Injury Surveillance Studies

Men's U20 Championship

Summary of Results: 2023

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5 November 2023

1 Introduction

World Rugby is committed to implementing injury surveillance studies at all major World Rugby competitions 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 competitions,
- identify changing patterns of injury during competitions, and
- bring injury-related areas of concern to the attention of World Rugby's Chief Medical Officer.

The data collected in injury surveillance studies are also used to address player welfare issues in a broader context.

Previous surveillance studies of the World Rugby U20 Championship (WRC) reported the incidence and nature of match injuries sustained during tournaments from 2008 to 2019 (Fuller and Taylor, 2019). The WRC was not contested from 2020 to 2022 due to the Covid pandemic.

The current report continues the on-going study of WRC by reporting match injuries sustained during the 2023 tournament. This review also combines the new data obtained from the 2023 tournament with data reported previously in order to provide an on-going and updated overview of the risks of injury in WRC.

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 Code (Orchard et al., 2010). 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 'injured' until able to undertake full normal training and be available for match selection, whether or not 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. Trends in data values were assessed using linear regression. 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 report.

3 Data collection

Prior to the tournaments taking place, the purpose of the epidemiological study was outlined to each participating team. Each player's baseline anthropometric information was recorded (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.

Medical staff prospectively recorded match injuries sustained during each tournament. A member of the team's medical staff also recorded detailed information about each injury (date of injury, date of return to play/training, location and type of injury, cause of injury, event leading to injury). The final piece of information recorded is normally an injured player's return-to-play/training date.

4 Results

Results from previous WRC tournaments (2008 to 2019) have been presented in a series of earlier reports (Fuller and Taylor, 2019); these reports are available on World Rugby's Player Welfare web pages.

The 2023 tournament took place in South Africa from 24 June to 14 July 2023. This study recorded players' anthropometric data and match injuries for all 12 countries taking part in the 2023 tournament (Argentina, Australia, England, Fiji, France, Georgia, Ireland, Italy, Japan, New Zealand, South Africa, Wales).

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 2023 WRC tournament together with average values obtained for players over the period 2008 to 2023. In 2023, forwards were significantly heavier ($p<0.001$) and taller ($p<0.001$) than backs but there was no statistically significant difference between the ages of backs and forwards ($p=1.000$).

Table 1: Players' anthropometric data for 2023 and the average values for the period 2008 - 2023.

Year / Measure	**Mean** (*Standard deviation, number of players*)		
	Backs	***Forwards***	***ALL players***
2023			
Stature, cm	181.3 (6.7, 156)	188.0 (6.9, 206)	185.1 (7.6, 362)
Body mass, Kg	87.5 (11.2, 156)	109.5 (9.5, 206)	100.0 (15.0, 362)
Age, years	19.2 (0.67, 157)	19.2 (0.66, 209)	19.2 (0.66, 366)
ALL tournaments (2008 – 2023)			
Stature, cm	181.7 (5.9, 1803)	188.1 (7.0, 2245)	185.2 (7.3, 4050)
Body mass, Kg	87.9 (8.1, 1801)	107.4 (9.1, 2244)	98.7 (13.0, 4047)
Age, years	19.1 (0.82, 1814)	19.2 (0.78,2253)	19.1 (0.79, 4069)

Trends in players' stature, body mass and age over the period 2008 to 2023 are shown for backs and forwards in Figures 1 to 3, respectively.

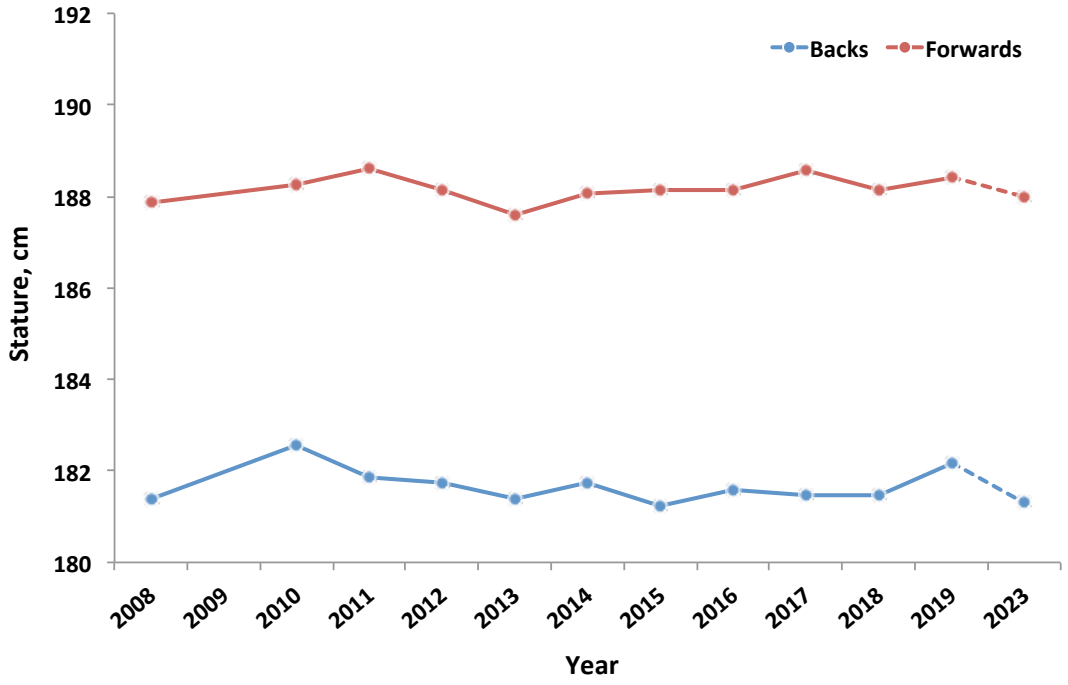

Figure 1. Trends in players' stature in the period 2008 to 2023.

