h), and rate ratios and 95% confidence intervals are presented throughout.

Results: A total of 131 matches were played (34 AASE, 97 non-AASE) and a total of 103 injuries were recorded (47 AASE, 56 non-AASE). The injury incidence in AASE matches (77/1000 h) was greater than in non-AASE matches (34/1000 h). The concussion incidence in AASE matches (20/1000 h) was 5 times that of non-AASE matches (4/1000 h). The head/face had the highest injury incidence for a specific location, followed by the shoulder region (AASE = 19/1000 h, non-AASE = 5/1000 h), which had the greatest injury burden (553/1000 h and 105/1000 h, respectively) for any specific body location. More than 50% of all injuries were associated with tackles.

Conclusions: A much greater incidence of all injuries occurred at the highest level of competition, and the concussion incidence was greater than that reported in any previously published study of youth rugby. Given the high incidence and burden of concussions and shoulder injuries, prevention and management deserve specific focus.

Key Words: adolescents, injuries, youths, sport, upper limb, concussion

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Key Points

- Playing in the more elite level of competition (Achieving Academic and Sporting Excellence [AASE] matches) was associated with a greater risk of injury, with an incidence rate difference of 43/1000 player-hours.
- The concussion incidence was 20/1000 player-hours in AASE matches, which was 5 times greater than the rate of 4/1000 player-hours in non-AASE matches and those in published studies of both youth and professional rugby.
- Shoulder injuries constituted the largest injury burden and the second highest incidence rate in the AASE group.

Sporting injuries in adolescents have short- and long-term health effects, with athletes reporting injury as a common reason for ceasing physical activity or changing sports.[1] Along with the social and economic effects that injuries may have on athletes and their families,[2] injuries are also detrimental to team success in various sports.[3,4] Consequently, it is important to understand the injury epidemiology of a given population in order to effectively plan injury-prevention strategies and minimize the effects of injuries on both the athlete and the team.

The epidemiology of professional rugby union is well researched across various countries and competitions: the authors of a meta-analysis[5] reported an injury incidence of 81/1000 player-hours. In England, the Rugby Football Union (RFU) has been conducting annual injury surveillance since 2002 to identify injury trends in the professional game.[6] Injury surveillance investigating the nature of injuries sustained at the community level of men's rugby union has also been ongoing since 2009.[7] Unfortunately, no longitudinal injury surveillance is currently underway for youth rugby in England despite the concerns of parents[8] and health care professionals[9] regarding game safety.

Based on the studies carried out in youth rugby, the injury risk (16–49/1000 player-hours) does not appear to be as great as the rate in the professional game.[10] The large incidence range is primarily due to different injury definitions, collection methods, and age groups in the various studies.[11] Subsequently, direct comparisons must be made with caution as it is difficult to interpret differences in results.

A further concern regarding schoolboy injury surveillance is that much of the research is now dated; for example, the latest study from England was conducted in

the 2006–2008 seasons,[12] although a recent study[13] of Irish schoolboy rugby union has provided some valuable insight into injury risk. Since the last study[12] in English schoolboy rugby, competitions in England have been restructured, including the creation of the under-18 Achieving Academic and Sporting Excellence (AASE) league in late 2008. This league was designed for secondary schools and colleges and offers a direct link with a professional rugby club that plays competitive fixtures against similar educational institutes. This contrasts with general schoolboy rugby (non-AASE) in which matches are played as regional competitions, or as exhibition matches, with varying standards among teams.

Given the sparse and dated research published in this area, the aim of our study was to investigate the injury risk in senior English schoolboy rugby union, comparing the risk for those taking part in an elite competition (AASE league) with those competing in a lower standard competition or friendly matches (non-AASE) at the same college and under the care of the same medical team.

METHODS

Design and Setting

This retrospective cohort study was performed over 3 seasons (August 2012–May 2015) at the male rugby union academy of an elite sports college in England. For each season, the academy consisted of 3 teams who used the same coaches, medical team, and facilities. The medical team consisted of a sports rehabilitator, who provided first aid for AASE matches and was the primary author; physiotherapists; and sports therapists. All teams followed the same weekly structure of 2 strength and conditioning sessions, 2 pitch-based training sessions, and 1 match. Playing squads were interchangeable, and players were not limited to 1 squad. Because the aim of the study was to assess injury risk at different playing levels, we did not examine specific players and their exposure to the different groups.

