World Rugby

Surveillance Studies

World Rugby U20 Championship

Summary of Results: 2008 to 2019

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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 IRB Junior World Championship) reported the incidence and nature of match injuries sustained during tournaments from 2008 to 2018 (Fuller and Taylor, 2018). The current report continues the on-going study of the World Rugby U20 Championship (WRC) by reporting match injuries sustained during the 2019 tournament.

This review also combines the new data obtained from the 2019 tournament with data reported previously in order to provide an on-going and updated overview 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 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 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. 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

At the beginning of each 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, Orchard code, 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 from previous WRC tournaments (2008 to 2018) have been presented in a series of earlier reports (Fuller and Taylor, 2018).

The 2019 WRC tournament took place in Argentina from 4 to 22 June 2019. This study recorded players' anthropometric data and match injuries for all 12 countries taking part in the 2019 tournament (Argentina, Australia, England, Fiji, France, Georgia, Ireland, Italy, New Zealand, Scotland, South Africa, Wales). It should be noted that half the matches during the 2019 WRC were played on grass and half were played on artificial turf.

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 2019 WRC tournament together with average values obtained for players over the period 2008 to 2019. 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.

Table 1: Players' anthropometric data for 2019 and the average values for the period 2008 - 2019.

Year / Measure	**Mean** (*Standard deviation, number of players*)		
	Backs	***Forwards***	***ALL players***
2019			
Stature, cm	182.2 (6.0, 147)	188.4 (7.3, 185)	185.6 (7.3, 348)
Body mass, Kg	87.5 (8.0, 147)	108.0 (8.9, 185)	98.9 (13.3, 348)
Age, years	19.2 (0.69, 147)	19.2 (0.69, 185)	19.2 (0.71, 348)
ALL tournaments (2008 – 2019)			
Stature, cm	181.7 (5.8, 1642)	188.2 (7.0, 2030)	185.3 (7.3, 3688)
Body mass, Kg	88.0 (7.7, 1640)	107.2 (9.1, 2029)	98.6 (12.8, 3685)
Age, years	19.1 (0.83, 1652)	19.2 (0.79,2035)	19.1 (0.81, 3703)

Trends in players' stature and body mass over the period 2008 to 2019 are presented for backs and forwards in Figures 1 and 2, respectively.

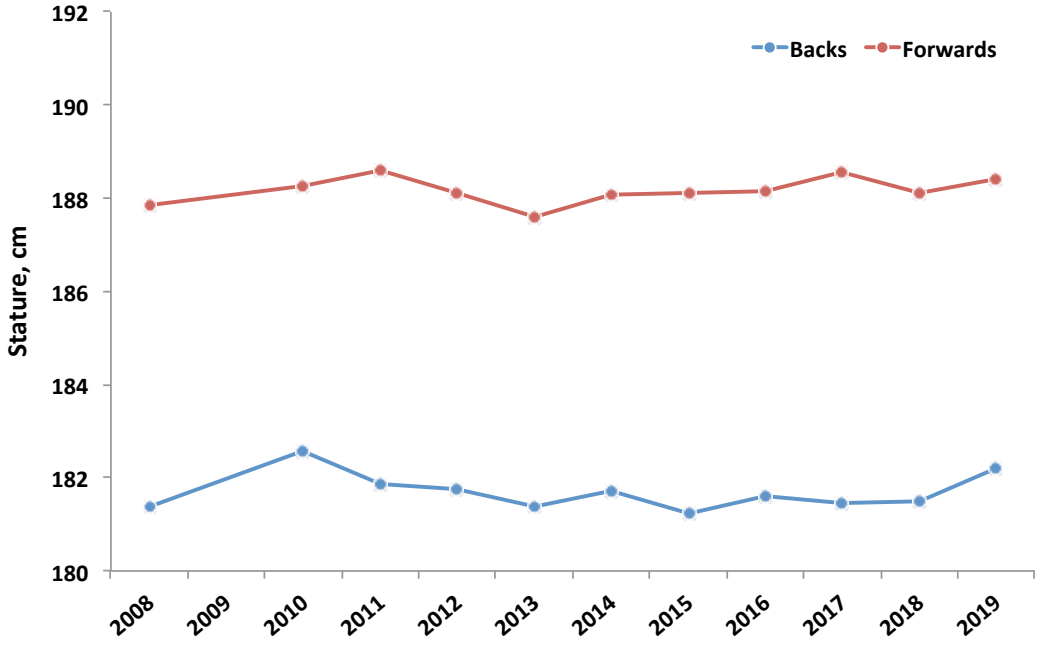

Figure 1. Trends in players' stature in the period 2008 to 2019.

