



International Rugby Board

Surveillance Studies

Junior World Championship

Summary of Results: 2008 to 2014

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1 Introduction

The IRB is committed to implementing surveillance studies (SS) at all major IRB Tournaments and to disseminate the results within the Rugby community. The aims of these studies are to record and analyse injuries and illnesses sustained by male and female players at individual Tournaments, to identify changing patterns of injury and to bring injury-related areas of concern to the attention of the IRB Chief Medical Officer.

The IRB Junior World Championship (JWC) represents the top tier of competition for U-20 international teams, while the IRB Junior World Rugby Trophy (JWRT) represents the second tier of competition for international teams competing at U-20 level. Results for the JWRT Tournaments are presented in a separate report (Fuller and Taylor, 2014). A previous report summarised the incidence and nature of match injuries sustained during the IRB JWC in the period 2008 to 2013 (Fuller and Taylor, 2013). This report presents results from the 2014 JWC and also consolidates these data with the data collected since 2008.

2 Methods

All studies were conducted in accordance with the definitions and protocols described in the IRB approved consensus statement on definitions and procedures for injury surveillance studies in rugby union (Fuller et al., 2007).

The definition of injury was: '*Any injury sustained during a JWC Tournament match that prevents a player from taking a full part in all normal training activities and/or match play for more than one day following the day of injury*'. Incidents where a player's absence from match play and/or training was caused by training activities, illness or other medical conditions not related to a JWC match were not included. A recurrent injury was defined as: '*An injury (as defined above) of the same type and at the same site as an index injury and which occurs after a player's return to full participation from the index injury*'. Injuries were classified using the appropriate OSICS 8 Code (Orchard, 1995). Injury location, type and cause together with the event leading to the injury were also recorded.

Injury severity was determined by the number of days a player was injured. A player was deemed to be 'injured' until he could undertake full normal training and be available for match selection, whether or not he was actually selected. Medical staff were required to make an informed clinical judgement about a player's fitness to train/play on those days when players were not scheduled to train or play. Injured players were followed after each Tournament to obtain their return to play date.

The complete lists of categories and sub-categories used for injury locations and types of injury are provided in the rugby injury consensus publication (Fuller et al., 2007).

Differences in players' anthropometric data were assessed using unpaired t-tests; differences in the incidences, mean severity and proportions of injuries were assessed using z-tests and differences in median severity using a Mann-Whitney U test. Statistical significance was accepted at the $p \leq 0.05$ level, although it is recognised that this could identify some differences that occurred by chance due to the number of statistical comparisons made in the study.

3 Data collection

At the beginning of the 2014 JWC Tournament, the team's medical staff explained to each squad player the purpose of the epidemiological study. Each player's baseline anthropometric information was recorded on a Player Baseline Information Form (playing position [back, forward]; date of birth; body mass [Kg]; stature [cm]). Players joining a team's squad at a later date were added to the team's list of players and the anthropometric data recorded at the time the player joined the squad.

A member of the team's medical staff recorded every match injury sustained during a JWC match on a Tournament Summary of Injuries Report Form, which was returned to the study co-ordinator immediately following the end of the Tournament. A member of the team's medical staff also recorded information about each injury on an Injury Report Form (date of injury, date of return to play, location and type of injury, cause of injury, event leading to injury): the final piece of information normally entered on the Injury Report Form was the date that the player returned to normal training/match play.

4 Results

Details relating to JWC Tournaments in the period 2008 to 2013 have been presented in an earlier report (Fuller and Taylor, 2013).

The IRB JWC 2014 Tournament took place in New Zealand from 2 to 20 June 2014. This study recorded players' anthropometric data and match injuries sustained by all 12 teams (Argentina, Australia, England, Fiji, France, Ireland, Italy, New Zealand, Samoa, Scotland, South Africa, Wales) taking part in the 2014 Tournament.

Anthropometric data and the incidence and mean and median severity of injury are reported for 2014. Information for all other parameters is not presented for the 2014 JWC, as the number of injuries recorded in a single JWC Tournament does not justify this level of analysis. However, data for all parameters are presented as mean values over the 2008 to 2014 period in order to provide a more meaningful long-term evaluation.