The first team participated in the AASE league, which is the RFU's flagship competition for collegiate teams linked with a professional rugby club. The competition is an under-18 league, but two under-19 players are allowed in the match-day squad. The second team participated in an under-19 intercollegiate league, while all first, second, and third teams played under-19 exhibition matches throughout the season. During the 2012–2015 period, the first team played 42 matches, including 34 AASE matches; the second team played 59 matches and the third team played 30.

Injury Surveillance and Definitions

We used a 24-hour time-loss injury definition, as per the consensus statement[14] for injury studies in rugby union, and we also adopted their recommendations for calculating severity, injury location, and injury type.

The medical team recorded all match injury details pitch side or when injured athletes were followed in clinic. All injury data were entered into an electronic database containing the following information: date of injury and return to play, cause, location, type, mechanism, and position. If an athlete was unable to identify the phase or mechanism of injury or if the onset was insidious, the mechanism was classified as *other*. Training attendance was compulsory, and those who were unable to train were assessed by the medical team, helping to ensure that all injuries were captured. To ensure consistency of diagnosis, injuries were coded as per the Orchard Sports Injury Classification System, version 10.[15] Athletes with injuries that extended into the off-season were followed and treated by the medical team until the end of the second week in May, after which time the treating therapist recorded an estimated date for return to play (only applicable to 1 injury).

The number of matches were recorded on a weekly basis by a sports rehabilitator. Matches were only included if the format was 15 per side (8 forwards, 7 backs) and 70 minutes in length (per under-18/19 rules). Consistent with the consensus statement,[14] we made no adjustments for player-minutes as a result of punishments for foul play (yellow or red cards) or injuries that left the team with fewer than 15 players. As such, each match consisted of 17.5 player-match hours.[14]

Injury incidence is reported per 1000 player-hours of match exposure using 95% confidence intervals (CIs). Injury burden is presented (mean severity × incidence/1000 h = days absent/1000 h) to show the overall cost of injuries to the team in terms of days absent from a given period of exposure.[10] Where the 95% CIs did not overlap, the result was deemed statistically significant for injury incidence and burden. We used t tests to assess differences in injury severity, although no significant findings ($P < .05$) were present in any of the categories. Incidence rate ratios (RRs = AASE incidences/non-AASE incidences) were calculated using 95% CIs. An RR > 1.0 suggested an increased risk for the AASE over the non-AASE group, whereas an RR < 1.0 suggested a negative association.

RESULTS

The study consisted of 132 male participants (age = 17.5 ± 0.6 years) completing 209 player-seasons, with 64 participants incurring time-loss injuries. Overall, data from 131 matches (34 AASE and 97 non-AASE; Table 1) were recorded; a total of 103 injuries (47 AASE and 56 non-AASE) occurred.

Over the 3 seasons, the AASE matches had an injury incidence of 77/1000 h (95% CI = 55, 100), while the non-AASE matches had an injury incidence of 34/1000 h (95% CI = 25, 42). As such, the injury incidence in AASE matches was higher than in non-AASE matches (RR = 2.3, 95% CI = 1.6, 3.4), at 1.4 and 0.6 injuries per match, respectively. The mean severity of injuries was 20 days (95% CI = 14, 26) in AASE matches and 19 days (95% CI = 14, 24) in non-AASE matches. The injury burden was greater for AASE matches (1545 days absence/1000 h, 95% CI = 1098, 1991) than for non-AASE matches (648 days absence/1000 h, 95% CI = 480, 817).

