International Rugby Board

Surveillance Studies

Junior World Championship

Summary of Results: 2008 to 2013

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1 November 2013

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. The IRB Junior World Rugby Trophy (JWRT) represents the second tier of competition for international teams competing at U-20 level and injury epidemiology results for these Tournaments are presented in a separate report (Fuller and Taylor, 2013). A previous report summarised the incidence and nature of match injuries sustained during the IRB JWC in the period 2008 to 2012 (Fuller and Taylor, 2012). This review consolidates the previous information with data collected during the 2013 Tournament.

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 injury types 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 occur by chance due to the number of statistical comparisons being made in the study.

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3 Data collection

At the beginning of each 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; stature) 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 being the date that the player returned to normal training/match play.

4 Results

Details relating to previous JWC Tournaments have been presented in earlier reports (Fuller and Taylor, 2012). The IRB JWC 2013 Tournament took place in France from 5 to 23 June 2013. This study recorded players' anthropometric data and match injuries sustained by all 12 teams (Argentina, Australia, England, Fiji, France, Ireland, New Zealand, Samoa, Scotland, South Africa, USA, Wales) taking part in the 2013 Tournament.

Trends in anthropometric data and the incidence and mean severity of injury are reported over the period 2008 to 2013. All other parameters are presented as mean values over the 2008 - 2013 period in order to provide a comprehensive evaluation of the data according to the rugby consensus statement (Fuller et al., 2007).

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 2013 JWC Tournament together with mean values obtained for players over the period 2008 to 2013. 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, 2013).

Table 1: Players' anthropometric data for 2013 and the mean data for the period 2008 - 2013.

Year / Measure	**Mean** (*Standard deviation, number of players*)		
	Backs	***Forwards***	***ALL players***
2013			
Stature, cm	181.4 (6.2, 148)	187.6 (6.9, 189)	184.9 (7.3, 337)
Body mass, Kg	88.8 (7.6, 148)	107.0 (9.1, 189)	99.0 (12.4, 337)
Age, years	19.1 (0.66, 151)	19.2 (0.68, 190)	19.2 (0.67, 341)
ALL Tournaments (2008 – 2013)			
Stature, cm	181.8 (5.8, 750)	188.1 (6.9, 917)	185.2 (7.1, 1667)
Body mass, Kg	88.2 (7.5, 748)	106.2 (8.9, 916)	98.1 (12.2,1664)
Age, years	19.1 (0.97, 758)	19.2 (0.92, 921)	19.2 (0.94, 1679)

Trends in players' stature, body mass and age over the period 2008 to 2013 are presented for backs and forwards in Figures 1 - 3.