There are no statistically significant trends in the stature of backs (p=0.373) or forwards (p=0.809) since 2008.

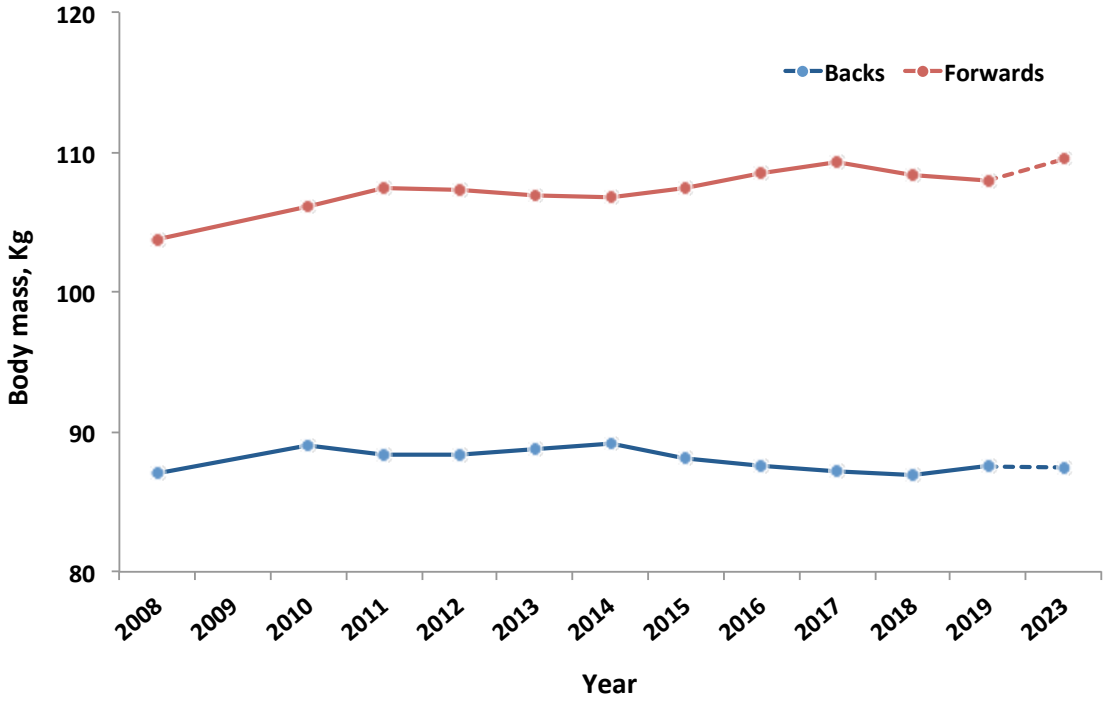

Figure 2. Trends in players' body mass in the period 2008 to 2023.

There has been a statistically significant increasing trend in the body mass of forwards ($p<0.001$) in the period 2008 to 2023 but no significant trend in the body mass of backs ($p=0.169$).

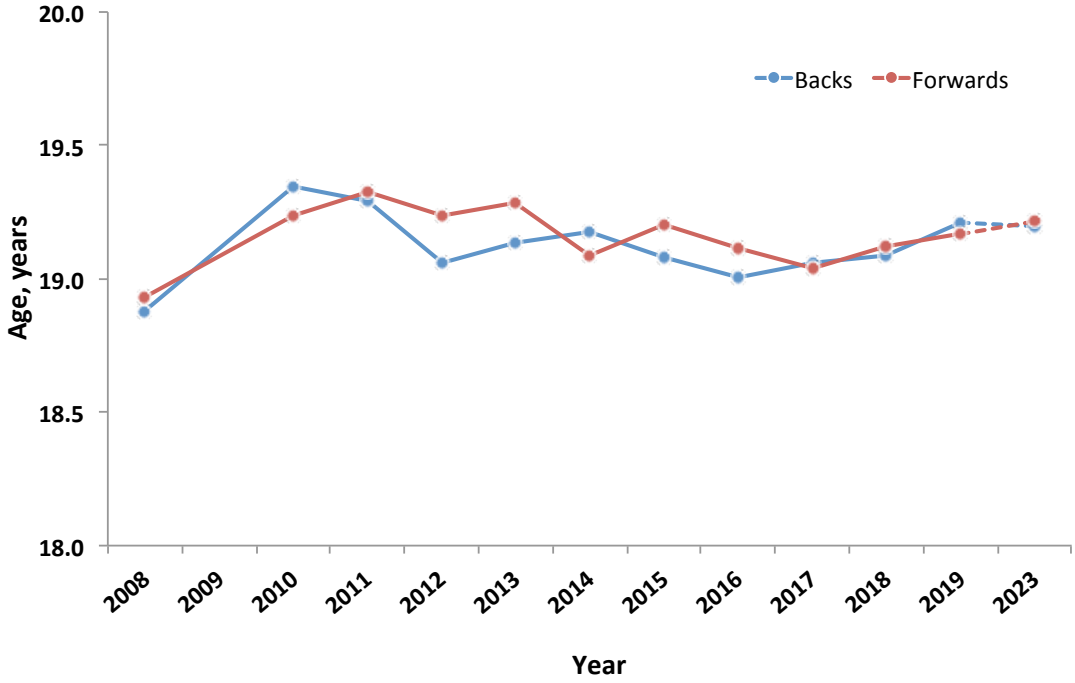

Figure 3. Trends in players' age in the period 2008 to 2023.