The incidence rate of head/neck injuries in AASE matches (25/1000 h, 95% CI = 13, 38) was greater than in non-AASE matches (5/1000 h, 95% CI = 2, 9; RR = 4.8, 95% CI = 2.1, 10.9). The incidence rate of upper limb injuries in AASE matches (25/1000 h, 95% CI = 13, 38) was greater than in non-AASE matches (9/1000 h, 95% CI = 5, 13; RR = 2.9, 95% CI = 1.4, 5.8). The incidence rates

Table 1. Comparison of Achieving Academic and Sporting Excellence (AASE) and Non-AASE Games Over 3 Seasons

	2012–2015		2012–2013		2013–2014		2014–2015	
Variable	AASE	Non-AASE	AASE	Non-AASE	AASE	Non-AASE	AASE	Non-AASE
Matches	34	97	9	36	12	31	13	30
Player-match h	595	1697.5	157.5	630	210	542.5	227.5	525
Injuries (time loss)	46	57	11	19	16	22	19	16
Incidence/1000 h (95% CI)	77 (55, 100)	34 (25, 42)	70 (29, 111)	30 (17, 44)	76 (39, 114)	41 (24, 58)	84 (46, 121)	31 (16, 45)
Severity, d (95% CI)	20 (14, 26)	19 (14, 24)	16 (7, 25)	14 (8, 20)	31 (16, 46)	16 (9, 23)	13 (7, 19)	30 (15, 45)
Injury burden d/1000 h (95% CI)	1545 (1098, 1991)	648 (480, 817)	1111 (455, 1768)	422 (232, 612)	2328 (1188, 3469)	656 (382, 930)	1121 (617, 1625)	912 (465, 1359)
Injuries/game	1.4	0.6	1.2	0.5	1.3	0.7	1.5	0.5

Abbreviation: CI, confidence interval.

of lower limb injuries were similar between groups, even though they accounted for approximately 25% of AASE injuries and around 50% of non-AASE injuries (RR = 1.0, 95% CI = 0.5, 2.1; Table 2).

A greater incidence of central/peripheral nervous system injuries occurred in AASE matches (24/1000 h, 95% CI = 12, 36) compared with non-AASE matches (4/1000 h, 95% CI = 1, 7; RR = 5.7, 95% CI = 2.3, 14.1), largely due to the difference in concussion incidence. The incidence rate of concussion in AASE matches (20/1000 h, 95% CI = 9, 32) was 5-fold that in non-AASE matches (4/1000 h, 95% CI = 1, 6; RR = 5.7, 95% CI = 2.1, 15.2). Concussions were also responsible for the largest injury burden of any specific injury in both groups (AASE = 403 days absent/1000 h, 95% CI = 175, 1194, and non-AASE = 119 days absent/1000 h, 95% CI = 24, 214). The mean severity of concussions sustained in AASE matches was 20 days (95% CI = 9, 31) and 34 days (95% CI = 7, 61) in non-AASE matches.

Tackles (including both the tackler and the person tackled) were the mechanism for greater than 50% of injuries in both groups, although the incidence rate in AASE matches (42/1000 h, 95% CI = 26, 59) was more than double that in non-AASE matches (19/1000 h, 95% CI = 12, 25; RR = 2.2, 95% CI = 1.3, 3.8). During AASE matches, injury risks were similar for tacklers (22/1000 h,

Table 2. Locations, Types, Mechanisms, and Positions of Injuries Sustained in Achieving Academic and Sporting Excellence (AASE) and Non-AASE Matches (95% Confidence Interval)[a]