4.1 Players' anthropometric data

Table 1 summarises the numbers and anthropometric data for players categorised as backs, forwards and all players competing at the 2014 JWC Tournament together with mean values obtained for players over the period 2008 to 2014. Forwards are significantly heavier ($p < 0.001$) and taller ($p < 0.001$) than backs but there is no statistically significant difference in the ages of backs and forwards.

Based on the All-Tournament data, backs and forwards competing in the JWC are significantly taller ($p < 0.001$) and heavier ($p < 0.001$) than players competing in IRB JWRT Tournaments (Fuller and Taylor, 2014).

Table 1: Players' anthropometric data for 2014 and the mean data for the period 2008 - 2014.

Year / Measure	Mean (Standard deviation, number of players)		
	Backs	Forwards	ALL players
2014			
Stature, cm	181.7 (6.1, 150)	188.1 (6.8, 188)	185.3 (7.2, 338)
Body mass, Kg	89.2 (8.0, 150)	106.7 (8.5, 188)	98.9 (12.0, 338)
Age, years	19.2 (0.71, 152)	19.1 (0.71, 189)	19.1 (0.71, 341)
ALL Tournaments (2008 - 2014)			
Stature, cm	181.8 (5.8, 900)	188.1 (6.9, 1105)	185.2 (7.1, 2005)
Body mass, Kg	88.4 (7.6, 898)	106.3 (8.8, 1104)	98.3 (12.2, 2002)
Age, years	19.1 (0.93, 910)	19.2 (0.89, 1110)	19.2 (0.91, 2020)

Trends in players' stature, body mass and age over the period 2008 to 2014 are presented for backs and forwards in Figures 1 - 3.