There are no statistically significant trends in the age of backs ($p=0.672$) or forwards ($p=0.733$) over the period 2008 to 2023.

4.2 Match injuries

4.2a Incidence of injury

Table 2 summarises the total numbers of match injuries, match exposures and incidences of match injuries for backs, forwards and all players during the 2023 WRC tournament together with the average values for the period 2008 to 2023.

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*
2023			
Injuries	24	32	56
Exposure	560.0	640.0	1200.0
Incidence	42.9 (28.7 – 63.9)	50.0 (35.4 – 70.7)	46.7 (35.9 – 60.6)
ALL tournaments (2008 – 2023)			
Injuries	350	428	778
Exposure	6,673	7,627	14,300
Incidence	52.4 (47.2 – 58.2)	56.1 (51.0 – 61.7)	54.4 (50.7 – 58.4)

There are no significant differences between the incidences of injury recorded for backs and forwards during the 2023 WRC (p=0.569) or between the average values observed for backs and forwards over the period 2008 to 2023 (p=0.342). Figure 4 shows the trends in injury incidence for backs and forwards over the 2008 to 2023 period.

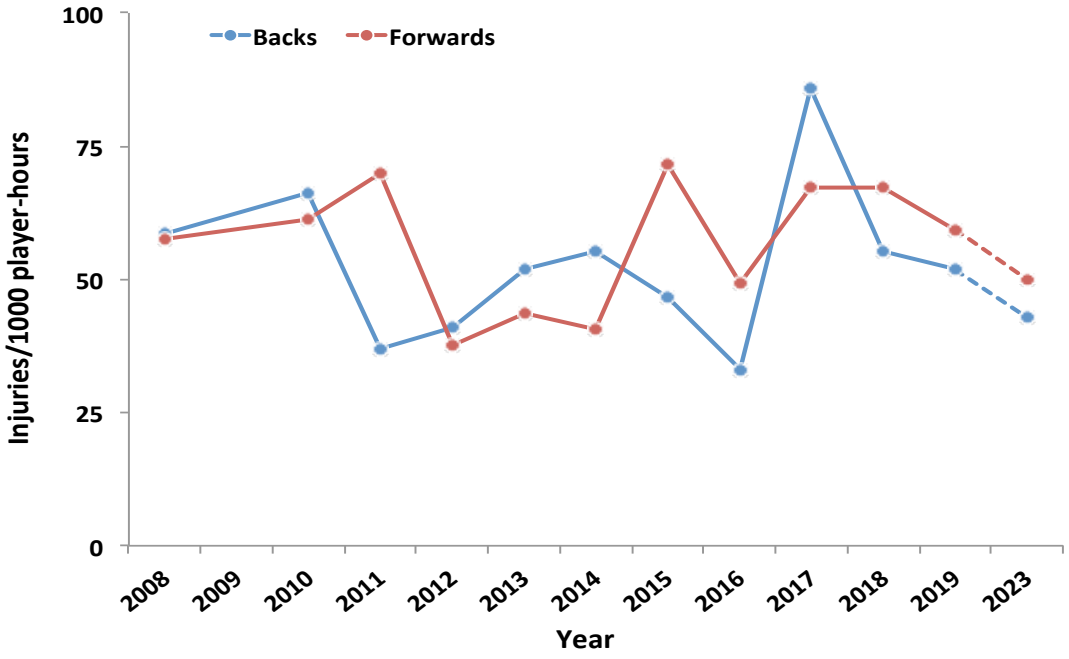

Figure 4. Trends in the incidence of injury in the period 2008 to 2023.

There are no significant trends in the incidences of injury for either backs (p=0.845) or forwards (p=0.918) over the period 2008 to 2023.

4.2b Severity of injury

Table 3 summarises the mean and median severities of injuries sustained at the 2023 WRC tournament and all injuries sustained in the period 2008 to 2023, as a function of playing position.

Table 3: Mean and median severity of all match injuries sustained during the 2023 WRC and over the period 2008 to 2023.

Measure	***Severity (95% Confidence interval)**, days*		
	Backs	***Forwards***	***ALL players***
2023			
Mean	28.7 (17.4 – 39.9)	52.1 (24.4 – 79.8)	42.1 (25.4 – 58.7)
Median	14.0 (9.0 – 43.0)	14.0 (9.0 – 43.0)	14.0 (12.0 – 41.0)
ALL tournaments (2008 – 2023)			
Mean	31.3 (26.1 – 36.6)	38.2 (32.2 – 44.3)	35.1 (31.0 – 39.2)
Median	9.0 (8.0 – 13.0)	9.0 (8.0 – 12.0)	9.0 (8.0 – 12.0)

There were no significant differences in the severity of injuries sustained by backs and forwards during the 2023 WRC for either the mean (p=0.091) or median (p=0.678) values. Similarly, there are no significant differences between backs and forwards over the period 2008 to 2023 for either the mean (p=0.091) or median (p=0.834) severity of injury. The mean severities of injury sustained by backs and forwards over the period 2008 to 2023 are presented in Figure 5. There are no significant trends in the mean severities of injuries sustained by backs (p=0.197) or forwards (p=0.190).

