Injury Surveillance Studies

Men's U20 Trophy

Summary of Results: 2023

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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 Trophy (WRT) reported the incidence and nature of match injuries sustained during tournaments from 2008 to 2019 (Fuller and Taylor, 2019). The WRT was not contested from 2020 to 2022 due to the Covid pandemic.

The current report continues the on-going study of WRT 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 WRT.

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 (Fuller et al., 2007).

The definition of injury was: '*Any injury sustained during a WRT 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 WRT 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 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. 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 WRT tournaments (2008 to 2019) have been summarised 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 Kenya from 15 to 30 July 2023. This study recorded players' anthropometric data and match injuries for seven (Hong Kong-China, Kenya, Scotland, Spain, Uruguay, USA, Zimbabwe) of the eight participating teams that took part in the tournament. Samoa did not provide injury data for the 2023 WRT injury surveillance study.

4.1 Players' anthropometric data

Table 1 summarises the numbers and anthropometric data (for players from the seven participating countries) categorised as backs, forwards and all players, together with the average values obtained for all players participating in WRT over the period 2008 to 2023.

Table 1: Players' anthropometric data for 2023 and the mean values for the period 2008 to 2023.

Year / Measure	**Mean** (*Standard deviation, number of players*)		
	Backs	***Forwards***	***ALL players***
2023			
Stature, cm	178.8 (6.3, 83)	184.8 (6.9, 111)	182.2 (7.3, 194)
Body mass, Kg	83.3 (8.5, 83)	102.0 (11.3, 111)	94.0 (13.8, 194)
Age, years	19.2 (0.77, 88)	19.1 (0.73, 115)	19.1 (0.75, 203)
ALL tournaments (2008 – 2023)			
Stature, cm	179.1 (6.3, 892)	184.6 (7.1, 1134)	182.2 (7.3, 2026)
Body mass, Kg	83.3 (8.6, 891)	101.8 (11.4, 1129)	93.6 (13.8, 2020)
Age, years	19.0 (0.79, 901)	19.0 (0.73, 1144)	19.0 (0.76, 2045)

There was no significant difference between the ages (p=0.347) of backs and forwards at the 2023 WRT but forwards were significantly heavier (p<0.001) and taller (p<0.001) than backs. Similarly, over the period 2008 to 2023 there is no significant difference between backs' and forwards' ages (p=1.000) but forwards are significantly taller (p<0.001) and heavier (p<0.001) than the backs.

Trends in players' age, stature and body mass over the period 2008 to 2023 are presented for backs and forwards in Figures 1 to 3, respectively. There have been no statistically significant trends in players' age (backs: p=0.438; forwards: p=0.260) stature (backs: p=0.127; forwards: p=0.517) or body mass (backs: p=0.939; forwards: p=0.127) over the period 2008 to 2023.

