



World Rugby

Surveillance Studies

World Rugby U20 Championship

Summary of Results: 2008 to 2016

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1 Introduction

World Rugby is committed to implementing surveillance studies at all major World Rugby 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 World Rugby's Chief Medical Officer.

Previous surveillance studies of the World Rugby U20 Championship (previously known as the Junior World Championship) reported the incidence and nature of match injuries sustained during tournaments from 2008 to 2015 (Fuller and Taylor, 2015). The current report continues the on-going study of the World Rugby U20 Championship (WRC) by reporting match injuries sustained during the 2016 tournament.

This review also combines the new data, obtained from the 2016 tournament, with data reported previously in order to provide an updated review of the risks of injury in the World Rugby U20 Championship.

2 Methods

All studies were conducted in accordance with the definitions and protocols described in the World Rugby 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 WRC 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 WRC 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 players' fitness to train/play on those days when players were not scheduled to train or play. Injured players were followed up after the tournament to obtain their return-to-play date. The return-to-play dates for players with injuries that remained unresolved 90 days after the final match 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 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 WRC 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 injury sustained during a WRC 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). Injury Report Forms were returned to the study co-ordinator when the final piece of information had been entered on the Form (normally the return-to-play date).

4 Results

Results for previous WRC tournaments (2008 to 2015) were presented in an earlier report (Fuller and Taylor, 2015).

The 2016 WRC tournament took place in England from 7 to 25 June 2016. This study recorded players' anthropometric data and match injuries sustained by 11 (Argentina, Australia, England, Georgia, Ireland, Italy, Japan, New Zealand, Scotland, South Africa, Wales) of the 12 countries taking part in the 2016 tournament.

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 2016 WRC tournament together with average values obtained for players over the period 2008 to 2016. Forwards are significantly heavier ($p < 0.001$) and taller ($p < 0.001$) than backs but there is no statistically significant difference between the ages of backs and forwards.

Table 1: Players' anthropometric data for 2016 and the average values for the period 2008 - 2016.

Year / Measure	Mean (Standard deviation, number of players)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
2016			
Stature, cm	181.6 (6.0, 143)	188.1 (7.1, 176)	185.2 (7.4, 319)
Body mass, Kg	87.6 (8.0, 143)	108.5 (9.4, 176)	99.1 (13.7, 319)
Age, years	19.0 (0.68, 143)	19.1 (0.66, 176)	19.1 (0.67, 319)
ALL tournaments (2008 – 2016)			
Stature, cm	181.7 (5.8, 1181)	188.1 (6.9, 1461)	185.2 (7.2, 2642)
Body mass, Kg	88.3 (7.6, 1179)	106.7 (9.0, 1460)	98.5 (12.4, 2639)
Age, years	19.1 (0.88, 1191)	19.2 (0.84, 1466)	19.1 (0.85, 2657)

Trends in players' stature and body mass over the period 2008 to 2016 are presented for backs and forwards in Figures 1 and 2.

