



International Rugby Board

Surveillance Studies

Women's Rugby World Cup

Summary of Results: 2010 and 2014

Colin Fuller and Aileen Taylor

1 December 2014

1 Introduction

The IRB is committed to implementing surveillance studies 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.

Women's Rugby is receiving greater attention, which increases the importance of collecting and analysing injury data in order that injury prevention strategies can be developed specifically for the women's game. This is the first IRB report related to the injury epidemiology for the Women's Rugby World Cup (WRWC): this report presents the results from the 2014 Tournament and provides a summary of the cumulative results for the 2010 and 2014 WRWC Tournaments. The results for the 2010 WRWC were previously published in the British Journal of Sports Medicine (Taylor et al., 2011).

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 the Women's Rugby World Cup in a training session or match that prevents a player from taking a full part in all training activities and/or match play for more than one day following the day of injury*'. 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*'. Specific injuries were classified using OSICS 8 (Orchard, 1995). Injury location, type and cause together with the event leading to the injury were also recorded.

Illnesses and injuries not related directly to rugby-related activities are not included in this study.

Injury severity was determined by the number of days a player was injured: a player was deemed to be 'injured' until she could undertake full, normal training and be available for match selection, whether or not she 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 up after each Tournament to obtain their return to play date: return to play dates for players with injuries that remained unresolved 90 days after the final game were estimated on the basis of the player's medical staff's clinical judgement and prognosis.

The complete lists of categories and sub-categories used for categorising injury locations and injury types are provided in the rugby injury epidemiology 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. Differences in injury numbers were assessed using the chi-squared test. Statistical significance was accepted at the $p=0.05$ 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.

3 Data collection

Before the start of the WRWC, the team's medical staff explained to squad players 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 country's squad at a later date were added to the 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 injury sustained during the WRWC on a Tournament Summary of Injuries Report Form, which was returned to the study co-ordinator at 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). Injury Report Forms were returned to the study co-ordinator when the final piece of information had been entered on the Form (normally the date that the player returned to training/match play).

4 Results

Details relating to eleven countries competing at the 2010 WRWC were presented in an earlier published research paper (Taylor et al, 2011). The 2014 WRWC took place in France from 1 to 17 August 2014. This study reports players' anthropometric data and match injuries sustained by ten (Australia, Canada, England, Ireland, New Zealand, Samoa, South Africa, Spain, USA and Wales) of the twelve competing countries (France and Kazakhstan did not provide data). Information for players' anthropometric data and the incidence and severity of injury are reported for the 2014 WRWC and for the combined data from the 2010 and 2014 WRWC. Because of the relatively small number of injuries reported, information for all other issues is only reported for the 2010 and 2014 combined data.

4.1 Players' anthropometric data

Table 1 summarises the numbers and anthropometric data for players categorised as backs, forwards and all players in the 2014 WRWC together with values averaged over the 2010 and 2014 WRWC.

Table 1: Players' anthropometric measurements: 2014 WRWC and combined 2010 and 2014 WRWC data.

Tournament/ Measure	Mean (Standard deviation, number of players)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
2014			
Stature, cm	166.8 (5.8, 120)	171.6 (6.9, 140)	169.4 (6.8, 260)
Body mass, Kg	69.2 (8.6, 120)	80.6 (9.2, 140)	75.3 (10.6, 260)
Age, years	26.9 (4.2, 120)	28.3 (4.0, 140)	27.6 (4.2, 260)
Combined 2010 and 2014			
Stature, cm	166.5 (5.8, 251)	171.5 (6.9, 293)	169.2 (6.9, 544)
Body mass, Kg	68.1 (7.6, 252)	79.9 (8.6, 293)	74.5 (10.1, 545)
Age, years	26.6 (4.3, 252)	28.1 (4.2, 293)	27.4 (4.3, 545)

For both the 2014 WRWC data and the combined 2010 and 2014, forwards were significantly older ($p < 0.001$), heavier ($p < 0.001$) and taller ($p < 0.001$) than backs.

4.2 Match injuries

4.2a Incidence of injury

Table 2 summarises the numbers of match injuries, match exposures and incidence of match injuries for backs, forwards and all players during the 2014 WRWC together with values averaged over the 2010 and 2014 WRWC.