There are no statistically significant trends in the stature of backs (p=0.706) or forwards (p=0.386) since 2008.

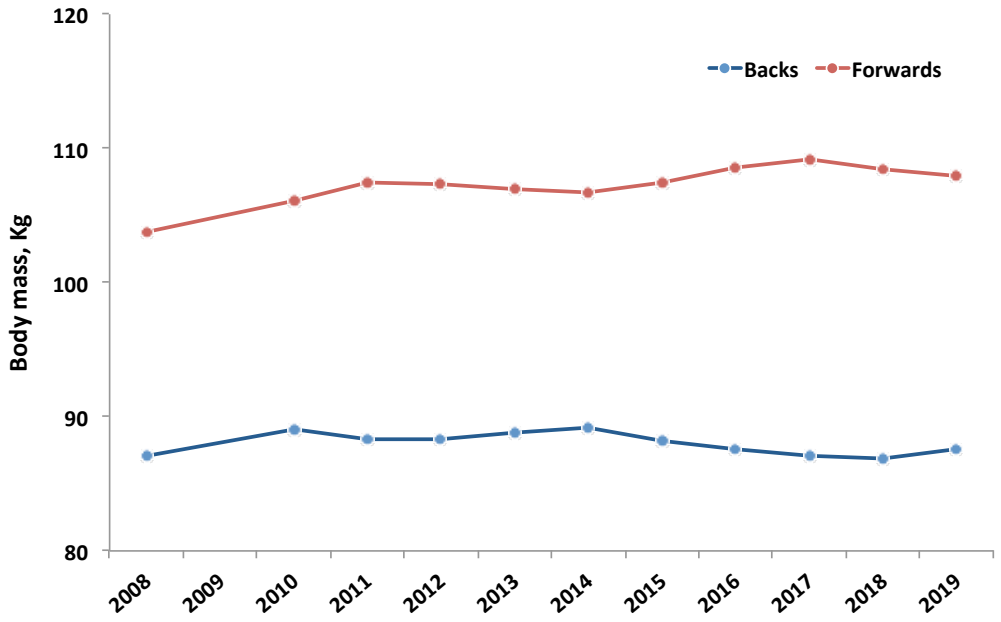

Figure 2. Trends in players' body mass in the period 2008 to 2019.

There has been a statistically significant increasing trend in the body mass of forwards (p=0.002) in the period 2008 to 2019 but no significant trend in the body mass of backs (p=0.226).

4.2 Match injuries

4.2a Incidence of injury

Table 2A summarises the total numbers of match injuries, match exposures and incidences of match injuries for backs, forwards and all players during the 2019 WRC tournament together with the average values for the period 2008 to 2019.

Table 2A: Number, exposure (player-hours) and incidence (injuries/1000 player-match-hours, 95% confidence interval) of match injuries.

Year / Measure	*Backs*	*Forwards*	*ALL players*
2019			
Injuries	29	38	67
Exposure	560.0	640.0	1200.0
Incidence	51.8 (36.0 – 74.5)	59.4 (43.2 – 81.6)	55.8 (43.9 – 70.9)
ALL tournaments (2008 – 2019)			
Injuries	326	396	722
Exposure	6,113	6,987	13,100.0
Incidence	53.3 (47.8 – 59.4)	56.7 (51.4 – 62.5)	55.1 (51.2 – 59.3)

There were small non-significant reductions in the incidence of injury for both backs and forwards during the 2019 WRC compared to 2018. There are no significant differences, however, between the incidences of injury recorded for backs and forwards during the 2019 WRC (p=0.575) or between the average values observed for backs and forwards over the period 2008 to 2019 (p=407).

There are no significant trends in the incidences of injury for either backs (p=0.808) or forwards (p=0.600) over the period 2008 to 2019, Figure 3.