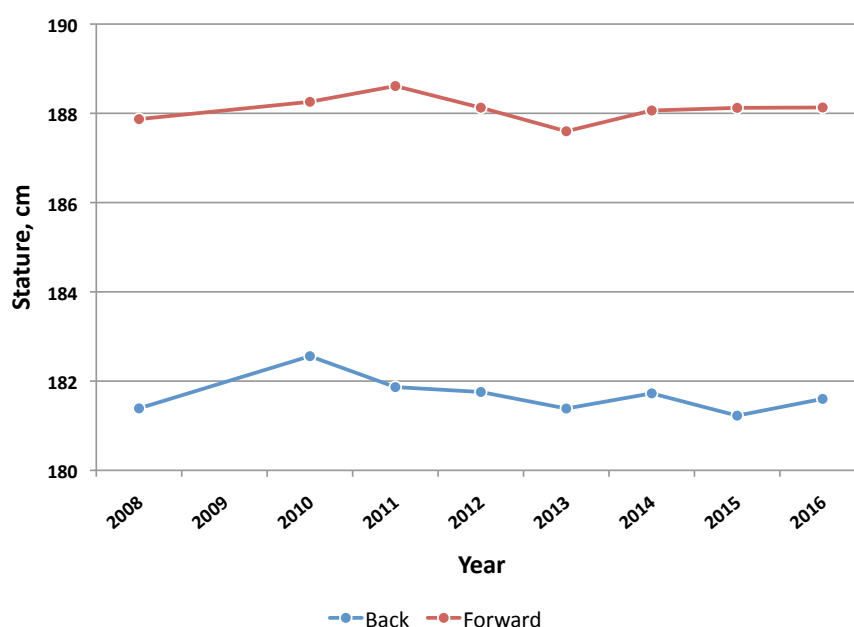


Figure 1. Trends in players' stature, 2008 to 2016

At the present time there is no evidence that backs ($p=0.399$) or forwards ($p=0.902$) have been getting taller over the period 2008 to 2016.

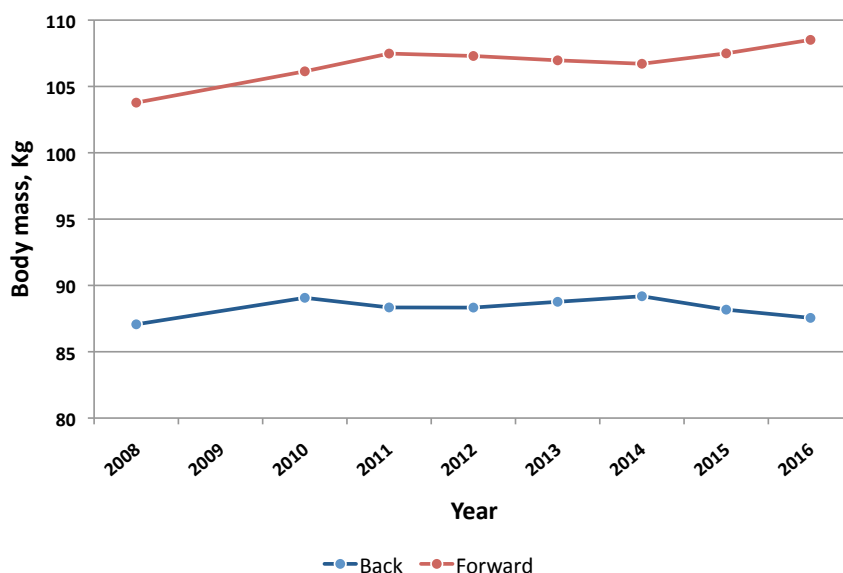


Figure 2. Trends in players' body mass, 2008 to 2016

There is no evidence that backs have been getting heavier ($p=0.702$) over the period 2008 to 2016 but there is a small, statistically significant trend indicating that forwards are getting heavier ($p=0.011$). However, if the data for the 2008 tournament, when players were 1 year younger are excluded, the increasing trend in body mass does not reach statistical significance ($p=0.092$).

4.2 Match injuries

4.2a Incidence of injury

Table 2 summarises the numbers of match injuries, match exposures and incidences of match injuries for backs, forwards and all players during the 2016 WRC tournament together with the average values for the period 2008 to 2016.

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
2016			
Injuries	17	29	46
Exposure	513.3	586.7	1100.0
Incidence	33.1 (20.6 – 53.3)	49.4 (34.4 – 71.1)	41.8 (31.3 – 55.8)
ALL tournaments (2008 – 2016)			
Injuries	218	272	490
Exposure	4433.3	5066.7	9500.0
Incidence	49.2 (43.1 – 56.2)	53.7 (47.7 – 60.5)	51.6 (47.2 – 56.4)

There are no significant differences between the incidences of injury recorded for backs and forwards during the 2016 WRC ($p=0.190$) or for the average values observed over the period 2008 to 2016 ($p=0.337$).