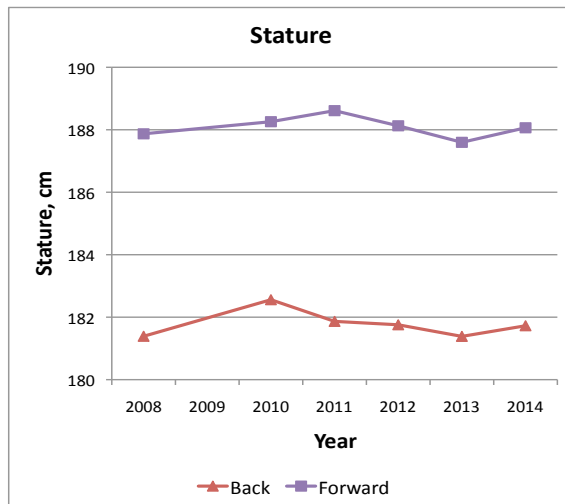


Figure 1. Trends in players' stature

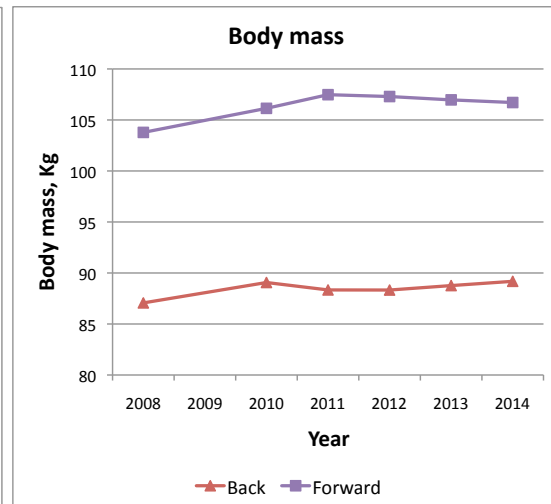


Figure 2. Trends in players' body mass

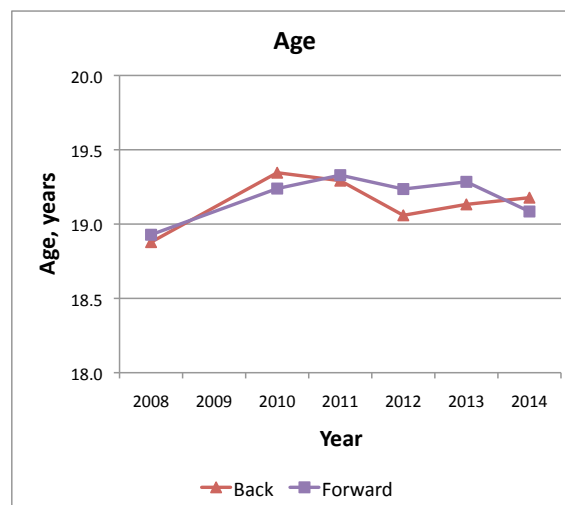


Figure 3. Trends in players' age

At the present time there is no evidence that players are getting bigger, as there have been no statistically significant changes in backs' or forwards' stature or body mass in the period 2008 to 2014.

4.2 Match injuries

4.2a Incidence of injury

Table 2 summarises the number of match injuries, match exposure and incidence of match injuries for backs, forwards and all players during the 2014 JWC Tournament together with the mean values for the period 2008 to 2014.

Table 2: Number, exposure (player-hours) and incidence (injuries/1000 player-match-hours, 95% confidence interval) of match injuries.

Year / Measure	Backs	Forwards	ALL players
2014			
Injuries	31	26	57
Exposure	560.0	640.0	1200.0
Incidence	55.4 (38.9 – 78.7)	40.6 (27.7 – 59.7)	47.5 (36.6 – 61.6)
ALL Tournaments (2008 – 2014)			
Injuries	177	201	378
Exposure	3406.7	3893.3	7300.0
Incidence	52.0 (44.8 – 60.2)	51.6 (45.0 – 59.3)	51.8 (46.8 – 57.3)

There are no significant differences in the incidences of injury between backs and forwards for either the 2014 JWC or for the mean values over the period 2008 – 2014.

The incidences of injury recorded at JWC Tournaments for backs and forwards are significantly higher (backs: $p < 0.001$; forwards: $p < 0.001$) than those recorded at the JWRT (Fuller and Taylor, 2014) but lower (backs: $p < 0.001$; forwards: $p < 0.001$) than those recorded at the RWC (Fuller et al., 2012).

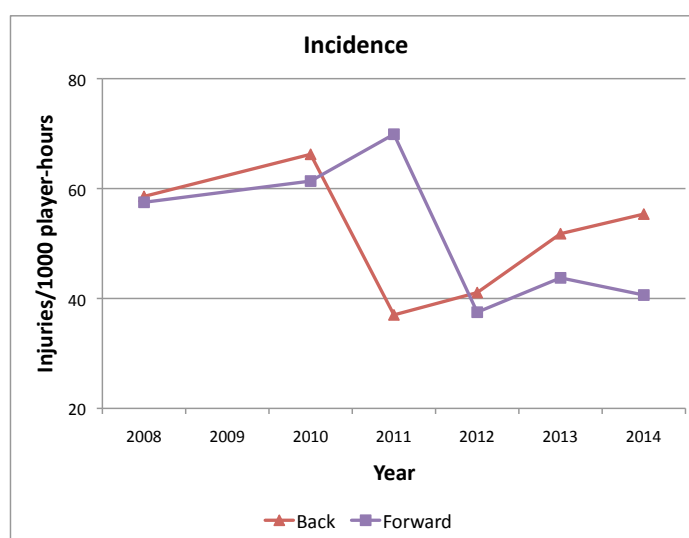


Figure 4. Trends in the incidence of injury

Injury incidence values for backs and forwards over the period 2008 to 2014 are presented in Figure 4. There are no statistically significant trends over this period for either backs or forwards.

4.2b Severity of injury

Table 3 summarises the mean and median severities of all injuries sustained at the 2014 JWC Tournament and over the period 2008 to 2014 as a function of playing position. Based on the combined Tournament injury data, there are no significant differences between backs and forwards for either the mean or median severity of injury.

Table 3: Mean and median severity of all match injuries sustained in at the 2014 JWC and over the period 2008 to 2014.