	AASE (2012–2015)			Non-AASE (2012–2015)			AASE Versus Non-AASE
Nature of Injury	Incidence /1000 h	Severity Days	Injury Burden /1000 h	Incidence /1000 h	Severity Days	Injury Burden /1000 h	Incidence Rate Ratio
General location							
Head/neck	25 (13, 38)	17 (9, 26)	434 (214, 653)	5 (2, 8)	27 (9, 45)	144 (50, 239)	4.8 (2.1, 10.9)
Upper limb	25 (13, 38)	24 (12, 37)	615 (304, 926)	9 (5, 13)	24 (12, 36)	209 (103, 315)	2.9 (1.4, 5.8)
Lower limb	19 (8, 29)	23 (9, 36)	418 (171, 666)	18 (11, 24)	16 (10, 22)	279 (179, 379)	1.0 (0.5, 2.1)
Trunk/torso	8 (1, 16)	9 (1, 17)	77 (10, 145)	2 (0, 4)	9 (0, 19)	16 (0, 34)	4.8 (1.1, 19.9)
Type							
Ligament (nonbone) joint	22 (10, 34)	36 (16, 55)	783 (357, 1209)	11 (6, 16)	19 (10, 27)	209 (115, 303)	2.0 (1.0, 4.0)
Central/peripheral nervous system	24 (12, 36)	19 (9, 29)	440 (210, 671)	4 (1, 7)	29 (8, 51)	121 (31, 211)	5.7 (2.3, 14.1)
Muscle/tendon	17 (6, 27)	14 (5, 22)	229 (87, 370)	9 (5, 14)	16 (8, 24)	150 (77, 224)	1.8 (0.8, 3.9)
Contusion/laceration	15 (5, 25)	6 (2, 10)	92 (32, 153)	7 (3, 10)	10 (4, 16)	65 (27, 104)	2.3 (1.0, 5.6)
Fracture/bone stress	0	NA	NA	2 (0, 5)	44 (1, 86)	103 (2, 203)	NA
Mechanism							
Tackling	22 (10, 34)	22 (10, 34)	475 (217, 734)	7 (3, 11)	21 (9, 33)	147 (64, 231)	3.1 (1.4, 6.8)
Tackled	20 (9, 32)	35 (15, 54)	696 (302, 1089)	12 (7, 17)	14 (8, 19)	159 (89, 228)	1.7 (0.8, 3.5)
Other	17 (6, 27)	11 (4, 18)	182 (69, 294)	4 (1, 7)	21 (5, 37)	87 (23, 152)	4.1 (1.6, 10.7)
Ruck/maul	7 (0, 13)	14 (0, 27)	92 (2, 183)	4 (1, 6)	26 (5, 47)	92 (18, 165)	1.9 (0.5, 6.7)
Collision	5 (0, 11)	9 (0, 19)	44 (0, 93)	3 (0, 6)	15 (2, 27)	43 (5, 81)	1.7 (0.4, 7.2)
Running	2 (0, 5)	4 (0, 12)	7 (0, 20)	2 (0, 5)	39 (1, 78)	93 (2, 183)	0.7 (0.1, 6.4)
Scrum	2 (0, 5)	18 (0, 53)	30 (0, 90)	0	NA	NA	NA
Kicking	2 (0, 5)	7 (0, 21)	12 (0, 35)	0	NA	NA	NA
Lineout	2 (0, 5)	4 (0, 12)	7 (0, 20)	1 (0, 2)	15 (0, 44)	9 (0, 26)	2.9 (0.2, 45.6)
Change of direction	0	NA	NA	1 (0, 2)	13 (0, 39)	8 (0, 23)	NA
Jumping	0	NA	NA	1 (0, 2)	20 (0, 59)	12 (0, 35)	NA
General position							
Forward	73 (43, 102)	23 (14, 33)	1692 (1000, 2383)	38 (25, 50)	18 (12, 24)	679 (451, 907)	1.9 (1.1, 3.3)
Back	83 (49, 117)	17 (10, 23)	1375 (813, 1937)	29 (17, 41)	21 (12, 30)	614 (363, 864)	2.9 (1.6, 5.1)

Abbreviation: NA, not applicable.

