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Injury patterns in U15 rugby players in Ulster schools: A Rugby Injury Surveillance (RISUS) Study

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Participation in collision sports such as rugby union has inherent risk of injury. The aim of this study was to examine injury patterns and risk factors in adolescent rugby players (U15 years). A prospective injury surveillance study was undertaken involving 26 schools (599 male rugby players, mean age 14.7years). Data were collected over the 2016/17 playing season, with injuries classified by body part and diagnosis. We explored the association between risk factors (demographic/biometric; injury history, protective equipment, training profile, level of play) using cox proportional hazard models with time to injury as the dependent variable. Nearly, 30% of players (178/599) suffered at least one injury. Injury incidence is estimated at 14.7 injuries/1000 match hours. Most injuries occurred in the tackle situation (64.6%, 135/209). Common injury sites were head/face (n = 95, 45.5%), ankle (n = 21, 10.0%), or wrist/hand (n = 15, 7.2%). Concussion (n = 79, 37.8%), wrist/ hand fractures (n = 19, 9.1%), or ankle sprains (n = 16, 7.6%) were the most common diagnoses. Seven concussions (8.9%) resulted in more than 28 days absence from play. A higher risk of injury was associated with: previous concussion (AHR 1.45; 95% CI 1.02 to 2.06), and any previous injury (AHR 1.85; 95% CI 1.23 to 2.78). One in three U15 rugby players sustained an injury over a single playing season. Concussion remains a concern in this age group and should be prioritized in future research.

KEYWORDS
adolescents, concussion, injury, rugby

1 | INTRODUCTION

Rugby Union is a collision sport and carries an inherent risk of injury.[1] Recently, a group of health professionals and academics advocated banning the tackle in schools rugby.[2,3] Others argue such a change is too radical and would attenuate many of the physical and psychological benefits associated with contact sports, including the development of resilience, toughness, and self-esteem.[4-7]

Alternative strategies for reducing injury risk in youth rugby union have been suggested including, adoption of safer tackling techniques, stricter protocols for concussion, and technology integration.[4,5,8,9] But, successful implementation and evaluation of preventative strategies are underpinned by having a comprehensive injury surveillance system in place. In September 2014, we initiated the Rugby Injury Surveillance in Ulster Schools (RISUS)[5]; our initial research reported an injury incidence of 29 per 1000 match hours in U18 rugby union players, with most time loss due to concussion, lower limb ligament injuries, and upper limb fractures/dislocations. These patterns concur with pooled data from meta-analyses, which estimate injury incidence in youth rugby at 10.3 and 26.7/1000 player hours for time loss injuries (at least 7 days) and medical attention, respectively.[10]

Although U15 players comprise a large proportion of registered rugby players, it is difficult to extrapolate specific data on this cohort from existing prospective studies. Younger adolescents also experience peak physical, cognitive, and psychosocial development,[11,12] an interaction that can place them at greater risk of injury during contact sports. Younger athletes may experience a more protracted and unpredictable recovery after concussion[13]; there is also concern that accumulating multiple concussions can have significant detrimental effects to an athlete's long-term neurological health and quality of life.[14] Although previous epidemiology studies in youth rugby have included a wide age range, it is difficult to extract specific prospective data from an U15 cohort. The aim of this prospective study was to quantify the injury burden in a large cohort of U15 rugby players, over an entire playing season. The primary objectives were to present injury patterns according to body part, diagnosis, and inciting event. Our secondary objective was to explore risk factors (demographic, biometrics; injury history; playing level; protective equipment) associated with injury.

2 | METHODS

2.1 | Study design

This was a prospective injury surveillance study undertaken over a single season (2016/17).

Injury surveillance ran between 1 September 2016 and 31 March 2017 inclusive.

2.2 | Recruitment

All 32 schools entered in the Ulster Medallion Shield Competition (U15 players) for the 2016/17 playing season were contacted. At least one researcher visited each school between August and September 2016. A total of 599 male Rugby Union players were recruited from across 26 different schools. To be eligible for inclusion, players must have been part of their school's U15 playing squad at the start of the 2016/17 playing season, thereby participating in the highest playing standard for this age group. Participation consists of on friendly and competitive matches cumulating in the end of season Competition (Medallion Shield). Ethical approval was obtained from the University of Ulster Ethics Committee (REC/14/0060). Individual informed consent was obtained from the players who participated and countersigned by their parents where appropriate.