Table 2: Number, match exposure (player-hours) and incidence (injuries/1000 player-match-hours, 95% confidence interval) of match injuries: 2014 WRWC and combined 2010 and 2014 WRWC data.

Tournament/ Measure	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
2014			
Injuries	20	22	42
Exposure	466.7	533.3	1000.0
Incidence	42.9 (27.6 – 66.4)	41.3 (27.2 – 62.6)	42.0 (31.0 – 56.8)
Combined 2010 and 2014			
Injuries	41	40	81
Exposure	980.0	1120.0	2100.0
Incidence	41.8 (30.8 – 56.8)	35.7 (26.2 – 48.7)	38.6 (31.0 – 48.0)

There were no significant differences in the incidences of injury for backs and forwards for the 2014 WRWC ($p = 0.904$) or for the combined 2011/2014 data ($p = 0.478$).

4.2b Severity of injury

Table 3 summarises the mean and median severities of injuries sustained during the 2014 WRWC for backs, forwards and all players together with values averaged over the 2010 and 2014 WRWC.

Table 3: Mean and median severities of match injuries: 2014 WRWC and combined 2010 and 2014 WRWC data.

Tournament/ Measure	Severity (95% Confidence interval), days		
	Backs	Forwards	ALL players
2014			
Mean	51.6 (11.0 – 92.2)	37.8 (12.9 – 62.7)	44.4 (21.2 – 67.5)
Median	7 (6 - 120)	9 (6 - 34)	7 (6 - 20)
Combined 2010 and 2014			
Mean	65.5 (32.4 – 98.5)	33.1 (15.7 – 50.4)	49.5 (30.5 – 68.5)
Median	9 (6 – 30)	7 (5 – 18)	7 (6 – 11)

There are no statistically significant differences in the mean or median severities of injuries sustained by backs and forwards.

4.2c Location of injury

Table 4 summarises the locations of injuries sustained by backs, forwards and all players during the 2010 and 2014 WRWC. The numbers of injuries reported are too small to give meaningful values for individual tournament.

Table 4: Locations of match injuries: combined 2010 and 2014 WRWC data.

Tournament/ Location of injury	% (95% Confidence interval)		
	Backs	Forwards	ALL players
Combined 2010 and 2014			
Head/neck	29.3 (15.3 – 43.2)	22.5 (9.6 – 35.4)	25.9 (16.4 – 35.5)
Head/face	24.4 (11.2 – 37.5)	17.5 (5.7 – 29.3)	21.0 (12.1 – 29.9)
Neck/cerv ¹ spine	4.9 (0 – 11.5)	5.0 (0 – 11.8)	4.9 (0.2 – 9.7)
Upper limbs	14.6 (3.8 – 25.5)	25.0 (11.6 – 38.4)	19.8 (11.1 – 28.4)
Shoulder/clavicle	9.8 (0.7 – 18.8)	10.0 (0.7 – 19.3)	9.9 (3.4 – 16.4)
Elbow	0.0 (-)	2.5 (0 – 7.3)	1.2 (0 – 3.6)
Wrist	2.4 (0 – 7.2)	2.5 (0 – 7.3)	2.5 (0 – 5.8)
Hand/fingers	2.4 (0 – 7.2)	10.0 (0.7 – 19.3)	6.2 (0.9 – 11.4)
Trunk	7.3 (0 – 15.3)	7.5 (0 – 15.7)	7.4 (1.7 – 13.1)
Ribs/upper back	2.4 (0 – 7.2)	0.0 (-)	1.2 (0 – 3.6)
Abdomen	4.9 (0 – 11.5)	0.0 (-)	2.5 (0 – 5.8)
Low back	0.0 (-)	7.5 (0 – 15.7)	3.7 (0 – 7.8)
Lower limbs	48.8 (33.5 – 64.1)	45.0 (29.6 – 60.4)	46.9 (36.0 – 57.8)
Hip/groin	0.0 (-)	7.5 (0 – 15.7)	3.7 (0 – 7.8)
Thigh, anterior	2.4 (0 – 7.2)	5.0 (0 – 11.8)	3.7 (0 – 7.8)
Thigh, posterior	2.4 (0 – 7.2)	0.0 (-)	1.2 (0 – 3.6)
Knee	26.8 (13.3 – 40.4)	20.0 (7.6 – 32.4)	23.5 (14.2 – 32.7)
L-Leg/Achilles	4.9 (0 – 11.5)	5.0 (0 – 11.8)	4.9 (0.2 – 9.7)
Ankle	12.2 (2.2 – 22.2)	7.5 (0 – 15.7)	9.9 (3.4 – 16.4)

