



Original research

Incidence and characteristics of injuries in elite Australian junior rugby league players

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ABSTRACT

Objectives: Rugby league (RL) is a physically demanding collision sport, yet few studies describe injuries at the junior level despite their potential impact on career pathways and long-term health. With the absence of an injury surveillance paradigm in junior competition, this study aimed to investigate injury incidence in an Australian setting.

Design: Prospective cohort study.

Methods: A set of injury surveillance forms were developed and used to record injury characteristics, mechanism, severity and follow-up throughout one season.

Results: Junior RL players ($n = 368$, age: 15.8 ± 1.0 years) from 15 clubs provided baseline information. Of these, approximately six clubs ($n = 122$) provided longitudinal injury data. A total of 109 injuries (90% match-related) were recorded, with the tackle accounting for 61%. Injury incidence (37.1 injuries per 1000 match hours) was consistent with previous literature. Most injuries did not result in missed matches. The ankle and head/face were most frequently injured (both 13%), with ankle injuries leading to the highest losses of match-play. Contusions were common (38%), although ligament injuries caused the greatest match-play losses. Injury site significantly differed between forwards and backs ($p = 0.003$), with forwards sustaining more head/face and sternum injuries, and backs more ankle injuries. Injury type ($p = 0.25$) and severity ($p = 0.09$) were similar between positions.

Conclusions: Given the ongoing biological maturation in adolescent players and the injury risks related to RL, playing intensity, training regimes and injury incidence warrant rigorous documentation and monitoring. This study argues for functional but low-burden injury surveillance systems (e.g. electronic platforms) to be developed and implemented in junior RL.

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1. Introduction

Rugby league (RL) is a contact sport characterised by bouts of high intensity sprinting and tackling interspersed with low intensity activities such as walking and jogging.^{1,2} A tackle event occurs when a defending player holds or grabs the attacking player to halt their progress, or throws them to the ground or over a marked line.³ While all players are exposed to tackles, the physical demands on each player vary considerably depending on position.¹ Forwards experience more collisions as they undertake the most tackling,² and backs perform more running and cover a greater distance.¹ The tackle event (both tackling a player and being tackled) is consistently reported to be the primary cause of injury, and injury rates in RL (148 per 1000 match hours)⁴ tend

to be higher than other football codes such as rugby union and soccer (81 and ~22 per 1000 match hours respectively).^{5,6} As RL players are exposed to such high risks of injury, it is crucial that they are monitored appropriately to ensure safety of the sport and minimise adverse effects to long-term health.

The incidence and nature of injuries are well documented in senior RL.⁴ However, only five studies, all from Australia and New Zealand, describe injuries at the junior level. Of these, three studied 16–19 year-old players,^{7–9} and two examined a common cohort aged 6–15 years.^{10,11} Only one compared training to match injuries,¹¹ and none evaluated injury time, severity or positional influences. Incidences of injury were higher in the two most recent studies,^{8,9} which may be attributed to methodological variation, more players and matches within a season, improved playing standard and intensity,^{9,11} increased speed and collision forces,^{11,12} and changing player physique.¹³ Notably, a 2010 study of Australian Football League (AFL) players found that hip and groin injuries sustained in the junior years predicted missed game

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time during elite senior competition.¹⁴ This finding highlights the impact of early injury on career pathways, underscoring the importance of surveillance programmes for adolescent players who are still undergoing maturation.

Injury surveillance comprises the first stage of the sports injury prevention framework, as described in van Mechelen's 'sequence of prevention' model¹⁵ and the expanded Translating Research into Injury Prevention Practice (TRIPP) model.¹⁶ The TRIPP model establishes a six-stage sequence for implementing and evaluating injury prevention in a 'real-world' sports context. In RL, while a set of definitions, classifications and methodologies for monitoring injuries have been developed,¹⁷ and an injury reporting form used for other sports trialled,¹⁸ establishment of a uniform surveillance model has still lagged behind rugby union, AFL, soccer and cricket.^{19,20} With most clubs employing their own injury recording methods, comparison of data across teams are complicated by variability in the assessment and interpretation of injuries.

This prospective cohort study aimed to develop and implement an injury surveillance system to comprehensively describe characteristics and incidence of injuries in elite junior RL players. Furthermore, this study explored relationships between injuries, playing position and other risk factors for injury.

2. Methods

This study was conducted over the 2012 season of the New South Wales Junior Representative RL Under 16's (U16) and Under 18's (U18) competition. Registered players from 33 clubs (832 players) were invited to participate through contact with club managers. All procedures were approved by the Human Research Ethics Committee of The University of Sydney (protocol number 13933), in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from participants and their parent/guardian.