2.3 | Injury definitions

All injury definitions (injury type, severity, and body part) were consistent with the 2007 International Rugby Board (IRB) consensus statement.[6] Time-loss injuries were defined as "any injury that prevents a player from taking a full part in all training and match play activities typically planned for that day for a period of greater than 24 hours from midnight at the end of the day the injury was sustained." Injury severity was defined by the total number of days from injury to full fitness. Injury severity was sub-classified as follows: minimal (2-3 days), mild (4-7 days), moderate (8-28 days), and severe injury (>28 days).

2.4 | Recording of injuries

Details of each individual injury occurring during the 2016/17 season were recorded using an online reporting system. The following information was uploaded as follows: the date of injury, classification of the injury at two levels (body site, type of injury), information on the injury event, the date of return from injury, medical verification, and if applicable their expertise (eg, Emergency consultant; General Practitioner; and Physiotherapist). Injury reporting was completed each week by a designated person at each school (data champion) and inputted directly onto our online system. The height and direction of the tackle were determined through self-reporting by the injured players and/or the data champions. Foul play was based on sanctions by the referee. Prior to the start of the season, data champions received training on study aims and data collection procedures. Three research assistants collated and checked all injury data weekly; schools that failed to register any data were sent reminders via text message or a follow-up phone call. A monthly audit of injuries was undertaken to screen for any unusual patterns of reporting. Data due to illness and/or non-sport-related medical conditions were not included in the study.

2.5 | Covariates (predictor variables)

At the start of the season, data were recorded under the following categories: demographic/biometric, injury history, use of protective equipment, training profile, and level of play. These prognostic factors were selected based on our previous research involving U18 players. Table 1 outlines the 12 covariates and their respective levels.

TABLE 1 Covariates (predictor variables)

Category	Covariates	Levels[a]
Demographic/biometric	Age	≤14.8 y vs >14.8 y
	Weight	≤64 kg vs >64 kg
	Height	≤1.72 m vs >1.72 m
	Playing position	Backs vs forward
Injury history	Any previous injury	y/n
	History of concussion	y/n
Use of protective equipment	Gum shield	y/n
	Shoulder pads	y/n
	Head guard	y/n
Training profile	Regular weight training	y/n
	Regular use of protein supplements	y/n
Level of play	School team ranking	Top vs bottom tier

[a]Level based on median splits; y/n = yes/no.

Height and body mass were measured on site using a Height Measure (Marsden HM-250P Leicester Portable) and Mechanical Floor Scales (SECA 869). Participants were asked to remove both shoes and socks prior to measurement of height and body mass. Height and body mass data were rounded up to the nearest 0.01 m and 0.1 kg, respectively. The remainder of covariates in Table 1 were collected via questionnaires, which were administered and collected on the same visit. A researcher remained present at all times to answer any questions participants may have had relating to the questionnaire.

2.6 | Data analysis

We performed statistical analyses with SPSS software (V.22.0; SPSS). Descriptive statistics were used to analyze baseline patient characteristics. Injury burden was presented as the total time lost to injury (training and match combined), from which we calculated the average player days lost per school, per season. We presented injury counts and percentages based on severity [minimal, mild, moderate, and severe injury), body site, type of injury, and injury event. Injury severity was reported as median number of days lost to injury.

Match injury incidence was reported as the number of injuries/1000 player -hours of exposure. Fixture lists were used to estimate the total number of player-match exposures from each school [(number of matches played x number of players in a school squad)]; as the duration of U15 rugby matches is one hour, this figure equates to the total number of match hours. Data on training exposure were not reported.

For the survival analyses, continuous covariates were categorized using 50th percentiles. The primary outcome was the time to injury. In this model, the time (in days) from the start of the playing season, to a participants' first event (injury) or the end of the follow-up period was the main endpoint. Initially, Kaplan-Meier survival curves were generated and log-rank tests were used to explore survival differences between levels of each covariate. Univariable and multivariable Cox proportional hazard models were then used to evaluate associations between covariates and hazard of injury. During the analysis, all candidate covariates were considered to be on an equal footing. Variables with a P value of <.1 in the univariable model were then analyzed within a multivariate Cox proportional hazard model. Players with any missing data for the risk factors of interest were excluded from the multivariable analysis.