The majority of injuries sustained by both backs (48.8%) and forwards (45.0%) were located in the lower limbs. Overall, the knee (26.8%), head/face (24.4%) and ankle (12.2%) were the most vulnerable locations for backs while for forwards the most vulnerable were the knee (20.0%), head/face (17.5%), shoulder/clavicle

(10.0%) and hand/fingers (10.0%). There are no statistically significant differences between backs and forwards for the sub-locations injured.

4.2d Type of injury

Table 5 summarises the types of injuries sustained by backs, forwards and all players during the 2010 and 2014 WRWC. The numbers of injuries reported remain too small to give meaningful values just for individual tournaments.

Table 5: Types of match injuries: combined 2010 and 2014 WRWC data.

Tournament/ Type of injury	% (95% Confidence interval)		
	Backs	Forwards	ALL players
Combined 2010 and 2014			
Bone	12.2 (2.2 – 22.2)	17.5 (5.7 – 29.3)	14.8 (7.1 – 22.6)
Fracture	12.2 (2.2 – 22.2)	15.0 (3.9 – 26.1)	13.6 (6.1 – 21.0)
Other bone	0.0 (-)	2.5 (0 – 7.3)	1.2 (0 – 3.6)
CNS/PNS	17.1 (5.6 – 28.6)	7.5 (0 – 15.7)	12.3 (5.2 – 19.5)
Concussion	17.1 (5.6 – 28.6)	7.5 (0 – 15.7)	12.3 (5.2 – 19.5)
Nerve	0.0 (-)	0.0 (-)	0.0 (-)
Joint (non-bone)/lig^t	36.6 (21.8 – 51.3)	47.5 (32.0 – 63.0)	42.0 (31.2 – 52.7)
Dislocation/sublux ⁿ	2.4 (0 – 7.2)	0.0 (-)	1.2 (0 – 3.6)
Lesion meniscus	4.9 (0 – 11.5)	7.5 (0 – 15.7)	6.2 (0.9 – 11.4)
Sprain/ligament	29.3 (15.3 – 43.2)	40.0 (24.8 – 55.2)	34.6 (24.2 – 44.9)
Muscle/tendon	29.3 (15.3 – 43.2)	17.5 (5.7 – 29.3)	23.5 (14.2 – 32.7)
Haematoma/etc	7.3 (0 – 15.3)	12.5 (2.3 – 22.7)	9.9 (3.4 – 16.4)
Muscle rupture/etc	12.2 (2.2 – 22.2)	0.0 (-)	6.2 (0.9 – 11.4)
Tendon injury/etc	9.8 (0.7 – 18.8)	5.0 (0 – 11.8)	7.4 (1.7 – 13.1)
Skin	2.4 (0 – 7.2)	2.5 (0 – 7.3)	2.5 (0 – 5.8)
Laceration	2.4 (0 – 7.2)	2.5 (0 – 7.3)	2.5 (0 – 5.8)
Other injuries	2.4 (0 – 7.2)	7.5 (0 – 15.7)	4.9 (0.2 – 9.7)
Dental	0.0 (-)	2.5 (0 – 7.3)	1.2 (0 – 3.6)
Visceral	2.4 (0 – 7.2)	2.5 (0 – 7.3)	2.5 (0 – 5.8)
Other injuries	0.0 (-)	2.5 (0 – 7.3)	1.2 (0 – 3.6)

CNS/PNS: Central and peripheral nervous systems

The majority of injuries sustained by backs (36.6%) and forwards (47.5%) were joint (non-bone)/ligament injuries. For backs, sprain/ligament (29.3%) and concussion (17.1%) were the most common types of injury; while, for forwards, the most common injuries were sprain/ligament (40.0%) and fracture (15.0%).