Trends in the incidence of injury over the period 2008 to 2016 are presented for backs and forwards in Figure 3.

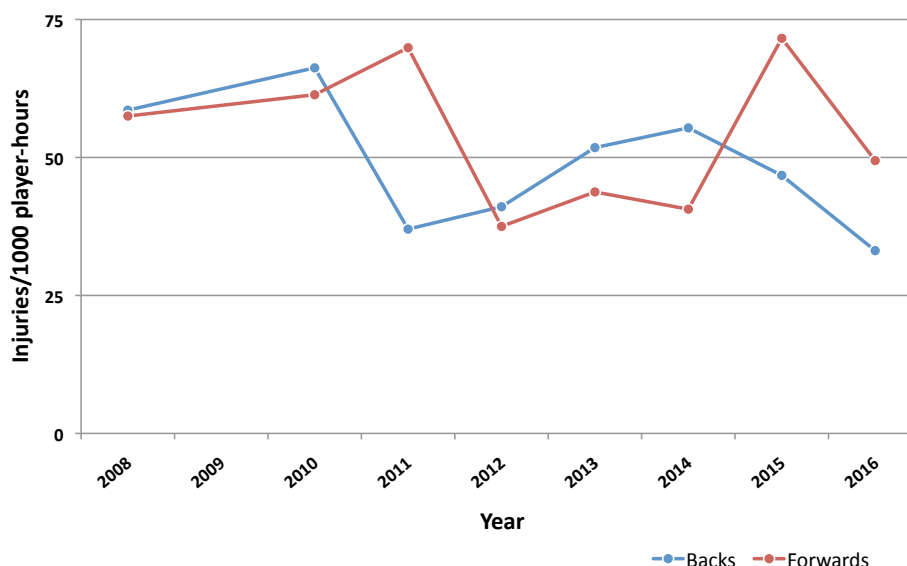


Figure 3. Trends in the incidence of injury, 2008 to 2016

There are no statistically significant trends in the incidence of injury for either backs ($p=0.166$) or forwards ($p=0.649$) over the period 2008 to 2016.

4.2b Severity of injury

Table 3 summarises the mean and median severities of all injuries sustained at the 2016 WRC tournament and over the period 2008 to 2016 as a function of playing position. Based on the 'All tournament' injury data, there are no significant differences between backs and forwards for either the mean ($p=0.073$) or median ($p=0.716$) severity of injury.

Table 3: Mean and median severity of all match injuries sustained during the 2016 WRC and over the period 2008 to 2016.

Measure	Severity (95% Confidence interval), days		
	Backs	Forwards	ALL players
2016			
Mean	45.8 (19.0 – 72.5)	45.7 (23.6 – 67.8)	45.7 (28.8 – 62.6)
Median	27 (7 – 69)	15 (6 – 52)	22 (7 – 39)
ALL tournaments (2008 – 2016)			
Mean	28.1 (21.7 – 34.5)	37.1 (29.6 – 44.6)	33.1 (28.0 – 38.2)
Median	8 (7 – 9)	7 (6 – 11)	8 (7 – 9)

The mean severities of injury sustained by backs and forwards over the period 2008 to 2016 are presented in Figure 4. There are no statistically significant trends in the mean severity of injury over this period for either backs ($p=0.123$) or forwards ($p=0.409$).