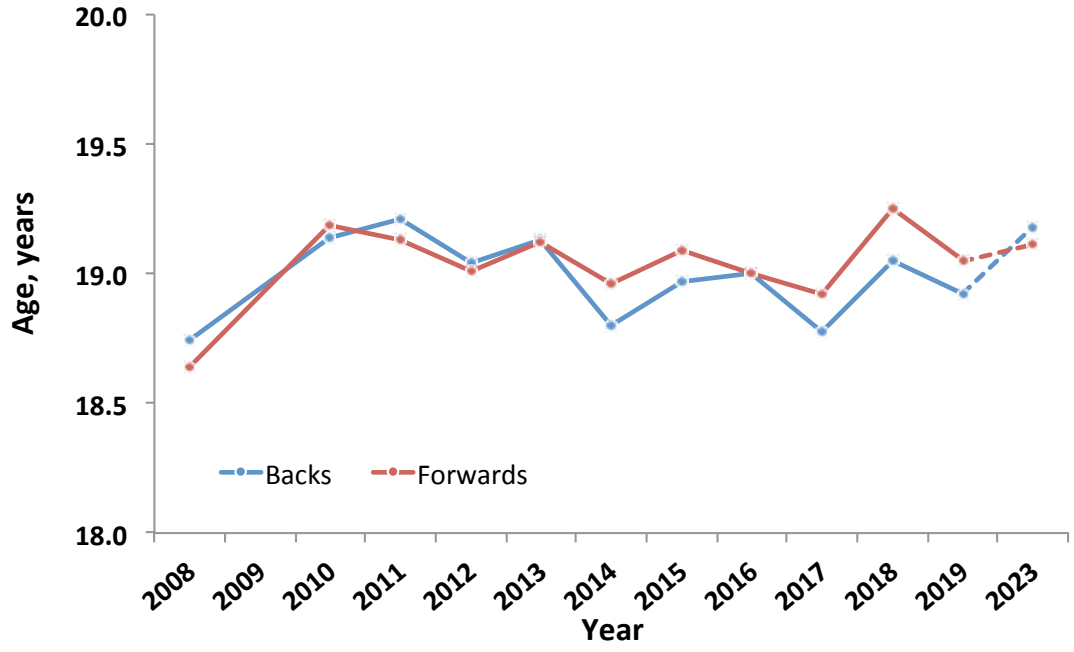

Figure 1. Trends in players' age, 2008 to 2023

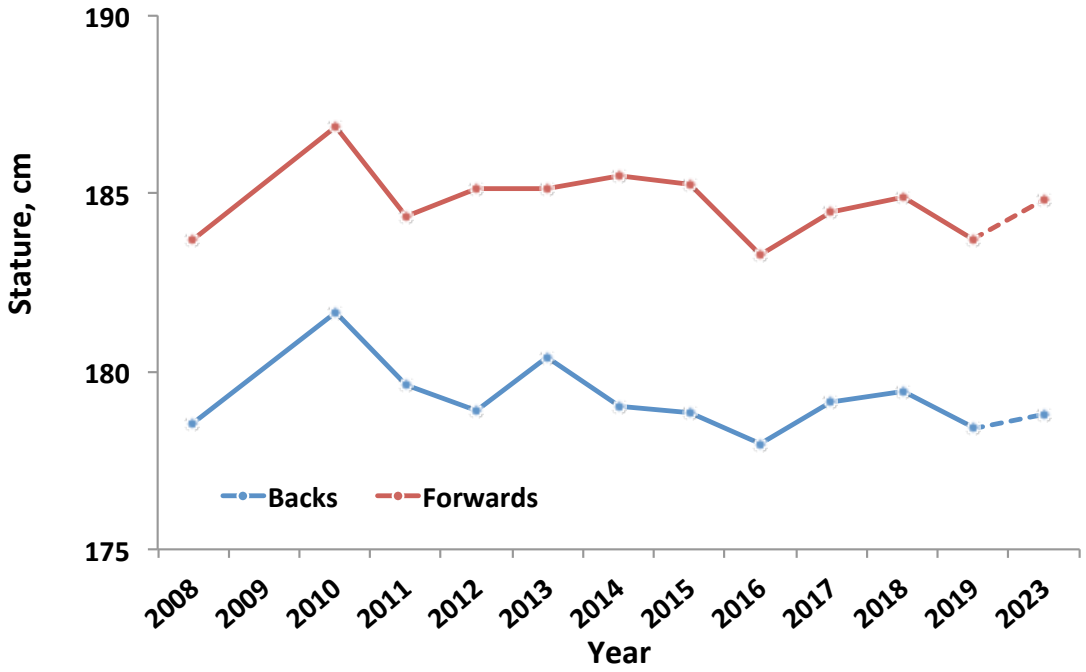

Figure 2. Trends in players' stature, 2008 to 2023

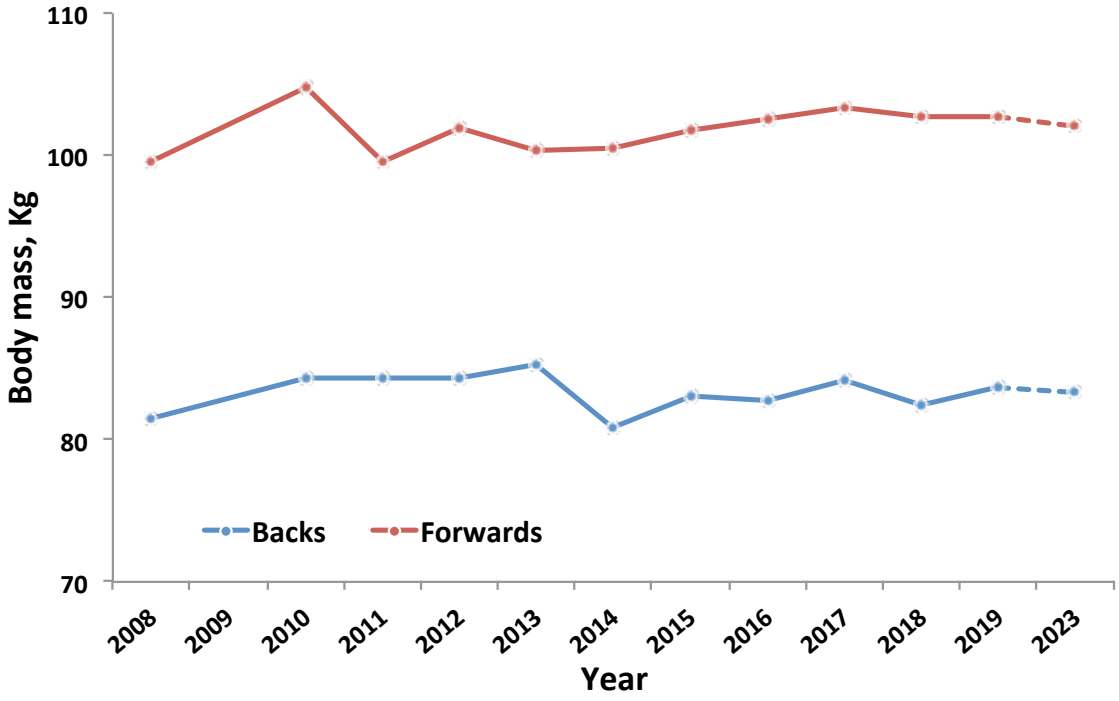

Figure 3. Trends in players' body mass, 2008 to 2023

4.2 Match injuries

Information on match exposure and the number, incidence, severity and burden of injuries sustained at the 2023 WRT are presented together with the corresponding long-run values for the time period 2008 to 2023. For all other injury information, only values averaged over the period 2008 to 2023 are presented, as the numbers of injuries sustained within the many sub-categories do not enable meaningful analyses to be presented for individual tournaments.

4.2a Incidence of injury

Table 2 summarises the number of match injuries, match exposures and incidences of match injuries for backs, forwards and all players during the 2023 WRT tournament together with the long-run values for the period 2008 to 2023.

Table 2: Number, exposure (player-match-hours) and incidence (injuries/1000 player-match-hours, 95% confidence interval) of match injuries for 2023 and values over the period 2008 to 2023.

Year / Measure	*Backs*	*Forwards*	*ALL players*
2023			
Injuries	8	11	19
Exposure	261.3	298.7	560.0
Incidence	30.6 (15.3 – 61.2)	36.8 (20.4 – 66.5)	33.9 (21.6 – 53.2)