4.2e Most common and highest risk injuries

The most common specific injuries sustained by backs during the 2010 and 2014 WRWC were concussion (17.5%) and ankle lateral ligament sprain (10.0%); for forwards, the most common were knee medial collateral ligament sprain (12.5%), concussion (7.5%) and ankle lateral ligament sprain (7.5%).

For backs, the injuries causing the greatest number of days absence were anterior cruciate ligament injuries (35.6% of all days lost by backs), knee cartilage damage

(13.9%) and shoulder dislocations (9.4%). For forwards, the highest risk injuries were anterior cruciate ligament injuries (28.1% of all days lost by forwards), knee medial collateral ligament rupture (15.2%) and fractured tibia/fibula (13.6%).

4.2f Nature of onset of injury

Table 6 summarises the nature of the onset of injuries sustained during the 2010 and 2014 WRWC by backs, forwards and all players.

Table 6: Nature of onset of match injuries: combined 2010 and 2014 WRWC data.

Tournament/ Nature of onset	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
Combined 2010 and 2014			
Acute	92.7 (84.7 – 100)	87.5 (77.3 – 97.7)	90.1 (83.6 – 96.6)
Gradual	7.3 (0 – 15.3)	12.5 (2.3 – 22.7)	9.9 (3.4 – 16.4)

Over 90% of all injuries sustained were acute in nature.

4.2g Cause of onset of injury

Table 7 summarises the cause of the onset of injuries sustained during the 2010 and 2014 WRWC by backs, forwards and all players.

Table 7: Cause of onset of match injuries: combined 2010 and 2014 WRWC data.

Tournament/ Cause of onset	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
Combined 2010 and 2014			
Contact	89.5 (79.7 – 99.2)	87.2 (76.7 – 97.7)	88.3 (81.1 – 95.5)
Non-contact	7.9 (0 – 16.5)	5.1 (0 – 12.1)	6.5 (1.0 – 12.0)
Other	2.6 (0 – 7.7)	7.7 (0 – 16.1)	5.2 (0.2 – 10.2)

Eighty-eight per cent of all injuries were the result of contact activities.

4.2h Match events leading to injury

Table 8 summarises the specific match activities causing the injuries sustained by backs, forwards and all players.

Being tackled (49.0%) and tackling (29.4%) were the events responsible for the most injuries to backs; being tackled (42.3%) and tackling (34.6%) were also the events responsible for most injuries to forwards.

Table 8: Match events leading to injury: combined 2010 and 2014 WRWC data.

Tournament/ Cause of onset	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
Combined 2010 and 2014			
Collision	13.2 (2.4 – 23.9)	17.9 (5.9 – 30.0)	15.6 (7.5 – 23.7)
Lineout	0.0 (-)	2.6 (0 – 7.5)	1.3 (0 – 3.8)
Maul	2.6 (0 – 7.7)	5.1 (0 – 12.1)	3.9 (0 – 8.2)
Ruck	15.8 (4.2 – 27.4)	17.9 (5.9 – 30.0)	16.9 (8.5 – 25.3)
Running	7.9 (0 – 16.5)	5.1 (0 – 12.1)	6.5 (1.0 – 12.0)
Scrum	0.0 (-)	2.6 (0 – 7.5)	1.3 (0 – 3.8)
Tackled	36.8 (21.5 – 52.2)	25.6 (11.9 – 39.3)	31.2 (20.8 – 41.5)
Tackling	21.1 (8.1 – 34.0)	15.4 (4.1 – 26.7)	18.2 (9.6 – 26.8)
Other	2.6 (0 – 7.7)	7.7 (0 – 16.1)	5.2 (0.2 – 10.2)

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 injuries are sustained during matches: combined 2010 and 2014 WRWC data.

