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Seasonal time-loss match injury rates and burden in South African under-16 rugby teams

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Abstract

Objectives

Youth rugby union is a popular sport with a high injury incidence density (IID) and burden. This high risk has called for further research into the factors affecting the injuries in youth rugby. The aim of the study was to analyse time-loss IID and burden in multiple schoolboy rugby teams over a season and the potential factors associated with injury.

Design

Prospective Cohort

Methods

All time-loss injuries were recorded from three schools for the whole season. Overall IID and injury burden were calculated, as well as for injury event, type, location and the match quarter in which they occurred and Poisson regression analyses were performed to determine differences.

Results

IID was 28.8 (18.9 – 38.6) injuries per 1000 player hours over the season, with an injury burden of 379.2 (343.6 – 414.9) days lost per 1000 player hours. The ball-carrier had a significantly higher IID (11.3 (5.2 – 17.5) per 1000 player hours) compared to other events, and the joint (non-bone)/ligament injuries were the most common (IID of 12.2 (5.8 – 18.6) per 1000 player hours) and severe type of injury (burden of 172.6 (148.5 – 196.6) days lost per 1000 player hours).

Conclusion

The IID was similar to previous youth rugby studies, however the injury burden was much lower. The South African youth cohort showed similar factors associated with injury for inciting event (the tackle) and injury type (joint (non-bone)/ligament) and location (lower limb) as seen in other studies in both youth and senior players.

Keywords: Youth, Team Sport, Injury and Prevention

Introduction

Rugby union (hence referred to as ‘rugby’) is a form of organised physical activity and has become a popular sport worldwide. There are estimated to be 8.5 million participants worldwide, with approximately 468 000 of those players being in South Africa (as of the end

of 2016).[1] Rugby is associated with higher injury rates than many other sports.[2] The injury incidence density (IID) has been reported as 81 (95% CI 63 – 105) injuries per 1000 match hours in senior players,[3] 35 injuries per 1000 match hours (95% CI 29 – 41) in English youth competitions,[4] and 22 injuries per 1000 player hours (95% CI 20 – 25) reported in South African youth tournaments.[5] Furthermore, the injury burden (a product of injury incidence and time lost from sport) resulting from rugby injuries has continued to rise in European populations.[4 6]

A key population to understand more about is South African youth rugby over a regular season. Whilst South African youth tournament injury rates and injury burden have been thoroughly investigated during highly competitive week-long tournaments,[5 7-12] this is a different environment compared to season-long cohorts. One study has investigated a single youth rugby team in South Africa over one season, and found an alarmingly high IID for this team, warranting the need for more seasonal youth rugby data to investigate the circumstances of injury.[13]

Therefore, a more comprehensive, multiple school and team prospective study is needed to determine a more accurate representation of IID and injury burden in this population. Such studies would contribute to a better understanding of the real injury burden and aetiology of injuries in South African youth rugby, which could optimise injury prevention programmes for this population.

Under-16 rugby players are thought to be a vulnerable group, as the disparity in size and ability within this age group is larger, with players ranging from pre-pubescent, pubescent to post-pubescent, compared to older cohorts where maturation would be achieved.[14] This disparity in development could lead to an increased injury risk, and therefore the injury profiles of under-16 youth players need to be explored further.

Multiple factors are related to the aetiology of rugby injuries, and have been investigated in both the youth and in seniors. [3 4 15-17] The tackle event has the highest injury incidence and the lower limb was the site most commonly injured.[3 17] However, in the South African youth cohort further insight into variables that describe the nature of these rugby injuries over a season need to be assessed.

Therefore, the primary aim of this study was to determine the time-loss match IID and injury burden of under-16 schoolboy rugby players in South Africa. A secondary aim was to

investigate potential factors related to injury incidence density and injury burden in these players.