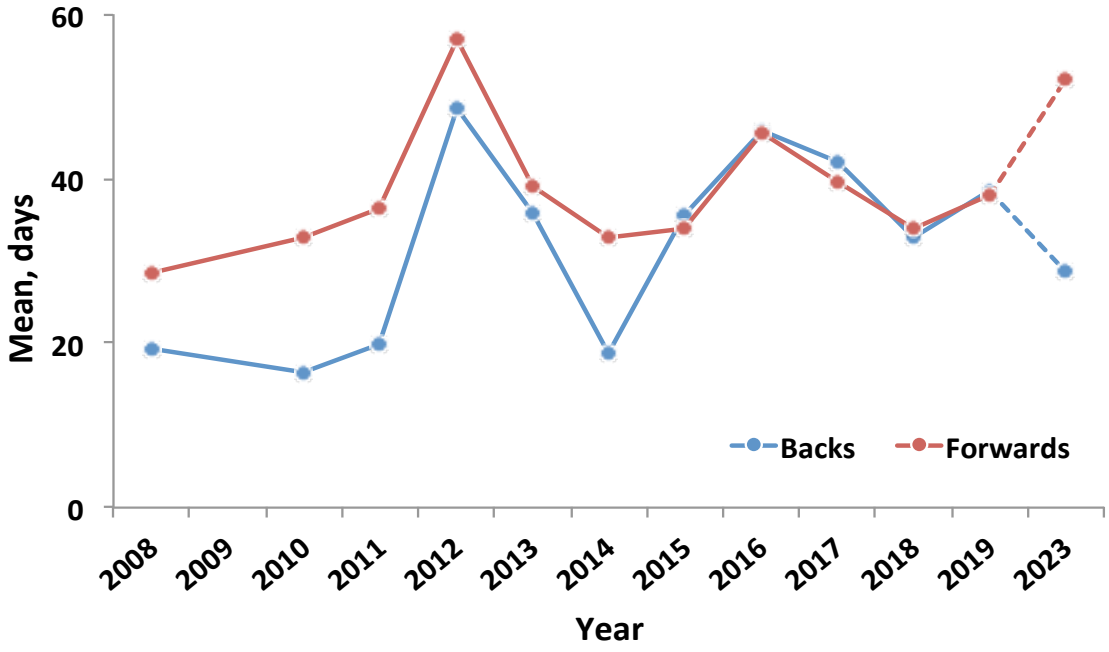

Figure 5. Trends in the mean severity of injury in the period 2008 to 2023.

The median severities of injury sustained by backs and forwards over the period 2008 to 2023 are presented in Figure 6. There has been an increasing but non-significant trend in the median severity of injuries sustained by backs over this period (p=0.074) but no significant trend for forwards (p=0.180).

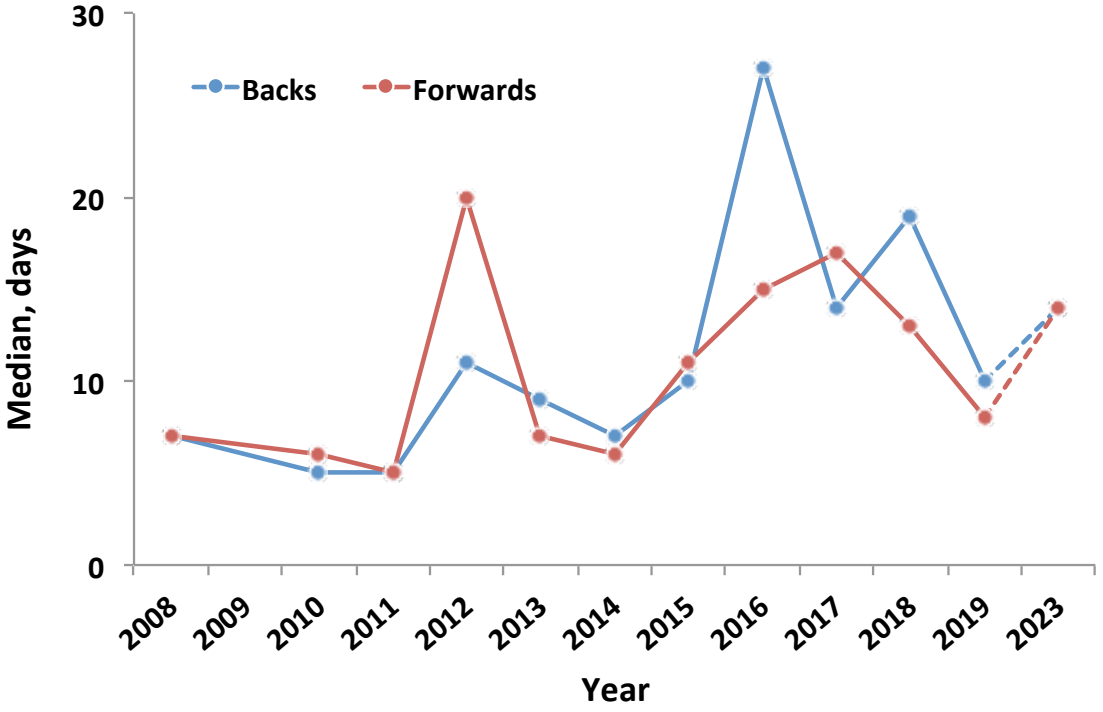

Figure 6. Trends in the median severity of injury in the period 2008 to 2023.

Figure 7 compares all injuries sustained in the period 2008 to 2023 within grouped injury severity categories for backs and forwards.