ALL tournaments (2008 – 2023)			
Injuries	126	131	257
Exposure	2837.3	3242.7	6080.0
Incidence	44.4 (37.3 – 52.9)	40.4 (34.0 – 47.9)	42.3 (37.4 – 47.8)

There was no significant difference (p=0.689) between the incidences of injuries for backs and forwards at the 2023 WRT. There was also no significant difference between the incidences of injury for backs and forwards over the period 2008 to 2023 (p=0.447).

Graphs of the incidence of injuries for backs and forwards over the period 2008 to 2023 presented in Figure 4 show there are no statistically significant trends (backs: p=0.921; forwards: p=0.710). The incidences of injury for both backs and forwards during the 2023 tournament again remained at the pre-2015 levels, after abnormally high values for both backs and forwards during the 2015 and 2016 tournaments.

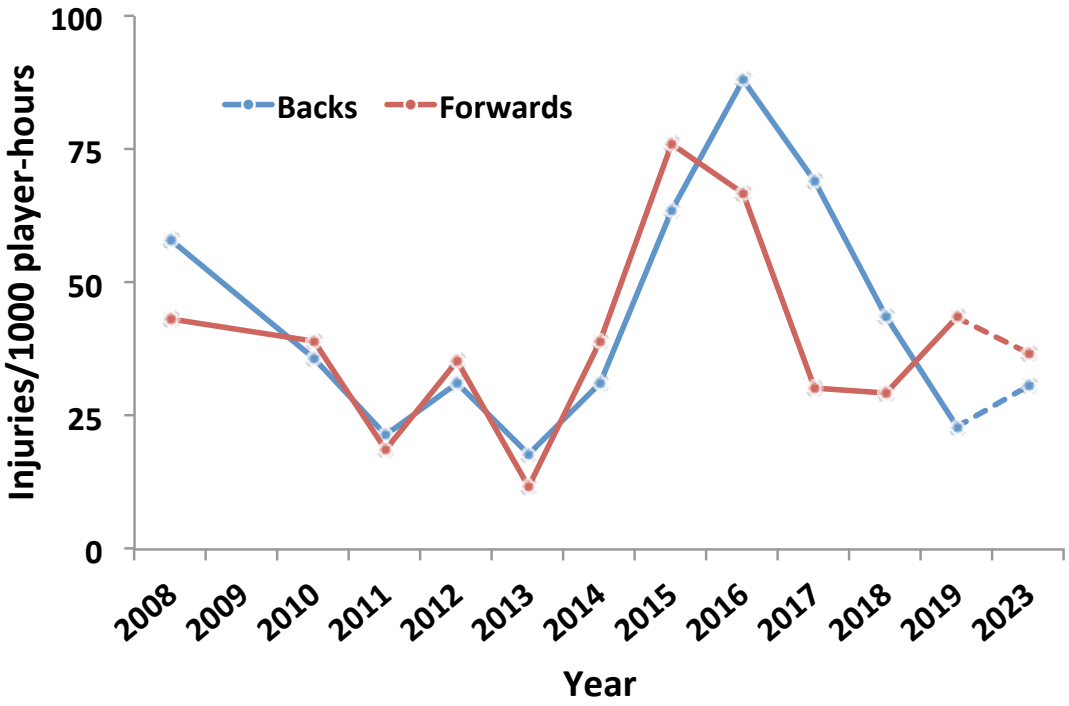

Figure 4. Trends in the incidence of injury, 2008 to 2023

4.2b Severity of injury

Table 3 summarises the mean and median severities of injuries sustained by backs and forwards during the 2023 tournament and also for all injuries sustained at WRT tournaments over the period 2008 to 2023. There were no statistically significant differences between the mean (p=0.226) or median (p=0.200) severities of injuries sustained by backs and forwards during the 2023 tournament.