Methods

Out of twelve eligible Western Cape schools, a convenience sample of four coaches of four schools were asked to invite their players to participate in the study. One school declined to participate in the study. All players and their parents/guardians who were willing to participate signed written informed consent. Players were able to withdraw at any point during the study. The Western Cape Education Department and the University of Cape Town Human Research Ethics Committee (HREC 850/2015) granted ethical clearance. This study is part of a larger study.[18]

Injury data collection was performed at the remaining three schools from the Western Cape region. All three schools were of a high level, participating in the Western Cape premier league (the highest level of competition for schoolboy rugby in the region). The season consisted of approximately sixteen matches for each school, with the season extending from April to August 2017. The players included in the study were from under-16 teams. Each school recorded the injuries sustained by their players and the teams were contacted on a Monday to send in the injury reports. The injuries were recorded using an injury data collection form designed by South African (SA) Rugby in accordance with the injury surveillance Consensus Statement[19] and which has been used in previous studies.[7 10] A medical professional confirmed all reported injuries. Only match time-loss injuries (an injury occurring during a match which resulted in a player being absent for more than 24 hours of normal activity)[19] were recorded for this study. All injuries were followed up until the player returned to sport to determine an accurate injury severity (minimal 2-3 days; mild 4-7 days; moderate 8-28 days; severe >28 days missed) and injury burden.[19] Associated risk factors were also recorded: injury event (tackle (additionally separated into tackler and ball carrier roles), ruck, open play, running, lineout, scrum, maul, kicking); injury type (joint (non-bone)/ligament; central/peripheral nervous system; broken bone/fracture; muscle/tendon; bruise/contusion; laceration; other injury (unsure)); game quarter (first, second, third or fourth), and; injury location (head/neck, trunk, upper limb, lower limb). The definitions of each of these factors were in accordance with the injury surveillance Consensus Statement.[19]

Player match exposure was calculated, according to the current Consensus Statement:[19]

$$Exposure = NM \times PM \times DM$$

For this equation, *NM* is the number of matches played, *PM* is the number of players per match, (always 15 players, the number of players on the pitch for one team at any given time), and *DM* is the match duration in hours (each match was the standard 60 minutes for under-16 rugby in South Africa). Exposure was used to determine the IID per 1000 player match hours and the corresponding 95% Confidence Intervals (95% CI).

Injury burden was calculated using the following equation:[19]

$$Injury\ Burden = overall\ mean\ injury\ incidence\ density\ \times\ mean\ absence\ per\ injury$$

Injury burden is expressed as the number of injury days lost per 1000 player hours and 95% CI. Poisson regression analysis, using IBM SPSS Statistics version 24, was performed to determine if there were significant differences between the IID and associated injury risk factors (phases of play, injury types, game quarters and injury locations).

Results

In the 2017 season there were 33 time-loss match injuries over 1147 exposure hours in total, comprising three schools and six different teams (130 different players, no players declined participation). The overall IID for the season was 28.8 (18.9 – 38.6) injuries per 1000 player hours.

Of the 33 time-loss injuries, 36% were of minimal severity (2 – 3 days missed), however, 12% were severe (>28 days missed). Overall, the injury burden for the season was 379.2 (343.6 – 414.9) days lost per 1000 player hours.

The tackle phase of play was broken down into tackler and ball-carrier roles. The ball-carrier had the highest IID of all events, 11.3 (5.2 – 17.5) per 1000 player hours, with the tackler role (7 (2.1 – 11.8) per 1000 player hours) and ruck (4.4 (0.5 – 8.2) injuries per 1000 player hours) having the next highest IID, respectively. All events, excepting the tackler role and ruck were significantly lower than the ball-carrier (Figure 1). The injury burden of the ball-carrier was 158.4 (135.4 – 181.4) days lost per 1000 player hours, and the injury burden for the tackler was 32.0 (21.7 – 42.4) days lost per 1000 player hours.

Joint (non-bone)/ligament injuries were the most common and severe, with an IID of 12.2 (5.8 – 18.6) injuries per 1000 player hours and a burden of 172.6 (148.5 – 196.6) days lost per 1000 player hours. The second most common injury type was that of central/peripheral nervous system (CNS/PNS) injuries with an IID of 6.1 (1.6 – 10.6) injuries per 1000 player hours, with

a burden of 120.0 (99.9 – 140.0) days lost per 1000 player hours (Figure 2). It must be noted that all of the CNS/PNS injuries in this cohort were concussions.

The body location with the highest IID was the lower limb: (13.9 (7.1 – 20.8) injuries per 1000 player hours), followed by the upper limb (7.8 (2.7 – 13.0) injuries per 1000 player hours) and then head/neck region (7.0 (2.1 – 11.8) injuries per 1000 player hours). The lower limb injuries also had the highest burden of 164.7 (141.3 – 188.2) days lost per 1000 player hours, whilst the head/neck injuries had a higher injury burden than the upper limb, with a burden of 122.8 (102.5 – 143.0) days lost per 1000 player hours (Figure 3).