Measure	Severity (95% Confidence interval), days		
	Backs	Forwards	ALL players
2014			
Mean	18.9 (9.6 – 28.1)	32.8 (7.2 – 58.5)	25.2 (12.5 – 38.0)
Median	7 (4 – 24)	6 (4 – 24)	7 (5 – 11)
ALL Tournaments (2008 – 2014)			
Mean	25.3 (18.6 – 32.0)	36.5 (27.4 – 45.7)	31.2 (25.4 – 37.0)
Median	7 (6 – 9)	6.5 (5 – 11)	7 (6 – 9)

The mean severities of injury sustained by backs and forwards over the period 2008 to 2014 are presented in Figure 5. There are no statistically significant trends in the mean severity of injury over this period for either backs or forwards.

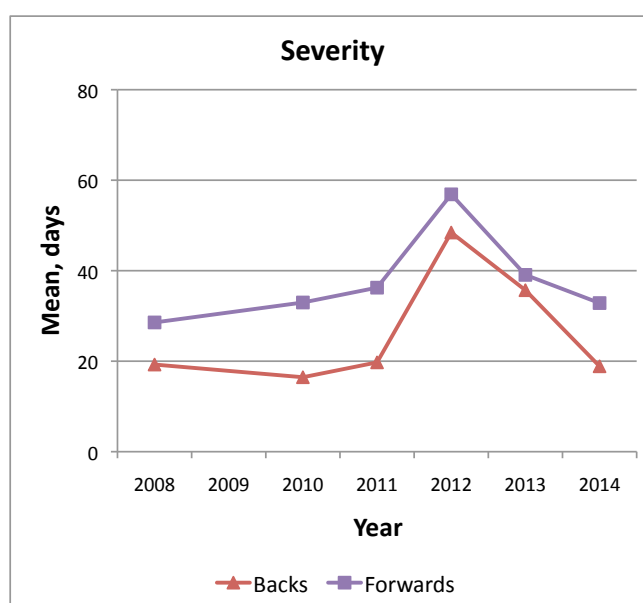


Figure 5. Trends in the mean severity of injury

4.2c Location of injury

Table 4 summarises the locations of all injuries sustained at JWC Tournaments as a function of playing position.

Table 4: Locations of all match injuries sustained in the period 2008 to 2014.

Location of injury	% (95% Confidence interval)		
	Backs	Forwards	ALL players
ALL Tournaments (2008 – 2014)			
Head/neck	11.0 (6.4 – 15.7)	14.2 (9.2 – 19.2)	12.7 (9.3 – 16.1)
Head/face	9.9 (5.4 – 14.3)	12.6 (7.9 – 17.4)	11.3 (8.1 – 14.6)
Neck/cerv ¹ spine	1.2 (0 – 2.8)	1.6 (0 – 3.4)	1.4 (0.2 – 2.6)
Upper limbs	26.7 (20.1 – 33.4)	28.9 (22.5 – 35.4)	27.9 (23.3 – 32.5)
Shoulder/clavicle	16.9 (11.3 – 22.5)	22.6 (16.7 – 28.6)	19.9 (15.8 – 24.0)
Upper arm	0.0 (-)	0.5 (0 – 1.6)	0.3 (0 – 0.8)
Elbow	1.7 (0 – 3.7)	2.1 (0.1 – 4.1)	1.9 (0.5 – 3.4)
Forearm	0.0 (-)	0.5 (0 – 1.6)	0.3 (0 – 0.8)
Wrist	0.0 (-)	0.5 (0 – 1.6)	0.3 (0 – 0.8)
Hand/fingers	8.1 (4.1 – 12.2)	2.6 (0.4 – 4.9)	5.2 (3.0 – 7.5)
Trunk	8.1 (4.1 – 12.2)	7.9 (4.1 – 11.7)	8.0 (5.2 – 10.8)
Ribs/upper back	5.2 (1.9 – 8.6)	3.7 (1.0 – 6.4)	4.4 (2.3 – 6.5)
Abdomen	0.6 (0 – 1.7)	1.6 (0 – 3.4)	1.1 (0.0 – 2.2)
Low back	1.2 (0 – 2.8)	1.1 (0 – 2.5)	1.1 (0.0 – 2.2)
Sacrum/pelvis	1.2 (0 – 2.8)	1.6 (0 – 3.4)	1.4 (0.2 – 2.6)
Lower limbs	54.1 (46.6 – 61.5)	48.9 (41.8 – 56.1)	51.4 (46.2 – 56.5)
Hip/groin	4.1 (1.1 – 7.0)	1.6 (0 – 3.4)	2.8 (1.1 – 4.5)
Thigh, anterior	3.5 (0.7 – 6.2)	6.3 (2.9 – 9.8)	5.0 (2.7 – 7.2)
Thigh, posterior	7.0 (3.2 – 10.8)	4.7 (1.7 – 7.8)	5.8 (3.4 – 8.2)
Knee	12.2 (7.3 – 17.1)	15.8 (10.6 – 21.0)	14.1 (10.5 – 17.7)
L-Leg/Achilles	5.8 (2.3 – 9.3)	3.7 (1.0 – 6.4)	4.7 (2.5 – 6.9)
Ankle	16.3 (10.8 – 21.8)	14.2 (9.2 – 19.2)	15.2 (11.5 – 18.9)
Foot/toe	5.2 (1.9 – 8.6)	2.6 (0.4 – 4.9)	3.9 (1.9 – 5.9)