Table 3: Mean and median severity of match injuries sustained during 2023 and average values for the period 2008 to 2023.

Series / Measure	***Severity** (95% Confidence interval), days*		
	Backs	***Forwards***	***ALL players***
2023			
Mean	66.1 (36.2 – 96.0)	45.3 (29.5 – 61.1)	54.1 (38.3 – 69.9)
Median	67.0 (16.0 – 149.0)	58.0 (12.0 – 73.0)	59.0 (20.0 – 75.0)
All tournaments (2008 – 2023)			
Mean	32.7 (23.1 – 42.3)	27.0 (20.1 – 33.8)	29.8 (23.9 – 35.6)
Median	14.0 (7.0 – 20.0)	11.0 (7.0 – 16.0)	12.0 (7.0 – 16.0)

Based on the 'All tournament' injury data for 2008 to 2023, there are also no significant differences between backs and forwards for the long-run mean (p=0.342) or median (p=0.900) severities of injury.

Trends in the mean and median severity of injuries sustained by backs and forwards over the period 2008 to 2023 are illustrated in Figures 5 and 6, respectively. There are no statistically significant trends in the mean (backs: p=0.197; forwards: p=0.481) or median (backs: p=0.128; forwards: p=0.250) severities of injury over this period. The wide yearly fluctuations observed in the mean and median severities of injury for backs and forwards reflect the relatively small number of injuries sustained by backs and forwards in individual WRT tournaments together with the impact that one or two severe injuries can have on the results for individual years.