Time of injury, min	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
Combined 2010 and 2014			
0 – 20	7.7 (0 – 16.1)	15.4 (4.1 – 26.7)	11.5 (4.4 – 18.6)
21 – 40+	35.9 (20.8 – 51.0)	20.5 (7.8 – 33.2)	28.2 (18.2 – 38.2)
41 – 60	15.4 (4.1 – 26.7)	33.3 (18.5 – 48.1)	24.4 (14.8 – 33.9)
61 – 80+	41.0 (25.6 – 56.5)	30.8 (16.3 – 45.3)	35.9 (25.3 – 46.5)

Significantly fewer injuries were sustained in the first quarter of a match compared to the other three quarters.

4.3 Training injuries

Training injuries were recorded for the first time during the 2014 WRWC. Seven training injuries were reported: match-day warm-up and cool-down activities: 4; non-match-day training activities: 3 (full-contact training: 1; semi-contact: 2). A total of 974.3 player-hours of match-day-warm-up and cool-down and 3,571.4 player-hours of non-match-day training were recorded. These correspond to incidences of 4.1 warm-up/cool-down injuries/1000 player-hours of match-day warm-up/cool-down and 0.8 training injuries/1000 player-hours of non-match-day training.

5 Key conclusions

While the amount of injury data available for women's international Rugby-15s remains small compared to the amount available for men's international Rugby-15s, the level of information now available from the 2010 and 2014 WRWCs is starting to provide important information. As the level of knowledge increases further, more evidenced-based decisions about the risk of injury in the women's game will become possible. Comparative data for women's Rugby-7s, which are referred to below, are available on the World Rugby Player Welfare web pages (Fuller and Taylor, 2014).

Based on the combined data from the 2010 and 2014 WRWCs, the following general conclusions can be reached about the risk of injury in women's elite Rugby-15s:

- Forwards are significantly older, taller and heavier than backs. Women's Rugby-15s players are also significantly older, and heavier than women's Rugby-7s players.
- The incidence of injury in women's Rugby-15s (38.6 injuries/1000 player-hours) is significantly lower than that seen in women's Rugby-7s (94.7 injuries/1000 player-hours).
- The mean injury severity in Rugby-15s (49.5 days) is similar to that observed in Rugby-7s (55.8 days); however, the median severity of injuries in Rugby-15s (7 days) is significantly lower than that seen in Rugby-7s (34 days).
- The distribution of injury locations is similar for Rugby-15s and Rugby-7s.
- The distribution of injury types is similar for Rugby-15s and Rugby-7s.
- The distributions of acute/gradual onset and contact/non-contact injuries are similar in Rugby-15s and Rugby-7s.
- Being-tackled and tackling are the major match events causing injury in both Rugby-15s and Rugby-7s; however, there are more injuries sustained in collisions and rucks in Rugby-15s compared to Rugby-7s.
- The incidence of injury during warming-up and cooling-down activities is significantly higher in Rugby-15s compared to Rugby-7s.

6. References

- Taylor A, Fuller CW, Molloy MG. Injury surveillance during the 2010 IRB Women's Rugby World Cup. *Br J Sports Med* 2011;**45**:1243-5.
- Fuller CW, Molloy MG, Bagate C, et al. Consensus statement on injury definitions and data collection procedures for studies of injuries in rugby union. *Br J Sports Med* 2007;**41**:328-331.
- Fuller CW and Taylor A. Women's Sevens world Series: Summary of Results: 2011/12 to 2013/14. Available on World Rugby Player Welfare site: www.irbplayerwelfare.com.
- Orchard J. Orchard Sports Injury Classification System (OSICS). *Sport Health* 1995;**11**:39-41.

7. Acknowledgements

The authors acknowledge the valuable support provided by many team physicians and physiotherapists during the collection of the data analysed in this report. Unfortunately, the authors are not always aware of the specific people providing the data, as many medical teams change from Tournament-to-Tournament and Series-to-Series. The authors would therefore like to apologise if anyone who provided data for the study is not included in the list of acknowledgements below:

Australia:	Sharon Stay
Canada:	Adrienne Stinson
England:	Justin Hughes
Ireland:	Brigid Collins
New Zealand:	Kirsty Stewart
Samoa:	Neru Leavasa
South Africa:	Jerome Mampane
Spain:	Jose Luis Bada
USA:	Katie Gloyer
Wales:	Gary Ahmed