Based on the combined data, the majority of injuries sustained by backs are lower (54.1%) and upper (26.7%) limb injuries; for forwards, the majority are also lower (48.9%) and upper (28.9%) limb injuries. The shoulder/clavicle is the most vulnerable sub-location for both backs (16.9%) and forwards (22.6%) followed by the ankle (16.3%) and knee (12.2%) for backs and the knee (15.8%) and ankle (14.2%) for forwards. There are no statistically significant differences between backs and forwards in the proportions of injuries sustained at each main location.

4.2d Type of injury

Table 5 summarises the types of injuries sustained at all JWC Tournaments as a function of playing position.

Table 5: Types of all match injuries sustained in the period 2008 to 2014.

Type of injury	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
ALL Tournaments (2008 – 2014)			
Bone	8.1 (4.1 – 12.2)	5.8 (2.5 – 9.1)	6.9 (4.3 – 9.5)
Fracture	7.6 (3.6 – 11.5)	2.6 (0.4 – 4.9)	5.0 (2.7 – 7.2)
Other bone	0.6 (0 – 1.7)	3.2 (0.7 – 5.6)	1.9 (0.5 – 3.4)
CNS/PNS	9.9 (5.4 – 14.3)	12.1 (7.5 – 16.7)	11.0 (7.8 – 14.3)
Concussion	7.6 (3.6 – 11.5)	8.9 (4.9 – 13.0)	8.3 (5.5 – 11.1)
Nerve	2.3 (0.1 – 4.6)	3.2 (0.7 – 5.6)	2.8 (1.1 – 4.5)
Joint (non-bone)/lig^t	43.6 (36.2 – 51.0)	53.7 (46.6 – 60.8)	48.9 (43.8 – 54.0)
Dislocation/sublux ⁿ	7.6 (3.6 – 11.5)	8.4 (4.5 – 12.4)	8.0 (5.2 – 10.8)
Lesion meniscus	1.7 (0 – 3.7)	3.7 (1.0 – 6.4)	2.8 (1.1 – 4.5)
Sprain/ligament	34.3 (27.2 – 41.4)	41.6 (34.6 – 48.6)	38.1 (33.2 – 43.1)
Muscle/tendon	35.5 (28.3 – 42.6)	25.3 (19.1 – 31.4)	30.1 (25.4 – 34.8)
Haematoma/etc	19.2 (13.3 – 25.1)	14.2 (9.2 – 19.2)	16.6 (12.8 – 20.4)
Muscle rupture/etc	12.2 (7.3 – 17.1)	8.9 (4.9 – 13.0)	10.5 (7.4 – 13.7)
Tendon injury/etc	4.1 (1.1 – 7.0)	2.1 (0.1 – 4.1)	3.0 (1.3 – 4.8)
Skin	1.7 (0 – 3.7)	3.2 (0.7 – 5.6)	2.5 (0.9 – 4.1)
Abrasion	0.0 (-)	0.5 (0 – 1.6)	0.3 (0 – 0.8)
Laceration	1.7 (0 – 3.7)	2.6 (0.4 – 4.9)	2.2 (0.7 – 3.7)
Other types	1.2 (0 – 2.8)	0.0 (-)	0.6 (0 – 1.3)
Other	1.2 (0 – 2.8)	0.0 (-)	0.6 (0 – 1.3)