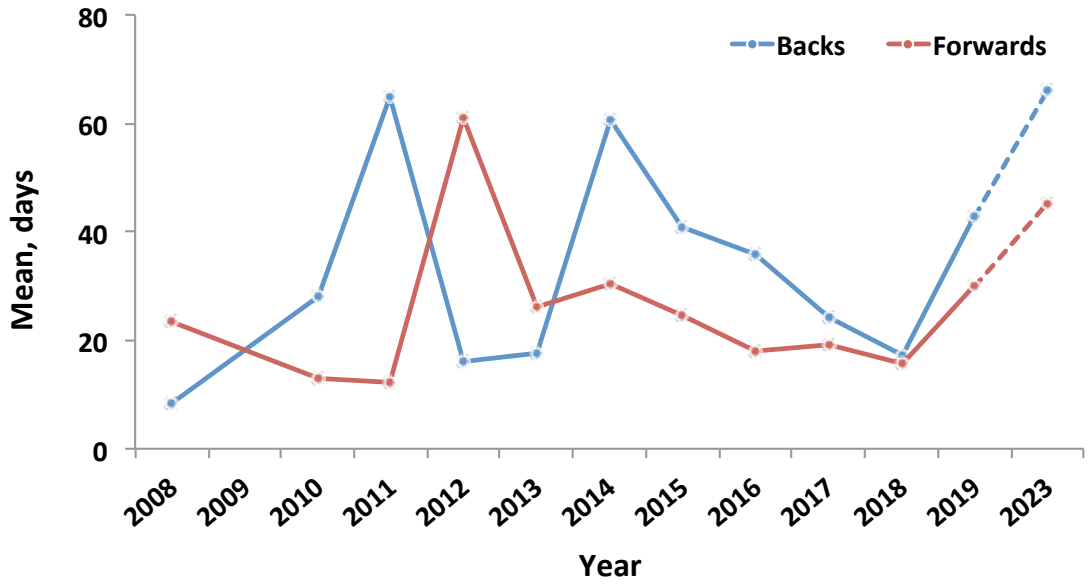

Figure 5. Trends in the mean severity of injury, 2008 to 2023

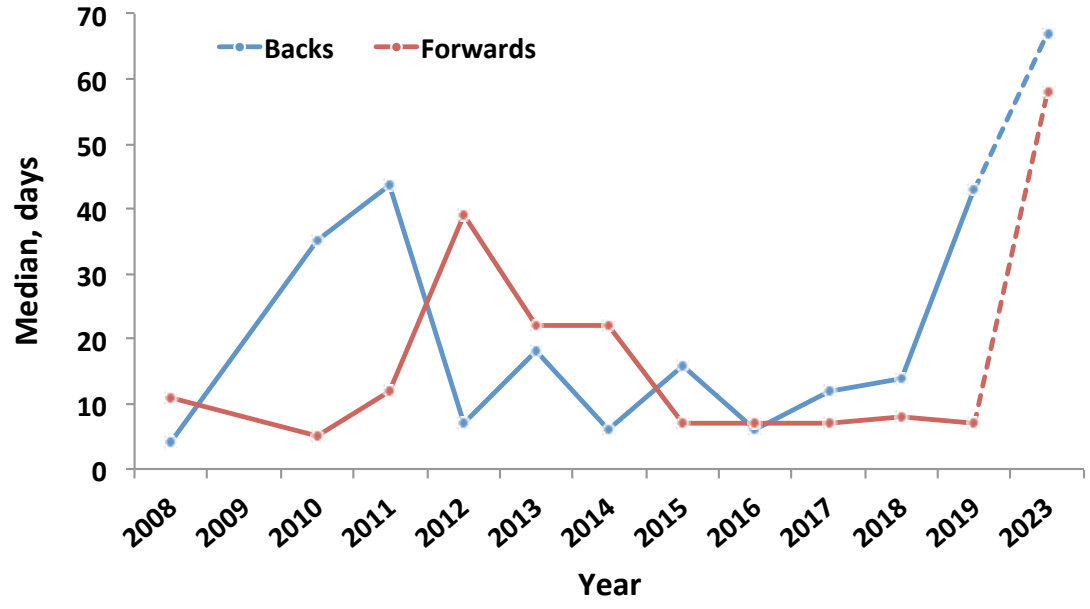

Figure 6. Trends in the median severity of injury, 2008 to 2023

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

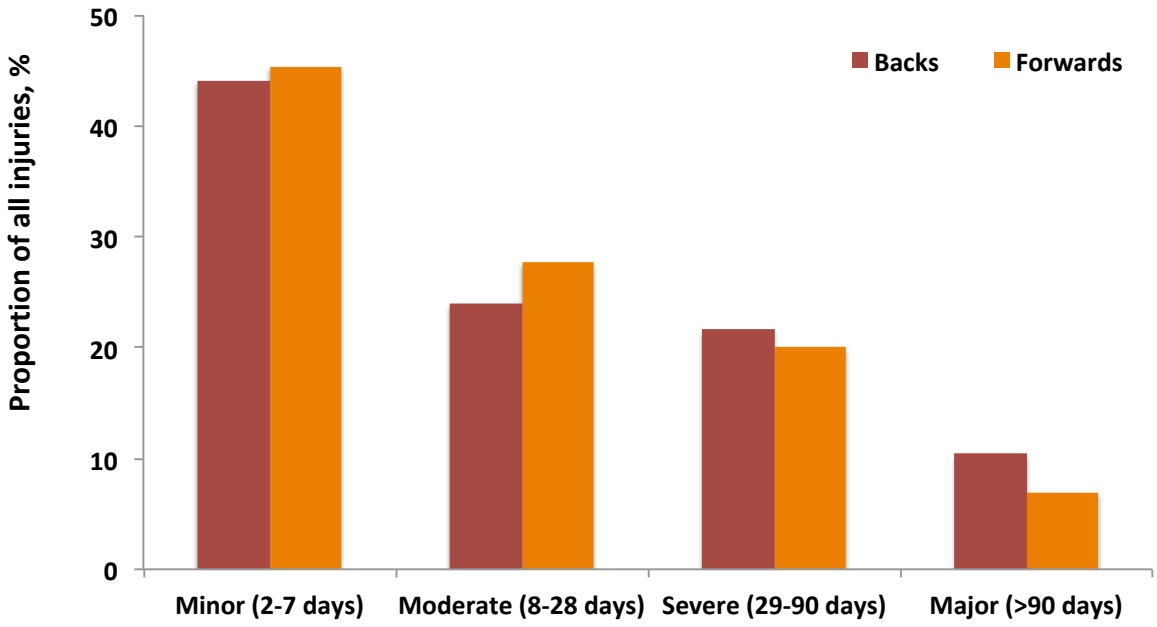

Figure 7. Severity of injuries (2008 to 2023 data) presented within standard injury categories for backs and forwards.

4.2c Injury burden

Trends in injury burden (incidence x mean severity), which provides an indication of the total risk of injury, are shown in Figure 8. Injury burden remained at pre-2015 levels during the 2023 tournament, for both backs and forwards. Over the period 2008 to 2023, injury burden has been significantly higher ($p=0.012$) for backs compared to forwards. Overall there have been no significant long-term trends in injury burden for either backs ($p=0.201$) or forwards ($p=0.410$). The large seasonal variations in injury burden demonstrate the impact of changes in both injury incidence and severity when there are a relatively small number of injuries sustained in individual tournaments.