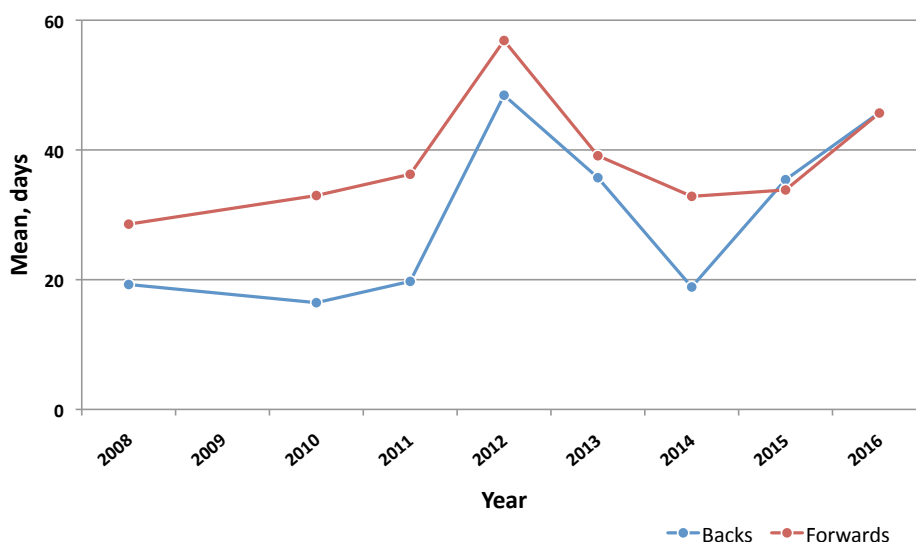


Figure 4. Trends in the mean severity of injury, 2008 to 2016

4.2c Location of injury

Table 4 summarises the locations of all injuries sustained at WRC tournaments over the period 2008 to 2016, as a function of playing position.

Based on the 'All tournament' data, the majority of injuries sustained by backs and forwards are lower limb (backs: 53.5%; forwards: 44.8%) and upper limb (backs: 25.8%; forwards: 28.7%) injuries. The shoulder/clavicle structure is the most vulnerable for both backs (17.4%) and forwards (22.2%) followed by the ankle (14.6%) and knee (13.1%) for backs and the head/face (17.2%) and knee (14.2%) for forwards. There are no statistically significant differences between backs and forwards in the proportions of injuries sustained at each of the main body locations.

Table 4: Locations of all match injuries sustained in the period 2008 to 2016.

Location of injury	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
ALL tournaments (2008 – 2016)			
Head/neck	13.6 (9.0 – 18.2)	18.8 (14.0 – 23.5)	16.5 (13.1 – 19.8)
Head/face	12.7 (8.2 – 17.1)	17.2 (12.7 – 21.8)	15.2 (12.0 – 18.4)
Neck/cerv ^l spine	0.9 (0 – 2.2)	1.5 (0 – 3.0)	1.3 (0.3 – 2.3)
Upper limbs	25.8 (19.9 – 31.7)	28.7 (23.2 – 34.2)	27.4 (23.4 – 31.4)
Shoulder/clavicle	17.4 (12.3 – 22.5)	22.2 (17.2 – 27.3)	20.0 (16.4 – 23.6)
Upper arm	0.0 (-)	0.4 (0 – 1.1)	0.2 (0 – 0.6)
Elbow	1.4 (0 – 3.0)	2.7 (0.7 – 4.6)	2.1 (0.8 – 3.4)
Forearm	0.0 (-)	0.4 (0 – 1.1)	0.2 (0 – 0.6)
Wrist	0.0 (-)	0.8 (0 – 1.8)	0.4 (0 – 1.0)
Hand/fingers	7.0 (3.6 – 10.5)	2.3 (0.5 – 4.1)	4.4 (2.6 – 6.3)
Trunk	7.0 (3.6 – 10.5)	7.7 (4.4 – 10.9)	7.4 (5.0 – 9.7)
Ribs/upper back	4.7 (1.9 – 7.5)	3.4 (1.2 – 5.7)	4.0 (2.2 – 5.8)
Abdomen	0.5 (0 – 1.4)	1.1 (0 – 2.4)	0.8 (0 – 1.7)
Low back	0.9 (0 – 2.2)	1.1 (0 – 2.4)	1.1 (0.1 – 2.0)
Sacrum/pelvis	0.9 (0 – 2.2)	1.9 (0.3 – 3.6)	1.5 (0.4 – 2.6)
Lower limbs	53.5 (46.8 – 60.2)	44.8 (38.8 – 50.9)	48.7 (44.2 – 53.2)
Hip/groin	3.8 (1.2 – 6.3)	1.5 (0 – 3.0)	2.5 (1.1 – 3.9)
Thigh, anterior	4.2 (1.5 – 6.9)	5.4 (2.6 – 8.1)	4.9 (2.9 – 6.8)
Thigh, posterior	7.0 (3.6 – 10.5)	4.6 (2.1 – 7.1)	5.7 (3.6 – 7.8)
Knee	13.1 (8.6 – 17.7)	14.2 (9.9 – 18.4)	13.7 (10.6 – 16.8)
L-leg/Achilles	6.1 (2.9 – 9.3)	3.1 (1.0 – 5.2)	4.4 (2.6 – 6.3)
Ankle	14.6 (9.8 – 19.3)	13.8 (9.6 – 18.0)	14.1 (11.0 – 17.3)
Foot/toe	4.7 (1.9 – 7.5)	2.3 (0.5 – 4.1)	3.4 (1.7 – 5.0)