Most injuries occurred in the first quarter of the match, followed by the fourth and then the third quarter. The first quarter had an IID of 10.5 (4.5 – 16.4) injuries per 1000 player hours. The second quarter had a significantly lower IID (2.6 (0.0 – 5.6) injuries per 1000 player hours) compared to the first quarter.

Discussion

The match IID for a season was 28.8 (18.9 – 38.6) per 1000 player hours for under-16 youth rugby players from the three different schools. This IID is comparable to the ranges of previous European youth rugby seasonal studies, where the reported IID were between 24 – 35 injuries per 1000 player hours.[4 6 15 17] These results indicate that the youth community rugby population of South Africa has an IID comparable to European cohorts when comparing overall injury incidences. These European cohorts were slightly older compared to the under-16 players included in this South African season-long study, and the support received at the European schools and the European competitions is unknown, which could play a role in the injury rates reported. Moreover, the South African season-long results are comparable to that of a similarly aged South African youth tournament population.[5] Although the objectives of both our study and the South African tournament study were similar to each other, the differences between these cohorts should be noted.[5] While the South African under-16 study is over the regular season of three schools in one age-group, the youth tournaments are week-long intense events comprised of the best players from multiple age groups. In addition, the South African youth tournament study comprised four years of data. The difference in context is important, as the players in our study were playing a match once every week, compared to the tournament study where they played a match every day or every second day for one week.[5] When the injury data

are compared further, this injury burden from our South African under-16 cohort does not follow a trend comparable to that of the European cohorts. The injury burden for our study was 379 (344 – 415) days lost per 1000 player hours, which is much less than the reported injury burden from Hislop *et al.* (2017) (observed in the control group of their trial), where the injury burden was 862 days lost per 1000 player hours.[6] Another study conducted in Europe,[4] reported that tackling alone was responsible for an injury burden of 264 days lost per 1000 player hours, compared to 32 days lost per 1000 player hours in our current South African cohort, illustrating a large discrepancy. In another study performed in youth rugby, 49% of injuries was classified as severe (>28 days lost), compared to 12% reported in our study, indicating a disparity in severity of injuries between the cohorts.[15] The injury severity in our South African cohort is much lower than previous studies of European players, and could therefore indicate that whilst the injury incidences are similar, the South African youth population has less severe injuries. Comprehensive injury reporting in our study, compared to other studies, could contribute to the low injury burden (i.e. to more injuries of a lower severity), where other studies have not reported the minor injuries as comprehensively. Further reasons could include the high level of coaching, conditioning, and medical support available to these particular school teams, and the structures in place for top rugby schools in South Africa.

When examining the literature, the injury type and location of injuries vary among age groups, depending on how recent the data are. The most commonly occurring injuries in our South African youth rugby study were joint (non-bone)/ligament and CNS/PNS injuries. In the present study, the lower limb had the highest injury incidence, as was to be expected with a high rate of joint (non-bone)/ligament injuries. However, this was not significantly different to the upper limb and the head/neck areas. The lower limb injury incidence reported in our study (13.9 injuries per 1000 player hours) was much higher than previous studies, both recent and older studies, where incidence was reported between 7 and 8 injuries per 1000 player hours.[6] [17] Joint (non-bone)/ligament injuries in our current South African cohort had an incidence of 12.2 injuries per 1000 player hours, which is similar to that reported by another schoolboy study with an incidence of 14 injuries per 1000 player hours (also the largest contributor to injuries).[4] When comparing the types of injuries, in more recent literature, CNS/PNS injuries have been shown to have a higher incidence than previously reported. This could be due to an increased awareness of concussions (through national and international rugby unions),[20] including the reporting of both confirmed and suspected concussions.[6] The concussion incidence in our study was 6.1 injuries per 1000 player hours, compared to older studies with

an incidence of 1.8 injuries per 1000 player hours during a season.[17] However, in more recent studies, an IID of 6 injuries per 1000 player hours during a season,[6] and 9.1 injuries per 1000 player hours during tournaments were found.[5] Another study showed a CNS/PNS incidence of 3 injuries per 1000 player hours, again much lower than presented in our study.[4] In older studies of youth in rugby, joint (non-bone)/ligament injuries are common and of similar incidence rates to what was found in this South African cohort. In contrast the CNS/PNS incidence reported in our cohort was higher than that reported in the older seasonal studies.[4 17] The youth population should be carefully monitored regarding these data, especially as concussion is an ever developing epidemiological field and the long-term effects are still relatively unknown.