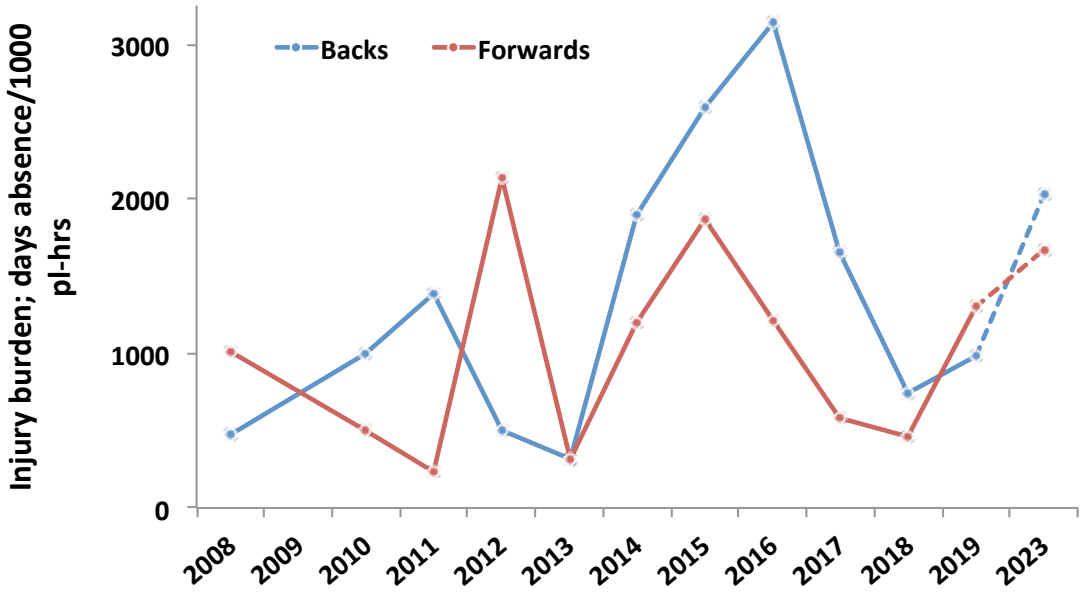

Figure 8. Trends in injury burden, 2008 to 2023

4.2d Location of injury

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

Based on the 'All tournament' data, the majority of injuries sustained by backs were lower limb (40.8%) and head/neck (28.0%) injuries. For forwards, the majority were sustained to the lower limbs (43.8%) and upper limbs (26.9%). The head/face (24.8%), shoulder/clavicle (15.2%) and knee (13.6%) were the most vulnerable sub-locations for backs and the head/face (20.8%), ankle (16.2%) and shoulder/clavicle (13.1%) for forwards. Based on the 95% CIs, there are no statistically significant differences between backs and forwards for the body locations injured.

Table 4: Locations of 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	28.0 (20.1 – 35.9)	23.1 (15.8 – 30.3)	25.5 (20.1 – 30.8)
Head/face	24.8 (17.2 – 32.4)	20.8 (13.8 – 27.7)	22.7 (17.6 – 27.9)
Neck/cerv[l] spine	3.2 (0.1 – 6.3)	2.3 (0 – 4.9)	2.7 (0.7 – 4.8)
Upper limbs	24.8 (17.2 – 32.4)	26.9 (19.3 – 34.5)	25.9 (20.5 – 31.3)
Shoulder/clavicle	15.2 (8.9 – 21.5)	13.1 (7.3 – 18.9)	14.1 (9.8 – 18.4)
Upper arm	0.8 (0 – 2.4)	1.5 (0 – 3.7)	1.2 (0 – 2.5)
Elbow	0.0 (-)	1.5 (0 – 3.7)	0.8 (0 – 1.9)
Forearm	0.0 (-)	3.1 (0.1 – 6.0)	1.6 (0.0 – 3.1)
Wrist/hand	8.8 (3.8 – 13.8)	7.7 (3.1 – 12.3)	8.2 (4.9 – 11.6)
Trunk	6.4 (2.1 – 10.7)	6.2 (2.0 – 10.3)	6.3 (3.3 – 9.3)
Ribs/upper back	1.6 (0 – 3.8)	5.4 (1.5 – 9.3)	3.5 (1.3 – 5.8)
Abdomen	0.8 (0 – 2.4)	0.0 (-)	0.4 (0 – 1.2)
Low back	3.2 (0.1 – 6.3)	0.8 (0 – 2.3)	2.0 (0.3 – 3.7)
Sacrum/pelvis	0.8 (0 – 2.4)	0.0 (-)	0.4 (0 – 1.2)
Lower limbs	40.8 (32.2 – 49.4)	43.8 (35.3 – 52.4)	42.4 (36.3 – 48.4)
Hip/groin	3.2 (0.1 – 6.3)	0.8 (0 – 2.3)	2.0 (0.3 – 3.7)
Thigh, anterior	4.8 (1.1 – 8.5)	4.6 (1.0 – 8.2)	4.7 (2.1 – 7.3)
Thigh, posterior	7.2 (2.7 – 11.7)	3.8 (0.5 – 7.2)	5.5 (2.7 – 8.3)
Knee	13.6 (7.6 – 19.6)	10.0 (4.8 – 15.2)	11.8 (7.8 – 15.7)
L-Leg/Achilles	1.6 (0 – 3.8)	4.6 (1.0 – 8.2)	3.1 (1.0 – 5.3)
Ankle	8.0 (3.2 – 12.8)	16.2 (9.8 – 22.5)	12.2 (8.1 – 16.2)
Foot/toe	2.4 (0 – 5.1)	3.8 (0.5 – 7.2)	3.1 (1.0 – 5.3)

4.2e Type of injury

Table 5 summarises the types of injuries sustained over all WRT tournaments in the period 2008 to 2023, as a function of playing position. Joint (non-bone)/ligament (backs: 36.8%; forwards: 41.5%) and muscle/tendon (backs: 33.6%; forwards: 22.3%) injuries were the most common main types of injury sustained in this period.