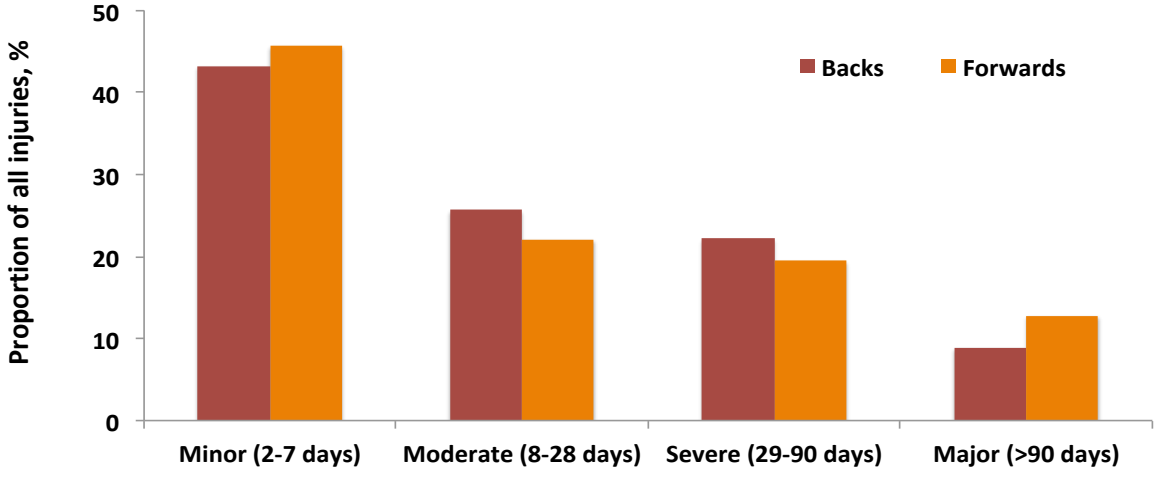

Figure 7. Severity of all injuries sustained in the period 2008 to 2023 presented within grouped injury categories for backs and forwards.

Trends in injury burden (incidence x mean severity) over the period 2008 to 2023 for backs and forwards are shown in Figure 8.

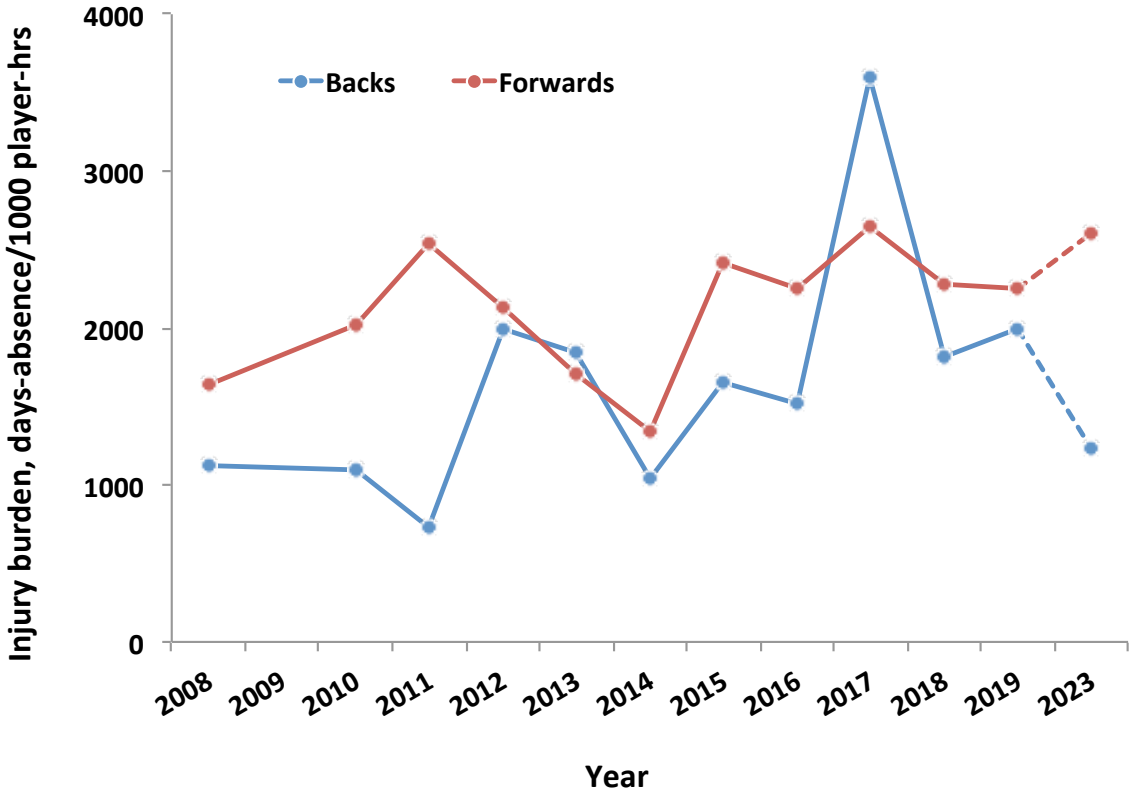

Figure 8. Trends in injury burden over the period 2008 to 2023.

The trends in injury burden for backs (p=0.288) and forwards (p=0.083) are not statistically significant.

4.2c Location and type of injury

Because of the numbers of injury sub-locations and sub-types, it is not meaningful to provide results for a single competition. Therefore, only the average values reported over the 2008 to 2023 period are presented in this section.

Table 4 summarises the locations of all injuries sustained at WRC tournaments over the period 2008 to 2023, as a function of playing position.