[a] Interpretation of results of small cell sizes (<5) should be done with caution given the large standard error and wide confidence interval ranges.
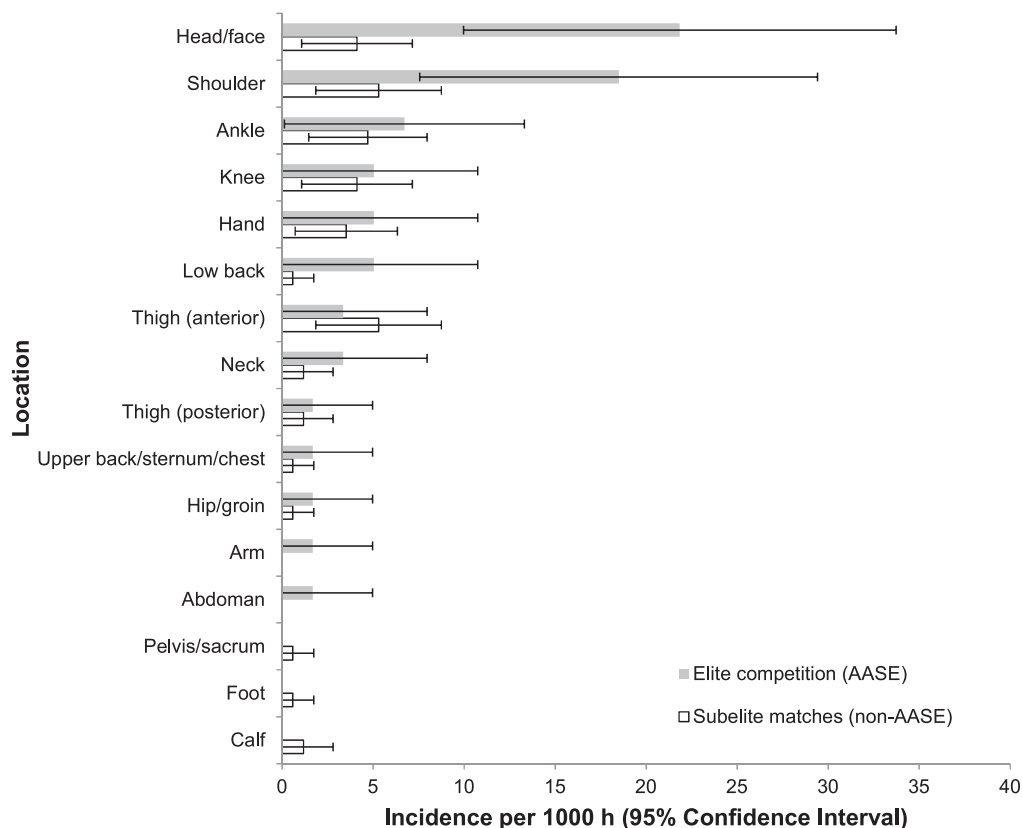
Figure. Incidence of injuries, per exact body location, for the 2 groups, with 95% confidence intervals. These results should be interpreted cautiously given the wide ranges in the confidence intervals. Abbreviation: AASE, Achieving Academic and Sporting Excellence.

95% CI = 10, 34) and those being tackled (20/1000 h, 95% CI = 9, 32). These rates were greater than in non-AASE matches, where being tackled (12/1000 h, 95% CI = 7, 17; RR = 1.7, 95% CI = 0.8, 3.5) was a greater risk than tackling (7/1000 h, 95% CI = 3, 11; RR = 3.1, 95% CI = 1.4, 6.8). The injury burden of being tackled in AASE matches (696 days absent/1000 h, 95% CI = 302, 1092) was greater than that in non-AASE matches (159 days absent/1000 h, 95% CI = 89, 228).

The body location with the highest injury incidence rate in AASE matches was the head/face (22/1000 h, 95% CI = 10, 34; Figure) with a rate 5 times greater than that in non-AASE matches (4/1000 h, 95% CI = 1, 7; RR = 5.3, 95% CI = 2.1, 13.3). The shoulder was the most frequently injured body location during non-AASE matches (5/1000 h, 95% CI = 2, 9), although this rate was far less than the shoulder injury incidence rate in AASE matches (19/1000 h, 95% CI = 8, 29; RR = 3.5, 95% CI = 1.4, 8.4). In AASE matches, shoulder injuries carried the highest overall injury burden (553 days absent/1000 h, 95% CI = 226, 879), which was greater than in non-AASE matches, where they had a burden rate of 105 days absent per 1000 player-hours (95% CI = 36, 173).

DISCUSSION

This 3-season study is the first injury-surveillance project on English schoolboy rugby union since 2008.[12] Our primary finding was the greater risk of injury when playing in AASE matches than in non-AASE matches. In addition, (1) the incidence of concussion during AASE matches was

greater than that in any other published research on youth rugby,[16] (2) the majority of injuries occurred during tackles for both groups, and (3) the incidence and burden of shoulder injuries were highest of any specific upper or lower limb region.

Injury Incidence

The incidence rate of non-AASE matches (34/1000 h) was similar to that in previous studies analyzing senior schoolboy rugby. Palmer-Green et al[12] found an injury incidence rate of 35 per 1000 player-hours for athletes in schools and colleges participating in under-18 schoolboy matches in England from 2006 to 2008. Similarly, a match injury incidence rate of 29 per 1000 player-hours was reported for under-18 rugby athletes in 28 schools in Ireland during the 2014–2015 season.[13] Both groups used the same time-loss injury definition and included teams of an equivalent age and standard as the non-AASE cohort, allowing for comparisons between studies.