4.2d Type of injury

Table 5 summarises the types of injury sustained at all WRC tournaments from 2008 to 2016, as a function of playing position.

Joint (non-bone)/ligament (backs: 43.2%; forwards: 52.1%) and muscle/tendon (backs: 34.7%; forwards: 23.0%) injuries are the most common main categories of injury sustained by both backs and forwards. Sprain/ligament (backs: 33.3%; forwards: 40.2%) and muscle haematoma (backs: 19.7%; forwards: 14.2%) injuries are the most common sub-types of injury sustained by backs and forwards.

There are no statistically significant differences between backs and forwards in the main types of injuries sustained at WRC tournaments over the period 2008 to 2016.

Table 5: Types of all match injuries sustained in the period 2008 to 2016.

Type of injury	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
ALL tournaments (2008 – 2016)			
Bone	8.5 (4.7 – 12.2)	5.7 (2.9 – 8.6)	7.0 (4.7 – 9.3)
Fracture	8.0 (4.3 – 11.6)	3.4 (1.2 – 5.7)	5.5 (3.4 – 7.5)
Other bone	0.5 (0 – 1.4)	2.3 (0.5 – 4.1)	1.5 (0.4 – 2.6)
CNS/PNS	11.3 (7.0 – 15.5)	16.5 (12.0 – 21.0)	14.1 (11.0 – 17.3)
Concussion	9.4 (5.5 – 13.3)	13.4 (9.3 – 17.5)	11.6 (8.7 – 14.5)
Nerve	1.9 (0.1 – 3.7)	3.1 (1.0 – 5.2)	2.5 (1.1 – 3.9)
Joint (non-bone)/lig^t	43.2 (36.5 – 49.8)	52.1 (46.0 – 58.2)	48.1 (43.6 – 52.6)
Dislocation/sublux ⁿ	8.0 (4.3 – 11.6)	7.3 (4.1 – 10.4)	7.6 (5.2 – 10.0)
Lesion meniscus	1.9 (0.1 – 3.7)	4.6 (2.1 – 7.1)	3.4 (1.8 – 5.0)
Sprain/ligament	33.3 (27.0 – 39.7)	40.2 (34.3 – 46.2)	37.1 (32.8 – 41.5)
Muscle/tendon	34.7 (28.3 – 41.1)	23.0 (17.9 – 28.1)	28.3 (24.2 – 32.3)
Haematoma/etc	19.7 (14.4 – 25.1)	14.2 (9.9 – 18.4)	16.7 (13.3 – 20.0)
Muscle rupture/etc	11.7 (7.4 – 16.1)	7.3 (4.1 – 10.4)	9.3 (6.7 – 11.9)
Tendon injury/etc	3.3 (0.9 – 5.7)	1.5 (0 – 3.0)	2.3 (1.0 – 3.7)
Skin	1.4 (0 – 3.0)	2.3 (0.5 – 4.1)	1.9 (0.7 – 3.1)
Abrasion	0.0 (-)	0.4 (0 – 1.1)	0.2 (0 – 0.6)
Laceration	1.4 (0 – 3.0)	1.9 (0.3 – 3.6)	1.7 (0.5 – 2.8)
Other types	0.9 (0 – 2.2)	0.4 (0 – 1.1)	0.6 (0 – 1.3)
Other	0.9 (0 – 2.2)	0.4 (0 – 1.1)	0.6 (0 – 1.3)