CNS/PNS: Central and peripheral nervous systems

Joint (non-bone)/ligament (43.6%) and muscle/tendon (35.5%) injuries are the most common main categories of injury sustained by backs with joint (non-bone)/ligament (53.7%) and muscle/tendon (25.3%) the most common by forwards. Sprain/ligament (34.3%) and muscle haematoma (19.2%) are the most common specific types of injury sustained by backs and sprain/ligament (41.6%) and muscle haematoma (14.2) injuries the most common by forwards.

There are no statistically significant differences in the types of injuries sustained by backs and forwards at JWC Tournaments over the period 2008 to 2014.

4.2e Most common injuries and injuries creating the greatest burden

The most common injuries and the injuries causing the greatest burden in terms of days lost from training and match play are shown in Table 6.

For backs, the most common specific injuries are ankle lateral collateral ligament sprains (7.9%), concussion (7.9%) and hamstring muscle strains (6.1%). For forwards, the most common are concussion (9.2%), acromioclavicular joint injuries (8.1%) and shoulder dislocation/subluxation (8.1%).

The injuries creating the largest injury burden (incidence x severity) are anterior cruciate ligament injuries (backs: 17.9%; forwards: 26.6%) and shoulder dislocation/subluxation (backs: 15.6%; forwards: 17.8%).

Table 6: Most common injuries sustained and injuries causing the greatest burden (days lost) in the period 2008 to 2014.

<i>Backs</i>	<i>%</i>	<i>Forwards</i>	<i>%</i>
All Tournaments (2008 – 2014)			
Most common injuries, % of total number			
Ankle lateral collateral ligament sprain	7.9	Concussion	9.2
Concussion	7.9	Acromioclavicular joint injuries	8.1
Hamstring muscle strain	6.1	Shoulder dislocation/subluxation	8.1
Acromioclavicular joint sprain	5.5	Knee MCL sprain	7.0
Thigh haematoma	4.8	Inferior tib-fib syndesmosis sprain	7.0
Hand/finger fractures	4.8	Thigh haematoma	6.5
Injuries causing greatest burden, % of total days lost			
Anterior cruciate ligament sprain	17.9	Anterior cruciate ligament sprain	26.6
Shoulder dislocation/subluxation	15.6	Shoulder dislocation/subluxation	17.8
Inferior tib-fib syndesmosis sprain	6.8	Knee MCL sprain	8.4
Acromioclavicular joint sprain	6.1	Inferior tib-fib syndesmosis sprain	7.1
Hand/finger fractures	6.0	Acromioclavicular joint sprain	4.5
Hamstring muscle strain	5.4	Concussion	2.4

4.2f Nature of onset of injury

Table 7 summarises the nature of injury-onset at JWC Tournaments as a function of playing position.

Table 7: Nature of the injury-onset of all match injuries sustained in the period 2008 to 2014.

Nature of onset	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
All Tournaments (2008 – 2014)			
Acute	95.3 (92.2 – 98.5)	88.0 (83.3 – 92.6)	91.5 (88.6 – 94.3)
Gradual	4.7 (1.5 – 7.8)	12.0 (7.4 – 16.7)	8.5 (5.7 – 11.4)

Over 90% of all injuries sustained are acute injuries: there were significantly ($p=0.012$) fewer acute and more gradual onset injuries sustained by forwards than backs.

4.2g Cause of onset of injury

Table 8 summarises the cause of onset of match injuries at JWC Tournaments as a function of playing position.

Table 8: Cause of onset of all injuries sustained in the period 2008 to 2014.

Cause of onset	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
All Tournaments (2008 – 2014)			
Contact	85.5 (80.2 – 90.9)	90.7 (86.5 – 94.9)	88.3 (84.9 – 91.6)
Non-contact	13.9 (8.6 – 19.1)	9.3 (5.1 – 13.5)	11.5 (8.1 – 14.8)
Other	0.6 (0 – 1.8)	0.0 (-)	0.3 (0 – 0.8)

The majority of injuries sustained by backs and forwards are the result of contact events; there is no significant difference between backs and forwards in the proportions of contact and non-contact injuries.