Table 4: Locations of all match injuries sustained in the period 2008 to 2023.

Location of injury	% (95% Confidence interval)		
	Backs	***Forwards***	***ALL players***
ALL tournaments (2008 – 2023)			
Head/neck	16.2 (12.3 – 20.1)	20.9 (17.0 – 24.8)	18.8 (16.0 – 21.6)
Head/face	15.7 (11.8 – 19.5)	18.8 (15.0 – 22.5)	17.3 (14.7 – 20.0)
Neck/cerv[l] spine	0.6 (0 – 1.4)	2.2 (0.8 – 3.6)	1.4 (0.6 – 2.3)
Upper limbs	22.6 (18.2 – 27.0)	29.3 (25.0 – 33.7)	26.3 (23.2 – 29.4)
Shoulder/clavicle	14.2 (10.5 – 17.9)	22.8 (18.8 – 26.9)	18.9 (16.1 – 21.7)
Upper arm	0.0 (-)	0.2 (0 – 0.7)	0.1 (0 – 0.4)
Elbow	0.9 (0 – 1.8)	1.9 (0.6 – 3.2)	1.4 (0.6 – 2.3)
Forearm	0.0 (-)	1.0 (0.0 – 1.9)	0.5 (0.0 – 1.0)
Wrist/hand	7.5 (4.8 – 10.3)	3.4 (1.6 – 5.1)	5.3 (3.7 – 6.8)
Trunk	6.7 (4.0 – 9.3))	6.7 (4.3 – 9.1)	6.7 (4.9 – 8.5)
Ribs/upper back	4.6 (2.4 – 6.9)	3.1 (1.5 – 4.8)	3.8 (2.5 – 5.2)
Abdomen	0.6 (0 – 1.4)	1.4 (0.3 – 2.6)	1.1 (0.3 – 1.8)
Low back	0.6 (0 – 1.4)	1.0 (0.0 – 1.9)	0.8 (0.2 – 1.4)
Sacrum/pelvis	0.9 (0 – 1.8)	1.2 (0.2 – 2.2)	1.1 (0.3 – 1.8)
Lower limbs	54.5 (49.2 – 59.7)	43.0 (38.3 – 47.8)	48.2 (44.7 – 51.8)
Hip/groin	2.6 (0.9 – 4.3)	1.4 (0.3 – 2.6)	2.0 (1.0 – 3.0)
Thigh, anterior	4.3 (2.2 – 6.5)	4.6 (2.6 – 6.6)	4.5 (3.0 – 5.9)
Thigh, posterior	9.3 (6.2 – 12.3)	4.1 (2.2 – 6.0)	6.4 (4.7 – 8.2)
Knee	13.0 (9.5 – 16.6)	14.4 (11.0 – 17.8)	13.8 (11.3 – 16.2)
L-leg/Achilles	5.2 (2.9 – 7.6)	2.4 (0.9 – 3.9)	3.7 (2.3 – 5.0)
Ankle	16.2 (12.3 – 20.1)	13.5 (10.2 – 16.7)	14.7 (12.2 – 17.2)
Foot/toe	3.8 (1.8 – 5.8)	2.6 (1.1 – 4.2)	3.2 (1.9 – 4.4)

Based on the 'All tournament' data presented, the majority of injuries sustained by backs and forwards are lower limb (backs: 54.5%; forwards: 43.0%) and upper limb (backs: 22.6%; forwards: 29.3%) injuries. For backs the most vulnerable structure is the ankle (16.2%) followed by the head/face (15.7%) and shoulder/clavicle (14.2%). For forwards, the shoulder/clavicle is the most vulnerable structure (22.8%) followed by the head/face (18.8%) and knee (14.4%). Based on the 95% confidence intervals, the only significant difference between backs and forwards is the higher proportion of posterior thigh injuries sustained by backs.

4.2d Type of injury

Table 5 summarises the types of injury sustained at all WRC tournaments over the period 2008 to 2023, as a function of playing position.

Table 5: Types of all match injuries sustained in the period 2008 to 2023.

Type of injury	% (95% Confidence interval)		
	Backs	*Forwards*	*ALL players*
ALL tournaments (2008 – 2023)			
Bone	9.0 (6.0 – 12.0)	5.5 (3.3 – 7.7)	7.1 (5.3 – 8.9)
Fracture	8.4 (5.5 – 11.3)	3.6 (1.8 – 5.4)	5.8 (4.1 – 7.4)
Other bone	0.6 (0 – 1.4)	1.9 (0.6 – 3.2)	1.3 (0.5 – 2.1)
C/PNS	13.6 (10.0 – 17.2)	17.0 (13.4 – 20.6)	15.5 (12.9 – 18.1)
Concussion	12.5 (9.0 – 15.9)	15.1 (11.7 – 18.5)	13.9 (11.5 – 16.4)
Nerve	1.2 (0.0 – 2.3)	1.9 (0.6 – 3.2)	1.6 (0.7 – 2.5)
Joint (non-bone)/lig[t]	40.3 (35.1 – 45.5)	50.1 (45.3 – 54.9)	45.7 (42.1 – 49.2)
Dislocation/sublux[n]	6.7 (4.0 – 9.3)	5.8 (3.5 – 8.0)	6.2 (4.5 – 7.9)
Lesion meniscus	1.2 (0.0 – 2.3)	4.8 (2.7 – 6.8)	3.1 (1.9 – 4.4)
Sprain/ligament	32.5 (27.5 – 37.4)	38.8 (34.2 – 43.5)	36.0 (32.6 – 39.4)
Other	0.0 (-)	0.7 (0 – 1.5)	0.4 (0.0 – 0.8)
Muscle/tendon	35.1 (30.0 – 40.1)	24.7 (20.6 – 28.8)	29.4 (26.2 – 32.6)
Haematoma/etc	18.6 (14.4 – 22.7)	13.9 (10.6 – 17.2)	16.0 (13.4 – 18.6)
Muscle rupture/etc	12.5 (9.0 – 15.9)	7.7 (5.1 – 10.2)	9.8 (7.7 – 12.0)
Tendon injury/etc	4.1 (2.0 – 6.1)	3.1 (1.4 – 4.8)	3.5 (2.2 – 4.9)
Skin	1.2 (0.0 – 2.3)	1.9 (0.6 – 3.2)	1.6 (0.7 – 2.5)
Abrasion	0.0 (-)	0.2 (0 – 0.7)	0.1 (0 – 0.4)
Laceration	1.2 (0.0 – 2.3)	1.7 (0.4 – 2.9)	1.4 (0.6 – 2.3)
Other types	0.9 (0 – 1.8)	0.7 (0 – 1.5)	0.8 (0.2 – 1.4)