CNS/PNS: Central and peripheral nervous systems

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.

The most common, specific injury sustained by both backs (9.7%) and forwards (13.7%) is concussion. However, anterior cruciate ligament injuries (backs: 16.8%; forwards: 21.2%) and shoulder dislocation/subluxation (backs: 13.7%; forwards: 18.4%) together are responsible for the greatest time loss for both backs (>30% in total) and forwards (>40% in total).

Table 6: Most common injuries sustained and the injuries causing the greatest burden (days lost) in the period 2008 to 2016.

<i>Backs</i>	<i>%</i>	<i>Forwards</i>	<i>%</i>
All tournaments (2008 – 2016)			
Most common injuries, % of total number			
Concussion	9.7	Concussion	13.7
Ankle lateral collateral ligament sprain	7.8	Acromioclavicular joint injuries	8.2
Hamstring muscle strain	6.3	Shoulder dislocation/subluxation	7.0
Acromioclavicular joint sprain	5.3	Knee MCL sprain	6.3
Thigh haematoma	5.3	Inferior tib-fib syndesmosis sprain	6.3
Knee MCL sprain	4.9	Thigh haematoma	5.9
Injuries causing greatest burden, % of total days lost			
Anterior cruciate ligament sprain	16.8	Anterior cruciate ligament sprain	21.2
Shoulder dislocation/subluxation	13.7	Shoulder dislocation/subluxation	18.4
Hamstring muscle strain	9.1	Knee MCL sprain	6.7
Acromioclavicular joint sprain	6.0	Inferior tib-fib syndesmosis sprain	6.4
Finger fractures	5.3	Acromioclavicular joint sprain	5.9
Knee MCL sprain	5.1	Concussion	5.4

4.2f Nature of onset of injury

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

Table 7: Nature of the injury-onset of all match injuries sustained in the period 2008 to 2016.

Nature of onset	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
All tournaments (2008 – 2016)			
Acute	97.2 (95.0 – 99.4)	94.7 (91.9 – 97.4)	95.8 (94.0 – 97.6)
Gradual	2.8 (0.6 – 5.0)	5.3 (2.6 – 8.1)	4.2 (2.4 – 6.0)

Over 95% of all injuries sustained are acute in nature: the differences between backs and forwards are not statistically significant ($p=0.172$).

4.2g Cause of onset of injury

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

Table 8: Cause of onset of all injuries sustained in the period 2008 to 2016

Cause of onset	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
All tournaments (2008 – 2016)			
Contact	85.6 (80.9 – 90.4)	87.5 (83.5 – 91.6)	86.7 (83.6 – 89.8)
Non-contact	13.9 (9.2 – 18.6)	12.5 (8.4 – 16.5)	13.1 (10.0 – 16.2)
Other	0.5 (0 – 1.4)	0.0 (-)	0.2 (0 – 0.6)

Over 85% of injuries sustained by backs and forwards are the result of contact events; there is no significant difference ($p=0.549$) 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 specific match events leading to injury as a function of playing position.

Table 9: Match events leading to all injuries sustained in the period 2008 to 2016.