The injury incidence rate for AASE matches (77/1000 h) was much greater than for any of the previous schoolboy studies. Palmer-Green et al[12] demonstrated an injury incidence rate of 47 per 1000 player-hours in the academies of professional rugby clubs in England. The findings of both studies, therefore, indicated that injury rates increased with the level of competition. Of note is that the injury incidence rate for AASE matches was more comparable with the rate of 81 per 1000 player-hours described by Williams et al[5] in a meta-analysis of injuries in professional rugby union. Indeed, the AASE incidence rate exceeded

that for international under-20 tournaments (57/1000 h).[17] These authors also used the same time-loss injury definition. The injury incidence we showed for AASE players is concerning given the negative effect sports injuries can have on school attendance and sports participation.[18] Ransom et al[19] found negative academic effects in those recovering from concussion, which may further affect AASE players given the high concussion rate during AASE matches.

The incidence of injury was greater during AASE matches than during non-AASE matches, with an incidence risk difference of 34 per 1000 player-hours. Approximately 25% of the participants were attached to under-18 squads at professional clubs, and these players were responsible for the majority of player-hours in AASE matches. The external commitment of these players to their parent club was an additional 2 training sessions per week and fixtures played outside the months of the AASE season. Although we did not assess these factors, it is likely these players had greater overall playing exposure and training volume and thus may have been at an increased risk of injury[20] compared with the athletes predominately in the non-AASE group. Most of the players who participated in AASE matches would have been second-year students and therefore bigger, faster, and stronger than first-year students.[21] Consequently, these athletes probably generated higher levels of force in contact situations, potentially leaving them and their opponents at an increased risk of injury.[22,23]

Injury Location and Diagnosis

A meta-analysis of professional rugby union injuries by Williams et al[5] demonstrated a greater number of injuries to the lower limb than to any other body location, and similar findings[7] have been reported in community-level rugby. However, the evidence is less clear in youth rugby. Palmer-Green et al[12] reported a greater incidence of lower limb injuries compared with other body locations in under-18 academy and schoolboy players, whereas Haseler et al[23] noted upper limb injuries were most common in community youth club rugby players. In our study, lower limb injuries were predominant during non-AASE matches, with upper limb and head/neck injuries having a higher incidence in the AASE group. A major contributing factor to the higher incidence rate of head/neck injuries in AASE matches was the high rate of concussion (20/1000 h), which accounted for 12 of the 15 (80%) head/neck injuries recorded. The observed incidence of concussion was greater than that reported in a recent systematic literature review[23] on concussion in youth rugby union (0.2–6.9/1000 h). Over the past 5 seasons, between 2009–2010 and 2014–2015, the incidence of concussion in the English premiership has increased yearly.[6] The RFU steering group that published these data[6] attributed the increase to a greater awareness of concussion and a change in the threshold of what was considered a concussion rather than an actual increase in the number sustained. Similar reasoning might account for the greater incidence of concussion reported during AASE matches (20/1000 h) than in slightly dated studies (ranging from 1981–2010) reported by Kirkwood et al.[16] However, the concussion incidence in non-AASE matches (4/1000 h) was much lower and comparable with data from schoolboy

rugby in Ireland.[13] The difference in concussion rates between groups could be related to differences in the medical care provided at AASE matches compared with non-AASE matches. All AASE matches are required to be covered by a health care professional with the RFU Immediate Care in Sport qualification. In contrast, medical care for non-AASE matches is less formalized, and on occasion, first aid is provided by coaches. A recent study by Mathema et al[24] found that coaches were less able to recognize symptoms of concussion compared with health care professionals, probably because of their professed lack of concussion education. First aid was provided by a coach in approximately 10% of non-AASE matches, and it is possible that concussions may have been underreported in these games. However, all team coaches received concussion training as part of their coaching qualification, and given the relatively small percentage of games not covered by a member of the medical team, it is unlikely to account for the risk difference of 16/1000 player-hours between the 2 groups. The mean severity of concussion sustained in non-AASE matches was 14 days more than that sustained in an AASE match (34 and 20 days, respectively). Rather than a true difference in severity between groups, these findings may be linked to the graduated return-to-play (GRTP) protocols used for different individuals. Players who were attached to a professional club, predominately AASE players, could go through the enhanced GRTP protocol at the discretion of the parent club. The minimum period of time in which this could be completed was 12 days.[25] It was mandatory for players not attached to a professional club to go through the standard GRTP protocol, resulting in a minimum of 23 days out.[25]