Similar to previous research, the most injury inciting event in this South African youth cohort was the tackle event.[3 4 7 10 16 17] The ball-carrier role had the highest injury incidence in this study, but this was not significantly different to the tackler. This is in agreement with some previous studies where the data has been broken up into the two roles and where the ball-carrier is at greater risk of injury, for both youth and professional rugby, but there are studies indicating the opposite as well.[3 4 21-23] However, the statistical differences between these two roles are rarely significant and most studies report and compare IID data by combining the roles and look at the tackle as a whole. For injury prevention purposes however, it is important to look at the tackler and ball-carrier roles separately, as the mechanisms of injury are different. Comparable with other studies, after the tackle event, the ruck was the next highest contributor to injuries.[3 17] IID per injury event, however, is a raw measure of the mechanisms of injury, as it does not account for how often the events occur in a match, compared to the number of injuries. For example, there are much fewer lineouts, scrums and rucks occurring in a match compared to tackles,[24] and therefore one would expect there to be more injuries occurring as a result of tackles, simply because more match time is spent on tackling than on the other phases. These higher injury rates in the tackle compared to the other phases of play, have resulted in injury prevention programmes focusing on this area. Multiple studies have now shown that safe and effective technique in the tackle can potentially reduce injury rates in the tackle situation.[9 12 25]

The timing of injuries was highest in the first quarter, slightly lower in the third and fourth quarter, but significantly lower in the second quarter. Having a high IID in the third and fourth quarter is common in studies on both youth and professional rugby;[3 5] however, these previous studies have shown a significantly lower incidence in the first quarter compared to all other quarters, contrary to this South African cohort.[3 16 26] The preceding half-time break, which

contributes to a lull in concentration in the third quarter, and the fatigue factor in players towards the end of the match, have been promoted as possible explanations for the increases seen in IID in these quarters.[3 16 26] However, the finding in our current South African cohort study of the first quarter leading to the highest injury rates has yet to be explained.[16] This increase in the first quarter could be attributed to a lack of preparatory conditioning as all of the first quarter injuries occurred in the first half of the season, or potentially over-exuberance of players at this level to establish physical dominance early on in a match and this early in the season, but this would require further investigation to confirm or deny.

A limitation of our study was that this was a single season prospective cohort study of a single age group carried out in a convenience sample of subjects. This is a limitation, as it only measured one rugby season with a fairly homogenous sample of well-resourced teams. Lower school leagues, with less resources might reflect the South African rugby playing population more realistically than the present study. Therefore, interpretations should be made with caution beyond this convenience sample and age group. Also, injury incidence studies do not account for the time spent performing a specific activity within a sport, and therefore do not adjust for frequency of commonly occurring events compared to rare events. Not accounting for the time spent performing an activity, can either over-represent or under-represent the true injury risk of each event.

Conclusion

This under-16 South African youth rugby cohort had an average match injury incidence of 28 injuries per 1000 player hours for one season. Although this IID is comparable to that of other youth cohorts, the injury burden was much lower at 379 days per 1000 player hours. This discrepancy was a result of the average injury being less severe in the present study. While earlier studies had their limitations, the current study largely replicated their main findings. The tackle was shown to be the main injury causing event, with this study showing the ball carrier to be more frequently injured than the tackler. The risk factors associated with injury were comparable to those in European youth rugby, with joint (non-bone)/ligament injuries having the highest injury incidence. The incidence of CNS/PNS, of which concussion was the majority contributor, should continue to be monitored closely. A larger cohort is needed to further investigate the match period in which the injuries are occurring as this South African cohort showed interesting information on the timing of injuries in South African youth rugby. South

African youth rugby has been under-researched in a seasonal context, and the results from this study provide further insight into the characteristics of the injuries occurring at this level.