C/PNS: Central and peripheral nervous systems

Joint (non-bone)/ligament (backs: 40.3%; forwards: 50.1%) and muscle/tendon (backs: 35.1%; forwards: 24.7%) injuries are the most common main categories of injury sustained by both backs and forwards. Sprain/ligament (32.5%) and muscle haematoma (18.6%) injuries are the most common sub-types sustained by backs: for forwards, the most common are sprain/ligament (38.8%) and concussion (15.1%).

Based on the 95% confidence intervals, there are no significant differences in injury types sustained by backs and forwards.

4.2e Most common injuries and injuries creating the greatest burden

The most common injuries and the injuries causing the greatest injury burden, in terms of days lost from training and match play, over the period 2008 to 2023 are shown in Table 6.

Table 6: Most common injuries sustained and the injuries causing the greatest burden (days lost) in the period 2008 to 2023 as a function of playing position.

Backs	*%*	*Forwards*	*%*
All tournaments (2008 – 2023)			
Most common injuries, % of all injuries sustained			
Concussion	12.8	Concussion	15.6
Ankle ligament sprains	12.5	Ankle ligament sprains	11.9
Hamstring muscle strain	8.3	Acromioclavicular joint injuries	9.1
Thigh haematoma	5.7	Knee MCL sprain	5.7
Knee MCL sprain	5.7	Thigh haematoma	4.9
Shoulder dislocation/subluxation	5.4	Shoulder dislocation/subluxation	4.9
Injuries causing greatest burden, % of total days lost			
Anterior cruciate ligament sprain	17.7	Anterior cruciate ligament sprain	22.8
Ankle ligament sprains	11.2	Shoulder dislocation/subluxation	12.3
Shoulder dislocation/subluxation	11.1	Ankle ligament sprains	10.6
Hamstring muscle strain	10.4	Concussion	7.1
Knee MCL sprain	7.6	Acromioclavicular joint injuries	5.9
Concussion	6.9	Knee MCL sprain	5.6

The most common, specific injury sustained by both backs (12.8%) and forwards (15.6%) remains concussion. Anterior cruciate ligament injuries (17.7%), ankle ligament sprains (11.2%), shoulder dislocation/subluxation (11.1%) and hamstring muscle strains are responsible for 50% of the total injury time experienced by backs. Anterior cruciate ligament injuries (22.8%), shoulder dislocation/subluxation (12.3%), ankle ligament sprains (10.6%) and concussions (7.1%) are responsible for 53% of total injury time experienced by forwards.

4.2f Nature of onset of injury

Table 7 summarises the nature of injury-onset at the 2023 WRC and at all WRC over the period 2008 to 2023, as a function of playing position.

Table 7: Nature of the injury-onset of all match injuries sustained at WRC 2023 and over the period 2008 to 2023.

Nature of onset	*% (95% Confidence interval)*		
	Backs	*Forwards*	*ALL players*
2023			
Acute	100.0 (-)	87.5 (76.0 – 99.0)	92.9 (86.1 – 99.6)
Gradual	0.0 (-)	12.5 (1.0 – 24.0))	7.1 (0.4 – 13.9)
All tournaments (2008 – 2023)			
Acute	97.7 (96.1 – 99.3)	94.7 (92.6 – 96.9)	96.1 (94.7 – 97.4)
Gradual	2.3 (0.7 – 3.9)	5.3 (3.1 – 7.4)	3.9 (2.6 – 5.3)

The higher proportion of acute injuries sustained by backs compared to forwards in 2023 did not reach statistical significance (p=0.072). Over the period 2008 to 2023, a significantly higher proportion of acute injuries were sustained by backs than forwards (p=0.036).

4.2g Cause of onset of injury

Table 8 summarises the cause of injury-onset at the 2023 WRC and at all WRC over the period 2008 to 2023, as a function of playing position.

Table 8: Cause of injury-onset of match injuries sustained at WRC 2023 and over the period 2008 to 2023

Cause of onset	% (95% Confidence interval)		
	Backs	*Forwards*	*ALL players*
2023			
Contact	84.2 (67.8 – 100)	96.7 (90.2 – 100)	91.8 (84.2 – 99.5)
Non-contact	15.8 (0 – 32.2)	3.3 (0 – 9.8)	8.2 (1.0 – 15.3)
All tournaments (2008 – 2023)			
Contact	82.3 (78.2 – 86.4)	89.7 (86.8 – 92.7)	86.4 (83.9 – 88.9)
Non-contact	17.7 (13.6 – 21.8)	10.3 (7.3 – 13.2)	13.6 (11.1 – 16.1)

The higher proportion of contact injuries sustained by forwards compared to backs in 2023 did not reach statistical significance (p=0.121). Over the period 2008 to 2023, however, forwards sustained significantly more contact and fewer non-contact injuries than backs (p=0.004).