Among specific body locations, the shoulder was one of the most often injured locations in both groups, with the injury risk in AASE matches (19/1000 h) 4 times higher than that in non-AASE matches (5/1000 h) and similarly great injury burdens (553 days absent/1000 h and 105 days absent/1000 h, respectively). High injury rates to the shoulder and upper limb have been found previously in rugby studies on adolescent,[13] amateur,[26] and professional players.[27] This is due to the high number of contact situations during matches and their propensity to cause injury.[28] Our results offer support, as 90% (18/20) of shoulder injuries occurred in contact situations. Usman et al[27] documented injury mechanisms linked to certain shoulder conditions to provide a broader understanding that may influence injury-prevention and -management techniques. Despite the documented risk of shoulder injuries, few researchers have addressed the prevention of shoulder injuries versus other injuries, such as to the lower limb, in rugby players.

Injury Mechanism

The tackle, encompassing both the tackler and the tackled player, was associated with more than 55% (57/103) of the injuries recorded in this study. The high injury risk from the tackle has been reported at the professional,[29] amateur,[7] and junior[11,13] levels of the game. Fuller et al[28] indicated that, at the professional level, this was due to the tackle being the most frequent contact match event rather than the risk per event being greater than for other phases of the match. The incidence of tackle injuries during AASE matches (42/1000

h) was more than double that of non-AASE matches (19/1000 h), which might reflect more tackles per AASE match, although the demands of youth rugby are not yet well described. Consistent with the findings of a systematic literature review[11] of youth rugby injuries, we observed no difference in injury risk between the tackler and the player being tackled.

Burger et al[30] conducted a study on tackle injury rates in multiple youth rugby tournaments (under-13 and under-18) in South Africa. They found that the risk of a tackle-related injury increased significantly as each quarter of the match ended, with 37% occurring in the final quarter. Various investigators looking at multiple sports have shown that the injury risk increases with time, probably due to fatigue.[28] Working in a fatigued state has been suggested to decrease the incidence of fatigue-induced injuries.[31] This theory could be applied to teaching tackle technique, although this area needs to be explored carefully given the potential risk of negative consequences. Decreasing the match duration, making more substitutions, or adding further stoppages may also decrease the fatigue a player endures toward the end of the match, potentially decreasing the injury risk.

Strengths and Limitations

A strength of our study was the high level of medical access that athletes received, which helped to capture all injuries where possible. All athletes, regardless of squad, had equal access to the medical team, and no bias was given toward either group. If an injury was not noted by the pitch-side first aider, the medical team would have been made aware of any athlete unable to train 2 days after the match and the injury would have been recorded. If an athlete was injured during the game but was able to train fully 2 days later, the injury would not have met the time-loss definition used.[14] As such, whether a medical professional or a coach was providing pitch-side first aid should not affect the difference in injury rates between groups. As discussed, an exception to this could be missed concussions, which may have occurred in non-AASE matches. The majority of concussions provide no visual clue to injury,[32] and if a concussed athlete was not identified during a match, he would have been able to train fully unless he sought attention from the medical team in clinic. Consequently, any concussions missed during these matches (perhaps more likely during non-AASE matches in which coaches provided first aid[24]) would result in the underreporting of concussion and the overall injury incidence.

No allowances were made for player-minutes when teams were reduced to less than 15 players. Therefore, the incidence in both groups is underreported. However, the effect of this is likely to be low given the small number of match minutes during which this occurred; for example, a yellow card results in a 7-minute sin-bin (ie, penalty box) at this level. This method is recommended by the consensus statement,[14] and any authors who adopt these guidelines will underreport player-time, allowing for comparisons between studies.

CONCLUSIONS

The risk of injury was greater for schoolboy rugby players when they were participating at a higher level of competition. In the AASE group, we found a concussion rate greater than that in any previously published youth rugby study. The incidence and burden of shoulder injuries were prevalent in both groups, with more research needed to address the screening and prevention of these injuries.

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