Hazard ratios (HRs) were presented with their 95% confidence interval. We considered a P value <.05 to be statistically significant. Non-proportionality (eg, decay, divergence, and crossing) was checked graphically by assessing Kaplan-Meier survival distribution for each level of the covariate; we also assessed equivalent log (minus log) survival plots. Finally, we extended Cox Regression models to include time-dependent covariates and checked for significance (product of the time variable*covariate). We undertook additional survival models to analyze whether protective equipment (shoulder pads, head guards, and gum shield) influenced risk of injury at respective body regions (shoulder, head/face).

3 | RESULTS

Out of the 32 schools invited, six did not participate in the study (n = 2 did not respond, n = 4 were not interested in participating). N = 599 male rugby union players were recruited across 26 participating schools. All participants entered the study at the start of the playing season. Table 2 provides a summary of participants' baseline characteristics. Some baseline data were incorrectly or incompletely recorded hence the difference in N.

3.1 | Injury history

At the start of the season, the average number of previous injuries reported was 1.1 (SD 1.2), with 39 participants reporting at least 3 previous injuries due to rugby. The most common previous rugby injury was concussion (n = 165/599, 27.5%).

TABLE 2 Baseline characteristics

Characteristic	N	Descriptive
Age in y (mean, SD)	599	14.7 (0.4)
Weight in kg (mean, SD)	599	65.2 (12.5)
Height in m (mean, SD)	599	1.72 (0.08)
Playing position (number backs/ number forwards)	599	292/307
History of at least 1 previous injury due to rugby (y/n)	589	356/233
Regularly wearing shoulder pads (y/n)	574	130 / 444
Regularly wearing gum shield (y/n)	574	500/74
Regularly wearing head guard (y/n)	570	182/388
Regularly undertaking weight training (y/n)	570	391/179
Regular consumption of protein supplements (y/n)	552	135/417

3.2 | Injury characteristics

One seventy-eight players reported 209 injuries during the 2016/17 playing season (Table 3). 421 players (70.1%) completed the season without incurring any injury. The three most common injury sites were head/face 45.5% (95/209), ankle 10% (21/209), and the hand 7.2% (15/209). Concussion 37.8% (79/209), fractures 15.8% (33/209), and sprains 15.3% (32/209) were the most common tissues affected by injury. A full breakdown of injury by body region and tissue type is shown in Table 4 and 5, respectively. A total of 43 specific diagnoses were reported, and the five most common are presented in Figure 1.

3.3 | Medical verification

Just over 50% of all injuries diagnoses (105/209) were made by a qualified health professional (n = 65 by Emergency Medicine Practitioners; n = 25 by physiotherapists; n = 15 by general practitioners). Injuries were also diagnosed by coaches and first aiders (n = 83), self-diagnosis (n = 7), and parents (n = 3). Of note, only 32.9% of concussions (26/79) were medically verified, with 60.3% (48/79) of concussion diagnoses made by coaching staff.

TABLE 3 Injuries reported during the 2016/17 playing season

Number of injuries	Number of players	Total injuries
0	421	0
1	149	149
2	27	54
3	2	6
	599	209

TABLE 4 Injury by body region

Body region	N (%)
Head/face	95 (45.5)
Neck C-spine	9 (4.3)
Thoracic spine	0 (0.0)
Abdomen	0 (0.0)
Chest wall	4 (1.9)
Clavicle/shoulder	10 (4.8)
Upper arm	1 (0.5)
Elbow	1 (0.5)
Forearm	0 (0.0)
Wrist	11 (5.3)
Hand/finger/thumb	15 (7.2)
Lower back	11 (5.3)
Sacrum/pelvis	0 (0.0)
Hip/groin	4 (1.9)
Anterior thigh	7 (3.3)
Posterior thigh	3 (1.4)
Knee	11 (5.3)
Lower leg/achilles	0 (0.0)
Ankle	21 (10.0)
Foot	0 (0.0)
Unclear	6 (2.9)

TABLE 5 Injury by tissue type

Diagnosis	N (%)
Sprain	32 (15.3)
Dental	1 (0.5)
Concussion	79 (37.8)
Hematoma	26 (12.4)
Fracture	33 (15.8)
Other bone	0 (0.0)
Muscle	20 (9.6)
Dislocation	2 (1.0)
Laceration	9 (4.3)
Tendon	6 (2.9)
Visceral	0 (0.0)
Nerve	0 (0.0)
Meniscus	1 (0.5)