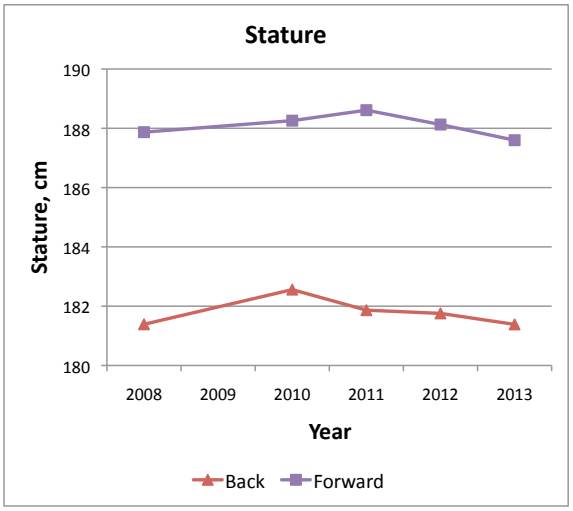

Figure 1. Trends in players' stature

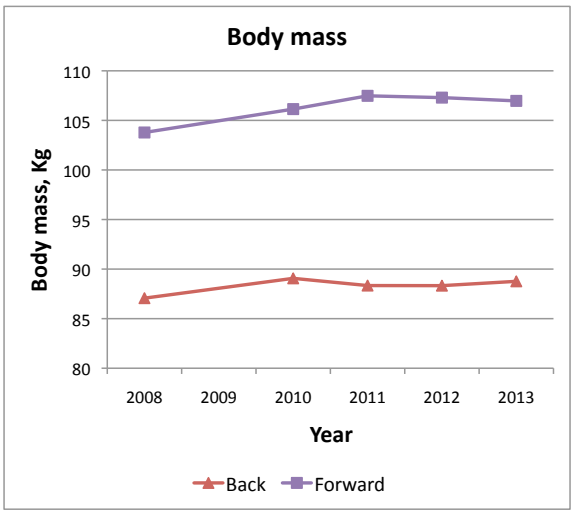

Figure 2. Trends in players' body mass

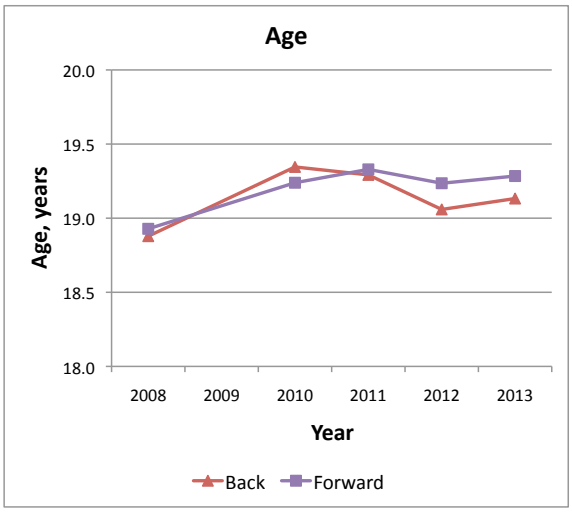

Figure 3. Trends in players' age

There have been no statistically significant changes in backs' or forwards' stature or body mass in the period 2008 to 2013.

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 2013 JWC Tournament together with the mean values for the period 2008 to 2013.

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*
2013			
Injuries	29	28	57
Exposure	560.0	640.0	1200.0
Incidence	51.8 (36.0 – 74.5)	43.8 (30.2 – 63.4)	47.5 (36.6 – 61.6)
ALL Tournaments (2008 – 2013)			
Injuries	146	175	321
Exposure	2846.7	3253.3	6100.0
Incidence	51.3 (43.6 – 60.3)	53.8 (46.4 – 62.4)	52.6 (47.2 – 58.7)

There are no significant differences in the incidences of injury between backs and forwards for either 2013 JWC or for the mean values over the period 2008 – 2013.

The incidences of injury recorded at JWC Tournaments are significantly lower (backs: $p<0.001$; forwards: $p<0.001$) than those recorded at the RWC (Fuller et al., 2012) but significantly higher (backs: $p=0.024$; forwards: $p=0.001$) than those recorded at JWRT Tournaments (Fuller and Taylor, 2013).

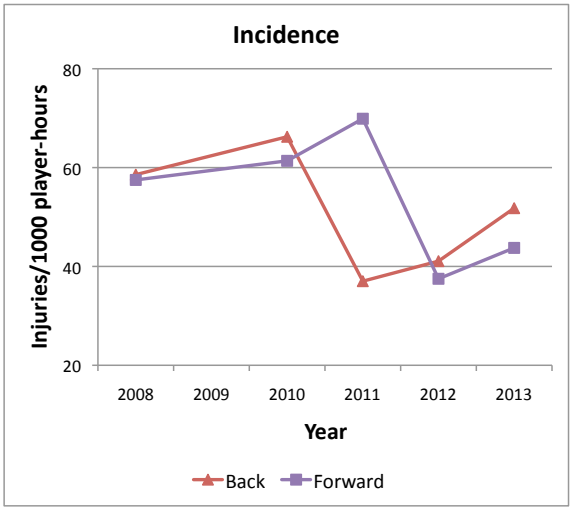

Figure 4. Trends in the incidence of injury

Trends in injury incidence for backs and forwards over the period 2008 to 2013 are presented in Figure 4. The downwards trend in the incidence of injury over the period 2008 to 2013 are not statistically significant for either backs or forwards.