Sprain/ligament (29.6%), muscle strains (21.6%) and concussion (20.0%) are the most common sub-types of injury sustained by backs and sprain/ligament (33.1%), concussion (15.4%) and bone fracture (13.8%) the most common injuries by forwards. Based on the 95% CIs, there are no statistically significant differences between backs and forwards in the types of injuries sustained.

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	4.8 (1.1 – 8.5)	13.8 (7.9 – 19.8)	9.4 (5.8 – 13.0)
Fracture	4.8 (1.1 – 8.5)	13.8 (7.9 – 19.8)	9.4 (5.8 – 13.0)
Other bone	0.0 (-)	0.0 (-)	0.0 (-)
CNS/PNS	20.0 (13.0 – 27.0)	17.7 (11.1 – 24.3)	18.8 (14.0 – 23.6)
Concussion	20.0 (13.0 – 27.0)	15.4 (9.2 – 21.6)	17.6 (13.0 – 22.3)
Nerve	0.0 (-)	2.3 (0 – 4.9)	1.2 (0 – 2.5)
Joint (non-bone)/lig[t]	36.8 (28.3 – 45.3)	41.5 (33.1 – 50.0)	39.2 (33.2 – 45.2)
Dislocation/sublux[n]	4.8 (1.1 – 8.5)	4.6 (1.0 – 8.2)	4.7 (2.1 – 7.3)
Lesion meniscus	4.8 (1.1 – 8.5)	3.8 (0.5 – 7.2)	2.7 (0.7 – 4.8)
Sprain/ligament	29.6 (25.3 – 41.9)	33.1 (25.0 – 41.2)	31.4 25.7 – 37.1)
Other	0.8 (0 – 2.4)	0.0 (-)	0.4 (0 – 1.2)
Muscle/tendon	33.6 (25.3 – 41.9)	22.3 (15.2 – 29.5)	27.8 (22.4 – 33.3)
Haematoma/etc	10.4 (5.0 – 15.8)	10.0 (4.8 – 15.2)	10.2 (6.5 – 13.9)
Muscle rupture/etc	21.6 (14.4 – 28.8)	9.2 (4.3 – 14.2)	15.3 (10.9 – 19.7)
Tendon injury/etc	4.8 (1.1 – 8.5)	3.1 (0.1 – 6.0)	2.4 (0.5 – 4.2)
Skin	4.8 (1.1 – 8.5)	3.8 (0.5 – 7.2)	2.7 (0.7 – 4.8)
Abrasion	0.0 (-)	0.8 (0 – 2.3)	0.4 (0 – 1.2)
Laceration	4.8 (1.1 – 8.5)	3.1 0.1 – 6.0)	2.4 (0.5 – 4.2)
Other types	3.2 (0.1 – 6.3)	0.8 (0 – 2.3)	2.0 (0.3 – 3.7)
Visceral	0.8 (0 – 2.4)	0.0 (-)	0.4 (0 – 1.2)
Other	2.4 (0 – 5.1)	0.8 (0 – 2.3)	1.6 (0.0 – 3.1)

CNS/PNS: Central and peripheral nervous systems

4.2f Most common and highest risk injuries

The most common specific injuries sustained by backs in the period 2008 to 2023 have been concussion (20.3%), acromio-clavicular joint sprain (8.9%), ankle ligament sprain (7.3%), hamstring muscle strain (6.5%) and anterior cruciate ligament tear/sprain (4.1%). For forwards, the most common have been concussion (15.5%), ankle ligament sprain (11.6%), acromio-clavicular joint sprain (6.2%), finger fracture (4.7%), knee MCL sprain (3.9%) and rib fracture (3.9%).

The injuries causing the greatest loss of time for backs in the period 2008 to 2023 have been ACL ligament tear/sprain (25.0%), concussion (22.4%), acromio-clavicular joint sprain (4.7%), neck muscle strain (4.2%) and wrist ligament tear (3.8%). For forwards, the greatest time loss has resulted from concussion (13.1%), ankle ligament sprain (11.2%), shoulder dislocation/subluxation (9.1%), forearm fracture (8.8%) and finger fracture (8.5%) injuries.

4.2g Nature of onset of injury

Table 6 summarises the nature of injury-onset at WRT tournaments in the period 2008 to 2023, as a function of playing position.