3.4 | Injury severity

Reported injuries were associated with an average time loss from rugby of 31.4 days (median time loss 23 days (range

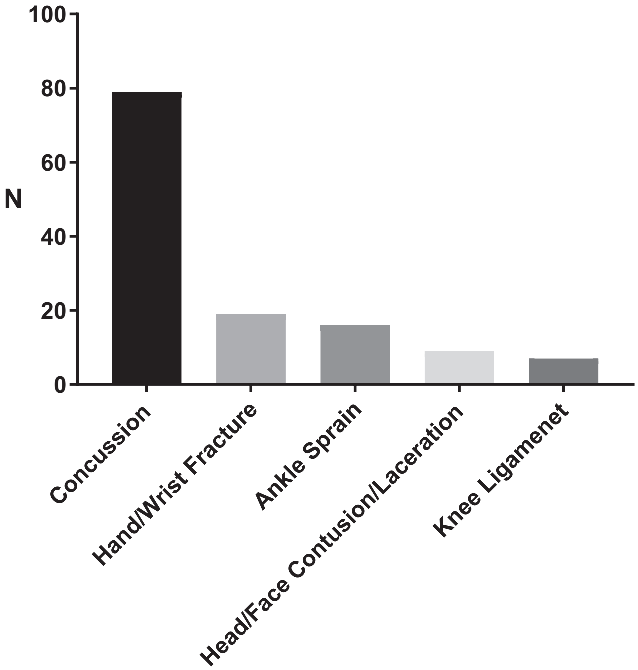

FIGURE 1 Top five most common diagnoses

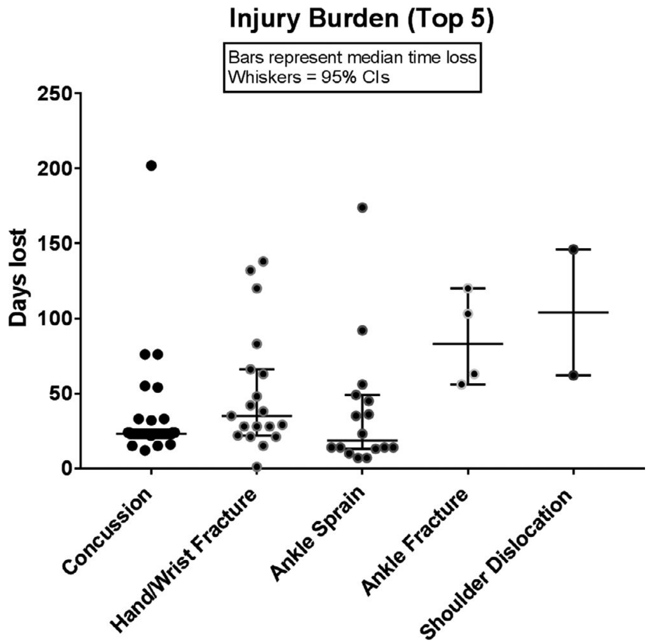

FIGURE 2 Diagnoses associated with the greatest injury burden (days lost to injury)

1-202 days, SD 30.4 days). Table 6 outlines injury severity based on time loss. Just over 70% (152/209) of injuries were minor or moderate, of which the most common were concussion 46.7% (71/152), ankle sprains 5.9% (9/152), fractures hand/finger/thumb fractures 4.6% (7/152), and knee sprains 3.3% (5/152). A total of 27.3% injuries (57/209) were classified as severe, of which 30 season ending. 10% of all concussions (8/79) incurred time loss of >28 days. Other common severe injuries were fractures to the wrist or hand 24.5% (14/57) and fractures or sprains to the ankle 19.3% (11/57).

3.5 | Injury burden

The total time lost to injury in this sample was 6411 days, with an average of 246.6 player days lost per school, per season. We noted that concussion (2165 days lost), fractures to the hand/wrist (958 days lost), sprains or fractures to the ankle (945 days lost), and shoulder dislocations (208 days lost) accounted for 66.7% of all days lost due to injury (Figure 2).

We were unable to obtain reliable training exposure however injury incidence was estimated for matches. Match exposures were calculated based on 599 players taking 20 game exposures over the season =11 980 exposures. This figure was reduced to 11 065 game exposures to account for the game exposures missed due to injury (n = 915). We recorded 163 injuries occurring during match situations, which, therefore, equates to 14.7 injuries per 1000 match exposures. As the duration of U15 rugby matches is one hour, this figure equates to 14.7 injuries per 1000 match hours.