4.2b Severity of injury

Table 3 summarises the mean and median severities of all injuries sustained at JWC Tournaments 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 the period 2008 to 2013.

Measure	***Severity (95% Confidence interval)**, days*		
	Backs	***Forwards***	***ALL players***
ALL Tournaments (2008 – 2013)			
Mean	26.7 (18.8 – 34.6)	37.1 (27.3 – 46.9)	32.3 (25.9 – 38.7)
Median	7 (6 - 9)	7 (5 – 11)	7 (6 - 10)

There are no significant differences in the mean or median severities of injuries sustained by forwards and backs at JWC and JWRT Tournaments (Fuller and Taylor, 2013).

Trends in the mean severities of injury for backs and forwards over the period 2008 to 2013 are presented in Figure 5.

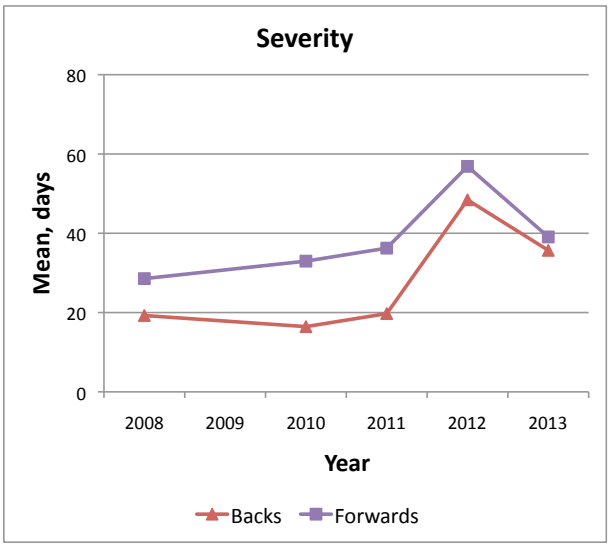

Figure 5. Trends in the mean severity of injury

There are no statistically significant trends in the mean severity of injury over time for either backs or forwards.

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 2013.