Table 6: Nature of injury-onset of all match injuries sustained in the period 2008 to 2023.

Nature of onset	% (95% Confidence interval)		
	Backs	***Forwards***	***ALL players***
All tournaments (2008 – 2023)			
Acute	84.8 (78.5 – 91.1)	90.7 (85.7 – 95.7)	87.8 (83.8 – 91.8)
Gradual	15.2 (8.9 – 21.5)	9.3 (4.3 – 14.3)	12.2 (8.2 – 16.2)

Eighty-eight per cent of all injuries sustained have been acute injuries. There is no statistically significant difference (p=0.108) between backs and forwards in the proportions of acute and gradual-onset injuries sustained in the period 2008 to 2023.

4.2h Cause of onset of injury

Table 7 summarises the cause of onset of match injuries sustained at WRT tournaments in the period 2008 to 2023, as a function of playing position.

Table 7: Cause of injury-onset of all match injuries sustained in the period 2008 to 2023.

Cause of onset	% (95% Confidence interval)		
	Backs	***Forwards***	***ALL players***
ALL tournaments (2008 – 2023)			
Contact	84.9 (78.4 – 91.3)	88.8 (83.3 – 94.3)	86.9 (82.6 – 91.1)
Non-contact	15.1 (8.7 – 21.6)	10.4 (5.0 – 15.8)	12.7 (8.5 – 16.9)
Other	0.0 (-)	0.8 (0 – 2.4)	0.4 (0 – 1.2)

Eighty-seven per cent of all injuries sustained by backs and forwards in the period 2008 to 2023 were caused by contact events. There is no statistically significant difference (p=0.362) in the proportions of contact and non-contact injuries sustained by backs and forwards.

4.2i Match events leading to injury

Table 8 provides a summary of the specific match events leading to injury in the period 2008 to 2023, as a function of playing position.

Being-tackled (30.6%), tackling (30.6%), and running (14.0%) were the events responsible for most injuries sustained by backs and being-tackled (24.8%), tackling (21.6%) and ruck (18.4%) the events responsible for most injuries sustained by forwards.

The most common events, for all players, leading to concussion were tackling (37.2%), collision (25.6%) and being-tackled (23.3%).

Table 8: 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	13.2 (7.2 – 19.3)	9.6 (4.4 – 14.8)	11.4 (7.4 – 15.4)
Kicking	0.8 (0 – 2.4)	0.0 (-)	0.4 (0 – 1.2)
Lineout	0.0 (-)	3.2 (0.1 – 6.3)	1.6 (0.0 – 3.2)
Maul	1.7 (0 – 3.9)	2.4 (0 – 5.1)	2.0 (0.3 – 3.8)
Ruck	5.8 (1.6 – 9.9)	18.4 (11.6 – 25.2)	12.2 (8.1 – 16.3)
Running	14.0 (7.9 – 20.2)	5.6 (1.6 – 9.6)	9.8 (6.0 – 13.5)
Scrum	0.0 (-)	8.0 (3.2 – 12.8)	4.1 (1.6 – 6.5)
Tackled	30.6 (22.4 – 38.8)	24.8 (17.2 – 32.4)	27.6 (22.1 – 33.2)
Tackling	30.6 (22.4 – 38.8)	21.6 (14.4 – 28.8)	26.0 (20.5 – 31.5)
Other	3.3 (0.1 – 6.5)	6.4 (2.1 – 10.7)	4.9 (2.2 – 7.6)

4.2j Time of injury

Table 9 provides a summary of the match period when injuries were sustained over the 2008 to 2023 period, as a function of playing position.

Table 9: Time during matches of when injuries were sustained in the period 2008 to 2023.

Time of injury, min	*% (95% Confidence interval)*		
	Backs	***Forwards***	***ALL players***
ALL tournaments (2008 – 2023)			
0-20	14.5 (8.3 – 20.7)	15.5 (9.3 – 21.7)	15.0 (10.6 – 19.4)
21-40+	27.4 (19.6 – 35.3)	27.1 (19.5 – 34.8)	27.3 (21.8 – 32.8)
41-60	19.4 (12.4 – 26.3)	29.5 (21.6 – 37.3)	24.5 (19.2 – 29.8)
61-80+	38.7 (30.1 – 47.3)	27.9 (20.2 – 35.6)	33.2 (27.4 – 39.0)

Over the 2008 to 2023 period significantly (p=0.014) more injuries were sustained during the second half of matches.

4.2k Removal of injured players from the pitch

For all injuries sustained in the period 2008 to 2023, 39.5% were removed immediately from the pitch, 28.9% were removed later in the game and 31.6% remained on the pitch until the end of the game.

For concussions, 53.3% of injured players were removed immediately, 17.8% later in the game and 28.9% remained on the pitch until the end of the game. At the 2023 tournament, the 4 players sustaining concussions were all removed immediately from play.

6. References

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