TABLE 6 Injury severity

	Minor (<7 d)	Moderate (7-28 d)	Severe (>28 d)
N (%)	22 (10.5%)	130 (62.2%)	57 (27.3%)

3.6 | Inciting event

Most injuries occurred during a match situation, with 22% of injuries (46/209) occurring during training. Tackling accounted for 64.6% of injuries (135/209), with 85 injuries sustained by the tackler and 50 injuries sustained whilst tackled (ball carrier). 10.5% of injuries were incurred in either ruck or maul situations (22/209). There were three injuries during scrummage and three during lineout.

3.7 | Tackle height and direction

Injuries sustained during tackle events were sub-grouped by the height and direction of contact (between the tackler and ball carrier). 22.9% (31/135) of cases had missing data, with the remaining 104 injuries summarized in Figure 3. 65% of tackle events associated with injury involved front-on contacts made at waist level (low) (n = 41) or at a level between the waist and chest (middle) (n = 28). Almost, one quarter were lateral tackles, where again contact was made at low (13/106) or middle heights (10/106). 11.3% (12/106) involved contact above the chest (high).

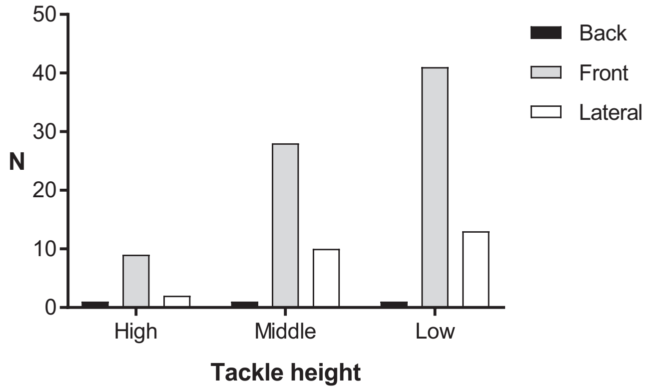

FIGURE 3 Tackle events resulting in injury, were sub grouped by the height and direction of contact

3.8 | Foul play

18% (9/50) of tackles that resulted in the ball carrier being injured were reported as illegal. In all cases, the cervical spine or head/face was the affected body region, six were concussions, one facial fracture, one facial contusion, and one cervical neck sprain. Two players injured themselves (one concussion and one facial contusion) while making an illegal tackle.

3.9 | Survival analysis

Thirty-three cases were excluded due to incomplete or missing values for covariates. This left a total of 566 participants in the survival analysis, based on 161 injury events and 405 right censored (all at the end of the playing season). No time-varying effects were observed, and the proportional hazard assumption was satisfied for all covariates (Table S1).

3.10 | Cox proportional hazards model

The univariate and adjusted hazard ratio, 95% CI, and P value for each variable in the Cox's proportional hazard model are outlined in Table S2. Four candidate variables were entered into the multivariate model, based on a P value <.1 in the univariate analysis. The multivariate model showed that the following factors were associated with a significantly higher risk of injury: history of previous concussion (adjusted HR (AHR) 1.45; 95% CI 1.02 to 2.06); and a history of any previous injury (AHR 1.85; 95% CI 1.23 to 2.78). Strength training and playing level variables were not associated with injury risk in the multivariate analyses.

3.11 | Region-specific protection

Players wearing shoulder pads were at similar risk of shoulder injury compared with those who did not wear any shoulder protection (log rank = 0.043; df 1;P = .836). The risk of concussion was similar regardless of the use of head guards (log rank = 0.832; df = 1;P = .362) or gum shields (log rank = 0.832; df = 1; P = .362).

4 | DISCUSSION

The body of literature defining injury risk in the youth game is limited. It is often argued that methodological differences between epidemiological studies make definitive conclusions impossible. We have adopted the recognized time-loss definition of injury used within the professional game, allowing both parents, and participating adolescents to make informed decisions on the risks of playing rugby at Schoolboy level.