Location of injury	% (95% Confidence interval)		
	Backs	*Forwards*	*ALL players*
ALL Tournaments (2008 – 2013)			
Head/neck	8.5 (3.9 – 13.1)	13.4 (8.2 – 18.6)	11.1 (7.6 – 14.7)
Head/face	7.8 (3.4 – 12.2)	11.6 (6.7 – 16.5)	9.8 (6.5 – 13.2)
Neck/cerv[l] spine	0.7 (0 – 2.1)	1.8 (0 – 3.9)	1.3 (0 – 2.6)
Upper limbs	29.1 (21.6 – 36.6)	31.1 (24.0 – 38.2)	30.2 (25.0 – 35.3)
Shoulder/clavicle	18.4 (12.0 – 24.8)	24.4 (17.8 – 31.0)	21.6 (17.0 – 26.3)
Upper arm	0.0 (-)	0.6 (0 – 1.8)	0.3 (0 – 1.0)
Elbow	2.1 (0 – 4.5)	2.4 (0.1 – 4.8)	2.3 (0.6 – 4.0)
Forearm	0.0 (-)	0.0 (-)	0.0 (-)
Wrist	0.0 (-)	0.6 (0 – 1.8)	0.3 (0 – 1.0)
Hand/fingers	8.5 (3.9 – 13.1)	3.0 (0.4 – 5.7)	5.6 (3.0 – 8.1)
Trunk	8.5 (3.9 – 13.1)	7.3 (3.3 – 11.3)	7.9 (4.8 – 10.9)
Ribs/upper back	5.0 (1.4 – 8.5)	4.3 (1.2 – 7.4)	4.6 (2.2 – 6.9)
Abdomen	0.7 (0 – 2.1)	1.8 (0 – 3.9)	1.3 (0 – 2.6)
Low back	1.4 (0 – 3.4)	1.2 (0 – 2.9)	1.3 (0 – 2.6)
Sacrum/pelvis	1.4 (0 – 3.4)	0.0 (-)	0.7 (0 – 1.6)
Lower limbs	53.9 (45.7 – 62.1)	48.2 (40.5 – 55.8)	50.8 (45.2 – 56.4)
Hip/groin	5.0 (1.4 – 8.5)	1.8 (0 – 3.9)	3.3 (1.3 – 5.3)
Thigh, posterior	7.8 (3.4 – 12.2)	4.3 (1.2 – 7.4)	5.9 (3.3 – 8.5)
Thigh, anterior	2.1 (0 – 4.5)	6.7 (2.9 – 10.5)	4.6 (2.2 – 6.9)
Knee	13.5 (7.8 – 19.1)	15.2 (9.7 – 20.7)	14.4 (10.5 – 18.4)
L-Leg/Achilles	7.1 (2.9 – 11.3)	3.7 (0.8 – 6.5)	5.2 (2.7 – 7.7)
Ankle	14.9 (9.0 – 20.8)	13.4 (8.2 – 18.6)	14.1 (10.2 – 18.0)
Foot/toe	3.5 (0.5 – 6.6)	3.0 (0.4 – 5.7)	3.3 (1.3 – 5.3)

Based on the combined data, the majority of injuries sustained by backs are lower (53.9%) and upper (29.1%) limb injuries and for forwards the majority are also lower (48.2%) and upper (31.1%) limb injuries. The shoulder/clavicle is the most vulnerable sub-location for both backs (18.4%) and forwards (24.4%) followed by the ankle (14.9%) and knee (13.5%) for backs and the knee (15.2%) and ankle (13.4%) 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 2013.

Type of injury	% (95% Confidence interval)		
	Backs	***Forwards***	***ALL players***
ALL Tournaments (2008 – 2013)			
Bone	9.2 (4.4 – 14.0)	6.7 (2.9 – 10.5)	7.9 (4.8 – 10.9)
Fracture	8.5 (3.9 – 13.1)	3.0 (0.4 – 5.7)	5.6 (3.0 – 8.1)
Other bone	0.7 (0 – 2.1)	3.7 (0.8 – 6.5)	2.3 (0.6 – 4.0)
CNS/PNS	7.8 (3.4 – 12.2)	*9.8 5.7 – 12.0)*	*8.9 (5.7 – 12.0)*
Concussion	5.0 (1.4 – 8.5)	*7.9 (1.0 – 24.0)*	*6.6 (3.8 – 9.3)*
Nerve	2.8 (0.1 – 5.6)	1.8 (0 – 3.9)	2.3 (0.6 – 4.0)
Joint (non-bone)/lig[t]	43.3 (35.1 – 51.4)	*54.3 (46.6 – 61.9)*	*49.2 (43.6 – 54.8)*
Dislocation/sublux[n]	7.8 (3.4 – 12.2)	9.1 (4.7 – 13.6)	8.5 (5.4 – 11.7)
Lesion meniscus	1.4 (0 – 3.4)	4.3 (1.2 – 7.4)	3.0 (1.1 – 4.9)
Sprain/ligament	34.0 (26.2 – 41.9)	40.9 (33.3 – 48.4)	37.7 (32.3 – 43.1)
Muscle/tendon	*36.9 (28.9 – 44.8)*	*26.2 (19.5 – 33.0)*	*31.1 (26.0 – 36.3)*
Haematoma/etc	19.9 (13.3 – 26.4)	15.2 (9.7 – 20.7)	17.4 (13.2 – 21.6)
Muscle rupture/etc	12.8 (7.3 – 18.3)	8.5 (4.3 – 12.8)	10.5 (7.1 – 13.9)
Tendon injury/etc	4.3 (0.9 – 7.6)	2.4 (0.1 – 4.8)	3.3 (1.3 – 5.3)
Skin	2.1 (0 – 4.5)	3.0 (0.4 – 5.7)	*2.6 (0.8 – 4.4)*
Abrasion	0.0 (-)	0.6 (0 – 1.8)	0.3 (0 – 1.0)
Laceration	2.1 (0 – 4.5)	2.4 (0.1 – 4.8)	2.3 (0.6 – 4.0)
Other types	0.7 (0 – 2.1)	0.0 (-)	0.3 (0 – 1.0)
Other	0.7 (0 – 2.1)	0.0 (-)	0.3 (0 – 1.0)