Cause of onset	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
All tournaments (2008 – 2016)			
Collision	12.9 (8.4 – 17.5)	17.2 (12.6 – 21.8)	15.3 (12.0 – 18.5)
Kicking	1.0 (0 – 2.3)	0.0 (-)	0.4 (0 – 1.0)
Lineout	0.0 (-)	3.9 (1.5 – 6.3)	2.2 (0.8 – 3.5)
Maul	1.0 (0 – 2.3)	4.3 (1.8 – 6.8)	2.8 (1.3 – 4.3)
Ruck	7.7 (4.1 – 11.3)	12.5 (8.4 – 16.6)	10.3 (7.6 – 13.1)
Running	11.5 (7.2 – 15.8)	5.9 (3.0 – 8.7)	8.4 (5.9 – 10.9)
Scrum	0.0 (-)	7.0 (3.9 – 10.2)	3.9 (2.1 – 5.6)
Tackled	40.2 (33.5 – 46.8)	21.1 (16.1 – 26.1)	29.7 (25.5 – 33.8)
Tackling	23.0 (17.3 – 28.7)	24.6 (19.3 – 29.9)	23.9 (20.0 – 27.7)
Other	2.9 (0.6 – 5.1)	3.5 (1.3 – 5.8)	3.2 (1.6 – 4.8)

Being-tackled (40.2%), tackling (23.0%) and collisions (12.9%) are the events responsible for most injuries sustained by backs and tackling (24.6%), being-tackled (21.1%) and collisions (17.2%) for forwards.

Sixty-five percent of all concussion injuries result from either tackling (45.5%) or collisions (23.3%).

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 2016.

Time of injury, min	% (95% Confidence interval)		
	<i>Backs</i>	<i>Forwards</i>	<i>ALL players</i>
All tournaments (2008 – 2016)			
0-20	17.1 (12.0 – 22.2)	20.0 (15.1 – 24.9)	18.7 (15.2 – 22.3)
21-40+	30.0 (23.8 – 36.2)	29.2 (23.7 – 34.8)	29.6 (25.4 – 33.7)
41-60	29.5 (23.4 – 35.7)	30.4 (24.8 – 36.0)	30.0 (25.9 – 34.1)
61-80+	23.3 (17.6 – 29.1)	20.4 (15.5 – 25.3)	21.7 (18.0 – 25.4)

Significantly more injuries were sustained during the second and third quarters of games compared to the first and fourth quarters for both backs ($p=0.026$) and forwards ($p=0.021$) over the period 2008 to 2016.

4.2j Removal of injured players from the pitch

Based on all injuries sustained over the period 2008 to 2016, 34.7% of players were removed from play immediately, 32.8% were removed later in the game and 32.4% remained on the pitch until the end of the game.

5 Summary

There is no evidence to suggest that backs or forwards competing in the World Rugby U20 Championship have increased in stature over the period 2008 to 2016. Similarly, there is no evidence to suggest that backs have increased in body mass over this period; however, there is growing evidence that forwards competing in the WRC may be slowly increasing in body mass.

The swings in reported incidence and severity of injuries from tournament to tournament reflects the relative size of the competition, in terms of the number of competing teams and in the number of games played. There are, consequently, relatively small numbers of injuries recorded at each tournament and, therefore, small changes in the numbers and especially in the nature individual injuries, have a profound effect on the incidence and severity values reported. Despite these swings, the changes from tournament to tournament have not been statistically significant over the period 2008 to 2016.

Lower limb injuries, especially to the knee and ankle, and joint (non-bone)/ligament injuries continue to be the most common locations and types of injury sustained at the WRC. The most common specific injury sustained by backs and forwards is concussion. Anterior cruciate ligament injuries, however, cause the greatest burden in terms of days lost to injury. The great majority of injuries sustained are acute in nature and result from contact game activities with the tackle the main game event leading to injury.

6. References

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