4.1 | Injury incidence

Match day injury incidence in this study was 14.7 injuries per 1000 match hours. This is lower than figures previously reported in a meta-analysis of rugby injuries in children and adolescents under 21 years (26.7 injuries 1000 player hours).[10] Our figures align with incidence figures reported in youth soccer[5,7] and are considerably less than in professional rugby cohorts (81.0/1000 player hours).[16] Furthermore, direct comparison to our previous work[5] shows that the injury risk in U15 schoolboy rugby was half that seen in U18 rugby (29.06/1000 player hours). An additional key finding was that in the current study, 27% of injuries were classified as severe compared to 49.1% in our previous research[5] in U18s players. This could relate to increased competition and/or the rapid change in player biometrics that has been observed as a player progresses into senior rugby. For example, the U15 players in the current study had significantly lower body mass (MD 13.6 kg, 95% CI, P < .0001) when compared with our U18 cohort..[5]

The total time loss from rugby due to injury was 6411 days with an average of 246 player days lost per school, per season. This is equivalent to 35 weeks of time loss, or each school losing approximately 1.5 players for an entire season. Approximately, a quarter of all injuries resulted in more than 28 days' time loss. In general, the proportion of ligament injuries (15% vs 33%) and muscle injuries (9.6% vs 15.3%) was much lower in the current cohort, when compared to U18 players.[5] However, fractures were more prevalent in the current study, comprising 15.8% of all injuries, compared to 8.9% in U18s.[5] The injury patterns by body region were very similar to patterns we previously reported within U18 players.[5] Perhaps, the only notable differences were lower proportions of injuries to the knee in the younger cohort U15 players (5.3% vs 13.3%) when compared to the U18s.[5]

In accordance with previous research in adolescent rugby,[5] the tackle situation and collisions were the most dangerous facets of play. Of note, 18% (9/50) of tackles that resulted in the ball carrier being injured were reported as illegal. In all cases, the cervical spine or head/face was the affected body region. Two players injured themselves (one concussion and one facial contusion) while making an illegal tackle. This further highlights the importance of promoting correct technique in the tackle. In conjunction with our previous research,[5] there was no association between wearing shoulder guards or head guards and risk of injury.

4.2 | Concussion

Concussion accounted for more than one in three of the injuries sustained in this group of players. Our reported incidence of 6.01 concussions per 1000 match hours is similar to U-18 cohorts,[5] but concussion comprised a much larger proportion of injuries in the current study. This highlights that younger players are more susceptible to head and neck injury, although the reasons for this are unclear. Neck strength is substantially lower in adolescent rugby players[17]; although weak neck musculature has been associated with greater concussion risk,[18] this has not been corroborated in an adolescent rugby population.[19] One RCT has shown that a multifaceted warm-up intervention reduced match injuries, including concussion, in a school's rugby population,[20] the underpinning mechanism is unclear.

The median time to return to play after concussion was 24 days, with all players adhering to the 3-week stand-down regulation. This positive finding, which was also reported in our previous study, provides further evidence that within School's rugby, return to play regulations post-concussion continue to be fully adhered to. Of note, only one-third of concussion diagnoses were verified by a medical practitioner, with the majority made by coaching staff. Currently, sensitive and specific diagnostic criteria for concussion are lacking; therefore, adolescent rugby should continue to promote a low index of suspicion for concussion diagnosis. Indeed, this continues to be addressed through mantras such as "if in doubt, sit them out," which are strategically promoted in School's Rugby. However, it is also important to consider that clinical tests based on a low threshold for diagnosis can increase the risk of false-positive findings. Although it is possible that our incidence figures of 6.01 concussions per 1000 match hours are inflated, this can only be verified through the development and implementation of more accurate diagnosis of concussion.

4.3 | Important inciting events and risk factors

In the present study, it was noted that players with a history of a previous concussion were at increased risk of musculoskeletal injury during the study period (AHR 1.45; 95% CI 1.02 to 2.06). It is accepted that having a history of previous concussion is one of the strongest and most consistent risk factors for future concussion.[21] The relationship between concussion and subsequent musculoskeletal injury is an emerging theme in recent studies.[22] In retired NFL American football players, studies[23,24] have demonstrated a correlation between previous history of concussion and an increased incidence of lower extremity musculoskeletal injury including osteoarthritis. Cohort studies have demonstrated an increased risk of subsequent musculoskeletal injury following a concussive injury in professional sports including rugby union,[25] ice hockey,[26] Australian Rules Football[27] and soccer,[28] alongside a similar trend in US collegiate athletes.[29,30] A recent study[31] has also examined this relationship in adolescent high-school athletes across various sports. After every previous concussion, the odds of sustaining a subsequent time-loss lower extremity injury increased by 34%. Our current study adds further evidence to this emerging theme. The increased risk of subsequent lower limb injury post-concussion remains positive in many studies, despite accounting for confounding factors such as previous musculoskeletal injury,[32] length of time loss following injury,[25] and risk-taking behavior.[29] It is established that balance and motor function can remain compromised following a concussive episode, despite clinical recovery from this event.[33-35] In adolescent athletes where the brain is developing, a prolonged recovery period is already recommended prior to return to play.[36] A more comprehensive rehabilitation plan that encompasses facets of neuromuscular control and cervico-vestibular rehabilitation may be warranted to reduce the risk of subsequent musculoskeletal injury in this population.[37]