4.2h Match events leading to injury

Table 9 provides a summary of the match events leading to injury as a function of playing position.

Being tackled (39.9%), tackling (20.2%) and collisions (14.9%) are the events responsible for the most injuries to backs and tackling (21.6%), being tackled (20.0%) and collisions (20.0%) to forwards.

Table 9: Match events leading to all injuries sustained in the period 2008 to 2014.

Cause of onset	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
All Tournaments (2008 – 2014)			
Collision	14.9 (9.5 – 20.3)	20.0 (14.2 – 25.8)	17.6 (13.6 – 21.5)
Kicking	1.2 (0 – 2.8)	0.0 (-)	0.6 (0 – 1.3)
Lineout	0.0 (-)	4.3 (1.4 – 7.3)	2.3 (0.7 – 3.8)
Maul	1.2 (0 – 2.8)	5.4 (2.1 – 8.7)	3.4 (1.5 – 5.3)
Ruck	7.7 (3.7 – 11.8)	12.4 (7.7 – 17.2)	10.2 (7.0 – 13.4)
Running	11.9 (7.0 – 16.8)	7.0 (3.3 – 10.7)	9.3 (6.3 – 12.4)
Scrum	0.0 (-)	5.4 (2.1 – 8.7)	2.8 (1.1 – 4.6)
Tackled	39.9 (32.5 – 47.3)	20.0 (14.2 – 25.8)	29.5 (24.7 – 34.2)
Tackling	20.2 (14.2 – 26.3)	21.6 (15.7 – 27.6)	21.0 (16.7 – 25.2)
Other	3.0 (0.4 – 5.5)	3.8 (1.0 – 6.5)	3.4 (1.5 – 5.3)

4.2i Time of injury

Table 10 provides a summary of the period in a match when injury events take place as a function of playing position.

Table 10: Time during matches of injuries sustained in the period 2008 to 2014.

Time of injury, min	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
All Tournaments (2008 – 2014)			
0-20	14.0 (8.8 – 19.2)	16.8 (11.5 – 22.2)	15.5 (11.8 – 19.2)
21-40+	30.4 (23.5 – 37.3)	31.6 (25.0 – 38.2)	31.0 (26.3 – 35.8)
41-60	33.9 (26.8 – 41.0)	32.6 (26.0 – 39.3)	33.2 (28.4 – 38.1)
61-80+	21.6 (15.5 – 27.8)	18.9 (13.4 – 24.50)	20.2 (16.1 – 24.4)

There are significantly more injuries sustained in the second and third quarters compared to the first and fourth quarters for both backs ($p < 0.001$) and forwards ($p < 0.001$) over the period 2008 to 2014.

4.2j Removal of injured players from the pitch

Based on all injuries sustained in the period 2008 to 2014, 33.5% of players were removed from play immediately, 34.9% were removed later in the game and 31.6% remained on the pitch until the end of the game. For players with concussion, however, 60.0% of players were removed immediately, 23.3% were removed later in the game and 16.7% remained on the pitch until the end of the game. Significantly more players with concussion are removed immediately from the pitch in JWC Tournaments compared with JWRT Tournaments (Fuller and Taylor, 2014).

5 Summary

The incidence and severity of injuries sustained in the JWC have not changed significantly in the period 2008 to 2014. Lower limb injuries, especially to the knee and ankle and joint (non-bone)/ligament injuries are the most common locations and types of injury. The most common specific injuries are ankle lateral collateral ligament sprains and concussion for backs and acromioclavicular joint injuries for forwards. Anterior cruciate ligament injuries and shoulder dislocation/subluxation cause the greatest burden in terms of days lost to injury. The great majority of injuries are acute in nature and result from contact game activities with the tackle the main source of injuries. Significantly more players with concussion are removed immediately from the pitch in JWC Tournaments compared with JWRT Tournaments.

The results presented here together with the results reported separately for the JWRT (Fuller and Taylor, 2014) provide benchmarks for the incidence, severity, nature and causes of injury in international U-20 rugby.

6. References

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