4.2h Match events leading to injury

Table 9 provides a summary of the specific match events leading to injury over the period from 2008 to 2023, as a function of playing position.

Table 9: Match events leading to all injuries sustained in the period 2008 to 2023.

Cause of onset	% (95% Confidence interval)		
	Backs	*Forwards*	*ALL players*
All tournaments (2008 – 2023)			
Collision	12.4 (8.9 – 15.9)	16.3 (12.8 – 19.9)	14.6 (12.0 – 17.1)
Kicking	0.9 (0 – 1.9)	0.0 (-)	0.4 (0 – 0.9)
Lineout	0.0 (-)	2.7 (1.1 – 4.2)	1.5 (0.6 – 2.3)
Maul	0.6 (0 – 1.4)	3.4 (1.7 – 5.2)	2.1 (1.1 – 3.2)
Ruck	5.6 (3.2 – 8.1)	12.0 (8.8 – 15.1)	9.1 (7.0 – 11.1)
Running	14.2 (10.4 – 17.9)	5.6 (3.4 – 7.8)	9.5 (7.4 – 11.6)
Scrum	0.0 (-)	6.8 (4.4 – 9.3)	3.7 (2.4 – 5.1)
Tackled	36.3 (31.2 – 41.4)	22.4 (18.4 – 26.5)	28.7 (25.5 – 31.9)
Tackling	23.9 (19.4 – 28.4)	27.1 (22.8 – 31.4)	25.6 (22.5 – 28.8)
Other	6.2 (3.6 – 8.8)	3.7 (1.8 – 5.5)	4.8 (3.3 – 6.3)

Being-tackled (36.3%), tackling (23.9%) and running (14.2%) are the events responsible for most injuries sustained by backs and tackling (27.1%), being-tackled (22.4%) and collisions (16.3%) for forwards.

Eighty-three per cent of all concussion injuries sustained over the period 2008 to 2023 resulted from tackling (50.9%), collision (17.9%) or being-tackled (14.2%) match events.

4.2i Time of injury

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

Table 10: Time during matches of injuries sustained over the period 2008 to 2023.

Time of injury, min	*% (95% Confidence interval)*		
	Backs	***Forwards***	***ALL players***
All tournaments (2008 – 2023)			
0-20	16.4 (12.5 – 20.3)	16.7 (13.1 – 20.3)	16.6 (13.9 – 19.2)
21-40+	26.6 (21.9 – 31.3)	29.1 (24.7 – 33.4)	27.9 (24.7 – 31.1)
41-60	30.7 (25.8 – 35.6)	29.1 (24.7 – 33.4)	29.8 (26.5 – 33.1)
61-80+	26.3 (21.6 – 31.0)	25.2 (21.0 – 29.4)	25.7 (22.6 – 28.8)

Significantly more injuries were sustained during the second, third and fourth quarters of games compared to the first quarter for both backs and forwards over the period 2008 to 2023.

Based on the 95% CI values, there are no significant differences between backs and forwards in terms of the match periods when injuries were sustained.

4.2j Removal of injured players from the pitch

Based on all injuries sustained over the period 2008 to 2023, 39% of players were removed from play immediately, 28% were removed later in the game and 33% remained on the pitch until the end of the game. For concussions, 68% of injured players were removed from play immediately, 17% were removed later in the game and 14% stayed on the pitch until the end of the game.

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7. Acknowledgements

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

Argentina:	Daniel Carlos Cirillo, Federico Calzon
Australia:	Emily Leys, Jin Lee, Peter Welsh, Richard Brown, Stephen Freeman, Tracy Peters
England:	Adam Reuben, Nigel Rayner, Phil Riley, Richard Tingay
Fiji:	Emosi Taloga, Isoa Logavatu, Jennifer Khalik, Maloni Bulanauca, Pauliasi Bauleka, William Koong
France:	Damien Monnot, Jean-Francois Surrault, Laurent Saint-Beat, Pascal Pradier, Philippe Turblin
Georgia:	Benjamin Moadab, Liam Robinson, Papuna Kuprashvili
Ireland:	Barry O'Flanagan, Brian Devitt, Garett Coughlan, James O'Donovan, John Philpott, Joseph Baker, Philip McClelland, Stuart O'Flanagan, Will Duggan
Italy:	Giorgio di Giacomo, Marco Giacobbe, Niccollo Gori, Roberto Alessandrini
Japan:	Daisuke Yoshikawa, Masataka Nagayama, Sohei Takamori, Tsukuru Nakaya
New Zealand:	James Bishop, Lincoln Wharetohunga Lynne Coleman, Matt Wenham, Noah Whitehead, Paul Cameron,
Samoa:	Areta Samuela, Ben Matalavea, Joshua Melrose, Karolina Unaisi Vunibaka, Neru Leavasa, Shaun Mauiliu
Scotland:	David Pugh, Sam Hewitt
South Africa:	Arthur Williams, Clement Plaatjies, Janash Ganda, Jerome Mampane, Phato Cele
USA:	Dennis Greenhill
Wales:	Gareth Jones, Julian Widdowson, Patrick Moran