CNS/PNS: Central and peripheral nervous systems

Joint (non-bone)/ligament (43.3%) and muscle/tendon (36.9%) injuries are the most common type of injury sustained by backs and joint (non-bone)/ligament (54.3%) and muscle/tendon (26.2%) the most common by forwards. Sprain/ligament (34.0%) and muscle haematoma (19.9%) are the most common specific types of injury sustained by backs and sprain/ligament (40.9%) and muscle haematoma (15.2) 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.

4.2e Most common and highest risk injuries

The most common specific injuries sustained by backs are ankle lateral collateral ligament sprains (7.1%), hamstring muscle injury (5.8%), acromioclavicular joint sprains (5.8%), concussion (4.5%) and knee medial collateral ligament sprains (3.2%). For forwards, the most common are concussion (8.2%), acromioclavicular joint injuries (8.2%), ankle inferior tibiofibular syndesmosis sprains (7.5%), quadriceps haematomas (6.9%) and knee medial collateral ligament sprains (5.0%).

Injuries creating the largest injury burden (incidence x severity) for backs are anterior cruciate ligament injuries (20.8%), shoulder dislocation/subluxation (18.2%), acromioclavicular joint injuries (7.1%), hamstring muscle injuries (6.2%) and hand fractures (5.8%). For forwards, the greatest injury burden is caused by

anterior cruciate ligament injuries (25.2%), shoulder dislocation/subluxation (16.5%), inferior tibia-fibula syndesmosis (7.9%), knee medial collateral ligament injuries (7.3%) and acromioclavicular joint sprains (3.6%).

4.2f Nature of onset of injury

Table 6 summarises the nature of injury-onset at JWC Tournaments as a function of playing position.

Table 6: Nature of the injury-onset of all match injuries sustained in the period 2008 to 2013.

Nature of onset	*% (95% Confidence interval)*		
	Backs	***Forwards***	***ALL players***
All Tournaments (2008 – 2013)			
Acute	96.5 (93.4 – 99.5)	88.5 (83.6 – 93.4)	92.2 (89.1 – 95.2)
Gradual	3.5 (0.5 – 6.6)	11.5 (6.6 – 16.4)	7.8 (4.8 – 10.9)

Over 90% of all injuries sustained are acute injuries: there were statistically significant (p=0.008) fewer acute and more gradual onset injuries sustained by forwards than backs.

4.2g Cause of onset of injury

Table 7 summarises the cause of onset of match injuries at JWC Tournaments as a function of playing position.

Table 7: Cause of onset of all injuries sustained in the period 2008 to 2013.

Cause of onset	*% (95% Confidence interval)*		
	Backs	***Forwards***	***ALL players***
All Tournaments			
Contact	83.2 (77.0 – 89.5)	91.8 (87.5 – 96.1)	87.8 (84.1 – 91.5)
Non-contact	16.1 (9.9 – 22.2)	8.2 (3.9 – 12.5)	11.9 (8.2 – 15.6)
Other	0.7 (0 – 2.2)	0.0 (-)	0.3 (0 – 1.0)

The majority of injuries sustained by backs (83.2%) and forwards (91.8%) are caused by contact events; there is no significant difference in the proportions of contact and non-contact injuries sustained by backs and forwards. There are no significant differences in the cause of injury-onset at JWC compared with JWRT Tournaments.