Practical Implications

- The under-16 age group should focus on joint (non-bone)/ligament injury prevention programmes, for both lower and upper limbs.
- The tackle should be a point of training focus for teams with safe and effective technique being taught and practiced regularly.
- Concussion injuries are prominent in this group and therefore the introduction of concussion injury prevention measures are required.

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Disclosure Statement

NS, EV, ML, WvM, WV, CR and JB declare they have no conflict of interest.

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Figure 1: Injury incidence density (IID) for injury events during the season. (*significantly different to Ball-Carrier; $p < 0.05$).

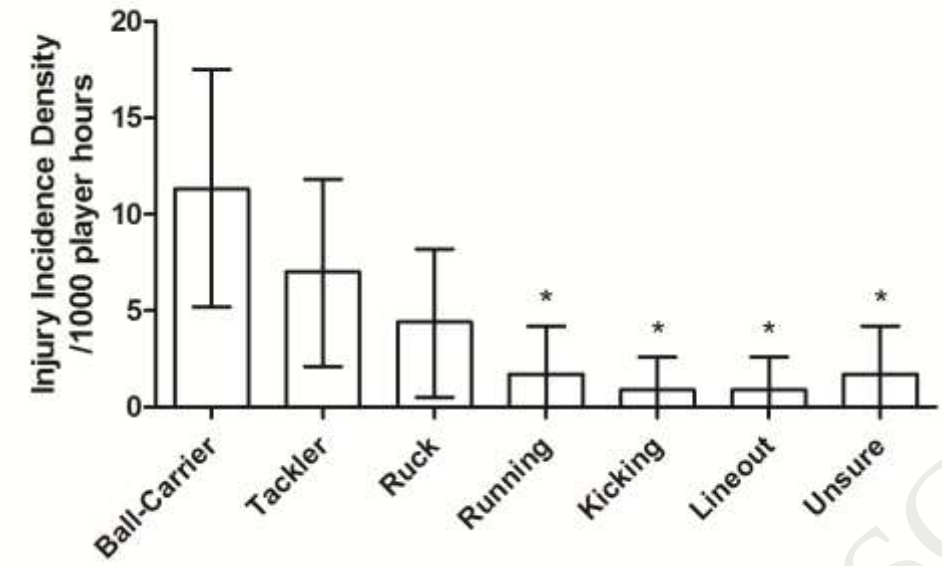

Figure 2: Injury incidence density (IID) and burden for injury type during the season. (*both Muscle/Tendon and Bruise/Contusion were significantly different to Joint (non-bone)/Ligament injuries; $p < 0.05$).

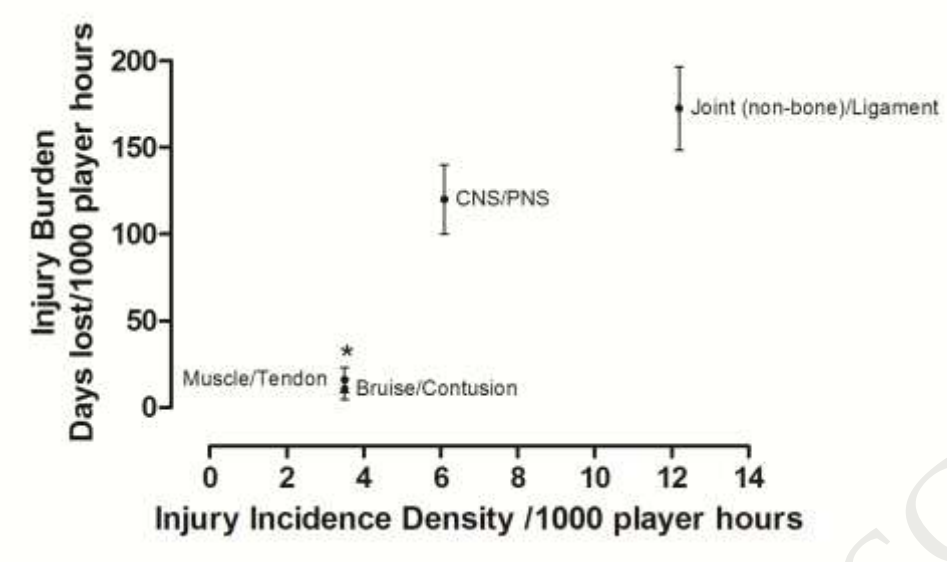

Figure 3: Injury incidence density (IID) and burden for injury location during the season.