Baseline information was collected (via questionnaire) at the beginning of the season including: player demographics (age, ethnicity); injury history; medical history; medications; supplementation; RL specific characteristics (player position, player history, protective gear); and weekly physical activity (time spent in team training, additional sporting endeavours, exercise or work/manual labour). Playing position was divided into two groups; forwards and backs.

A set of injury surveillance forms (with accompanying definitions, terminology, data collection methodology and reporting instructions) were developed from current literature,^{9,10,18,21} and injury report forms already tested and adopted across many sports.^{19,22,23} This data collection system (injury notification, injury follow-up and match exposure forms) observed the first two stages of the van Mechelen and TRIPP models (i.e. identification and description of the nature and extent of the problem, and identification of factors and mechanisms involved in their occurrence).^{15,16} As junior RL relies heavily on the community with volunteers often undertaking multiple club roles, the forms were developed with this in mind. Forms were designed to be: suitable for use by a range of personnel; simple and time-efficient, yet capture sufficient detail; and in a format that was user-friendly and well-structured to facilitate computer entry and analysis.

An injury was defined as 'any physical or medical condition that occurs during participation in RL match or training activities that requires medical treatment or results in a missed match or training participation'.²⁴ In the event of an injury, the sport trainer or team manager completed an injury notification form that recorded administrative details, the injury circumstance (occurrence: match vs. training, first vs. second half, environmental conditions); injury details (site, type, mechanism); and injury management (initial treatment, treating person, referrals). To maximise consistency and

reduce reporting bias, forms were to be completed as soon as possible after the injury and by the same designated individual from each team.

An injury follow-up form (completed by the physiotherapist, rehabilitation trainer or medical practitioner) documented the: injury diagnosis; referrals; number of modified and/or missed training sessions; and number of missed matches. Injuries were classified into severity categories based on the number of matches missed (0: transient; 1: mild time-loss; 2–4: moderate time-loss; ≥ 5 : major time-loss).^{17,25}

A match exposure form was completed by the same individual for each team (manager or trainer) where possible. Players' game time was recorded as exact number of minutes spent in play, or to the nearest quarter of on-field play (U16: 15 min; U18: 18 min). If actual game time was not recorded, players were attributed the full game time (U16: 60 min; U18: 70 min) and interchange players half the game time. Injury incidence and match exposure calculations were in accordance to King et al.¹⁷

Each team was consulted to identify key staff responsible for coordinating data collection and completing the study documents. Implementation of the surveillance system was tailored for each team following discussions on feasibility. Presentations to individual teams/clubs were conducted to familiarise the key staff to study objectives and procedures, staff roles and main elements for successful study completion. The purpose of each form and written instructions were also provided. All paperwork was supplied to the teams with reply-paid envelopes provided. Researchers maintained regular telephone and email contact throughout the season to maximise compliance and follow-up on missing data.

Data were analysed using IBM SPSS Statistics 20 (IBM Corporation, Armonk, USA). Significance was set at $p < 0.05$ with data reported as percentages, mean \pm SD and/or median (range). Unpaired *t*-tests and Chi-square tests were used to compare baseline characteristics between the U16 and U18 players. Chi-square tests were used to compare injury site, type and mechanism between forwards and backs. A Mann-Whitney test was used to compare median injuries per match hour between forwards and backs. Spearman's correlation (ρ) was used to associate injury incidence with weekly physical activity and previous injury.

3. Results

A total of 368 junior players (U16: 54%; U18: 46%) from 15 clubs consented to participate and provided baseline information (Table 1). Injury data across the season were primarily obtained from six clubs, totalling 33% of the baseline recruits ($n = 122$; U16: 68%; U18: 32%; Supplementary Fig. 1).

Supplementary material related to this article can be found, in the online version, at [doi:10.1016/j.jsams.2015.03.007](https://doi.org/10.1016/j.jsams.2015.03.007).

The baseline cohort was predominantly Caucasian Australian (61%) and Polynesian (20%). Players had played RL for at least one year with median experience being nine (1–14) years. Three-quarters of players had external sporting commitments, and 69% reported a previous injury (51% being RL-related). Of these, previous muscle (35%) and ligament (26%) strains were the most common, with 16 players reporting severe injuries requiring surgery: ankle ($n = 5$); shoulder ($n = 4$) and knee ($n = 2$) reconstructions; anterior cruciate ligament (ACL; $n = 1$); wrist ($n = 4$); and nose ($n = 4$) surgeries.

Amongst the 122 players with a complete longitudinal dataset, 109 injuries sustained by 63 players (U16: $n = 40$; U18: $n = 23$) were recorded. Of these, 11 (10%) were training injuries with the remaining being match-related; primarily acquired in the second half (55% of all injuries). The tackle accounted for 61% of all injuries: 36% from being tackled and 25% from tackling a player. Multiple

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