4.2h Match events leading to injury

Table 8 provides a summary of the match events leading to injury as a function of playing position.

Being tackled (37.7%) and tackling (20.3%) are the events responsible for the most injuries to backs and tackling (21.4%) and collisions (20.8%) the events responsible for most injuries to forwards.

Table 8: Match events leading to all injuries sustained in the period 2008 to 2013.

Cause of onset	% (95% Confidence interval)		
	Backs	*Forwards*	*ALL players*
All Tournaments			
Collision	15.2 (9.2 – 21.2)	20.8 (14.5 – 27.1)	18.2 (13.8 – 22.6)
Kicking	1.4 (0 – 3.4)	0.0 (-)	0.7 (0 – 1.6)
Lineout	0.0 (-)	3.8 (0.8 – 6.7)	2.0 (0.4 – 3.6)
Maul	1.4 (0 – 3.4)	6.3 (2.5 – 10.1)	4.0 (1.8 – 6.3)
Ruck	7.2 (2.9 – 11.6)	14.5 (9.0 – 19.9)	11.1 (7.5 – 14.7)
Running	13.8 (8.0 – 19.5)	6.3 (2.5 – 10.1)	9.8 (6.4 – 13.1)
Scrum	0.0 (-)	5.7 (2.1 – 9.3)	3.0 (1.1 – 5.0)
Tackled	37.7 (29.6 – 45.8)	18.2 (12.2 – 24.2)	27.3 (22.2 – 32.3)
Tackling	20.3 (13.6 – 27.0)	21.4 (15.0 – 27.8)	20.9 (16.3 – 25.5)
Other	2.9 (0.1 – 5.7)	3.1 (0.4 – 5.9)	3.0 (1.1 – 5.0)

4.2i Time of injury

Table 9 provides a summary of the period in a match when injury events take place as a function of playing position.

Table 9: Time during matches of injuries sustained in the period 2008 to 2013.

Time of injury, min	% (95% Confidence interval)		
	Backs	*Forwards*	*ALL players*
All Tournaments			
0-20	14.9 (9.0 – 20.8)	16.3 (10.7 – 21.9)	15.6 (11.6 – 19.7)
21-40+	29.1 (21.6 – 36.6)	31.3 (24.3 – 38.4)	30.3 (25.2 – 35.4)
41-60	29.8 (22.2 – 37.3)	30.7 (23.7 – 37.7)	30.3 (25.2 – 35.4)
61-80+	26.2 (19.0 – 33.5)	21.7 (15.4 – 28.0)	23.8 (19.0 – 28.5)

There are no statistically significant differences in the proportions of injuries sustained during each quarter for either backs or forwards.

4.2j Removal of injured players from the pitch

For all injuries, 33.9% of players were removed from play immediately, 34.9% were removed later in the game and 31.3% remained on the pitch until the end of the game. For players with concussion, 50.0% of players were removed immediately, 25.0% were removed later in the game and 25.0% remained on the pitch until the end of the game.

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5 Summary

JWC U-20 players are significantly taller and heavier than players competing in JWRT Tournaments (Fuller and Taylor, 2013).

The status of the JWC as the first tier of U-20 competition compared to the second tier U-20 JWRT competition is reflected in the higher incidence of injury sustained in JWC Tournaments. The severity of injuries sustained in JWC Tournaments is similar to injuries sustained during JWRT Tournaments. The most common injury location is the lower limb and the most common type of injury a joint (non-bone)/ligament injury for both backs and forwards.

The results presented here together with the results reported separately for the JWRT (Fuller and Taylor, 2013) provide the best available benchmark for the incidence, severity, nature and causes of injury for international U-20 rugby.

6. References

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