U15 players with a history of any previous injury were at significantly higher risk of injury compared with those with no history of injury. Currently, the relationship between previous injury and a subsequent lower limb injury that differs in nature or location is rarely considered.[38] There is some evidence to show that in professional soccer[39,40] and rugby,[41] subsequent injuries are more severe and associated with a greater time loss than index injuries. A recent meta-analysis [42] also showed that a history of lower limb muscular or joint injuries was associated with a variety of lower limb subsequent injuries that are of a different type. We have provided further evidence that previous injury can modify the interaction between other injury determinants; however, future research must further consider causal factors to better inform the development tertiary prevention programs. We found a trend that U15 schoolboy players who regularly undertake regular weight training or play for a higher tiered (more competitive) school are a higher risk of injury. There were similar findings from our previous research in U18 players.[5] We would again suggest that players at competitive schools are probably exposed to higher training loads and potentially more physical collisions during match play. Indeed, the highest injury incidence figures associated with adolescent sport are from high-level under-18 rugby competitions (49.5 injuries per 1000 player exposure hours).[43] There is now much evidence to suggest that poor load management is a major risk factor for injury.[44] We would suggest that future research is needed to better inform the prescription of training and competition load in adolescent rugby players. An initial step should be to incorporate objective and periodic monitoring of training and match load within this population, particularly in high ranking or competitive teams.

4.4 | Study strengths and limitations

This paper provides a comprehensive description of, and the associated risk factors for, injuries sustained over a season in a U-15 schoolboy rugby playing population. Findings are based on a large cohort of players competing in the same cup competition, over an entire playing season. At the start of the study, our sampling frame was all 32 schools and 26 were successfully recruited. Injuries were reported prospectively, using a recognized time-loss definition of injury used in well-established surveillance programs within the professional game. The injury incidence of 14.7 injuries per 1000 match play hours may be lower than the true figure due to potential under reporting of injury. This work allows for direct comparison with the risk of injury in U18 rugby highlighting a significant increase in injury rate and severity between these age groups. We were unable to record individual player exposure; therefore, our incidence figures cannot be stringently compared with gold standard exposure data and incidence figures recorded in the professional game. Medical verification occurred in 53% of injuries, and the remainder of injuries was verified through the player, the coach, or a parent; although this may affect the accuracy of the diagnosis, this is not likely to affect the validity of other key injury data, for example, body part or time to return to play. Our reported data on the injury mechanisms (tackle height and direction) were primarily self-reported and require validation using video analysis. Although we found no evidence of region-specific protection from shoulder pads, head guards, or gum shields, these were exploratory analyses. The relatively low number of shoulder injury events (n = 10) increases the risk of type two error.

4.5 | Putting into perspective

The objective of this study was to explore injury incidence in U15 schoolboy rugby players. Our findings are lower than incidence figures previously reported of rugby injuries in children and adolescents,[10] compare favorably with figures reported in youth soccer,[7,15] and show that the injury risk in was half that seen in U18 rugby.[5] Our findings support the evidence that the tackle situation continues to be most dangerous facet of play.[5,45]

5 | CONCLUSION

One in three U15 rugby players sustained an injury over a single playing season. Concussion remains one the most prevalent injuries, accounting for more than one in three of the injuries, and should be prioritized in future research. Overall, there is a need to explore the effects of appropriate tackling technique and the monitoring player load (ie, training and match volume) on injury risk in underage schoolboy rugby players.

AUTHOR CONTRIBUTIONS

All authors were all involved in the conception, consent process, data collection, data upload, data interpretation, and drafting of this paper.

DATA AVAILABILITY STATEMENT

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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