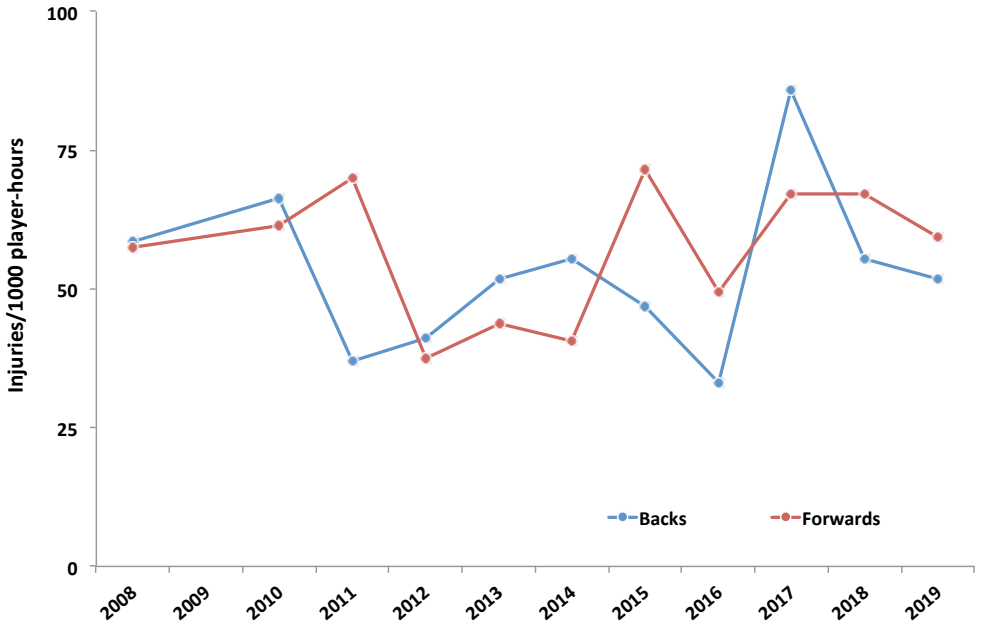

Figure 3. Trends in the incidence of injury in the period 2008 to 2019.

For the 2019 WRC, half the matches were played on grass and half were played on artificial turf. Table 2B represents the data shown in Table 2A with the values spread accordingly over the two surfaces.

Table 2B: Number, exposure (player-hours) and incidence (injuries/1000 player-match-hours, 95% confidence interval) of match injuries for grass and artificial turf.

Year / Measure	*Backs*	*Forwards*	*ALL players*
2019; Grass playing surfaces:			
Injuries	12	19	31
Exposure	280	320	600
Incidence	42.9 (24.3 – 75.5)	59.4 (37.9 – 93.1)	51.7 (36.3 – 73.5)
2019; Artificial turf playing surfaces:			
Injuries	17	19	36
Exposure	280	320	600
Incidence	60.7 (37.7 – 97.7)	59.4 (37.9 – 93.1)	60.0 (43.3 – 83.2)

There were no statistically significant differences in the incidence of injuries sustained on grass and artificial turf playing surfaces when comparing backs v backs (p=0.358); forwards v forwards (p=1.000) and all players v all players (p=0.542).

4.2b Severity of injury

Table 3 summarises the mean and median severities of injuries sustained at the 2019 WRC tournament and all injuries sustained in the period 2008 to 2019, as a function of playing position.

Table 3: Mean and median severity of all match injuries sustained during the 2019 WRC and over the period 2008 to 2019.

Measure	***Severity (95% Confidence interval)**, days*		
	Backs	***Forwards***	***ALL players***
2019			
Mean	35.2 (15.5 – 54.9)	37.9 (16.0 – 59.8)	36.7 (21.8 – 51.7)
Median	10.0 (6 – 29)	7.0 (4 – 20)	8.0 (6 – 20)
ALL tournaments (2008 – 2019)			
Mean	31.2 (25.7 – 36.7)	37.1 (31.0 – 43.2)	34.4 (30.2 – 38.6)
Median	9.0 (7 – 12)	9.0 (7 – 13)	9.0 (8 – 11)

There were no significant differences in the severity of injuries sustained by backs and forwards during the 2019 WRC for either the mean (p=0.857) or median (p=0.616) severity of injury. Similarly, there are no significant differences between backs and forwards over the period 2008 to 2019 for either the mean (p=0.162) or median (p=0.939) severity of injury. The mean severities of injury sustained by backs and forwards over the period 2008 to 2019 are presented in Figure 4. There is a non-significant increasing trend in the mean severity of injuries sustained by backs (p=0.081) but no significant trend for forwards (p=0.647).

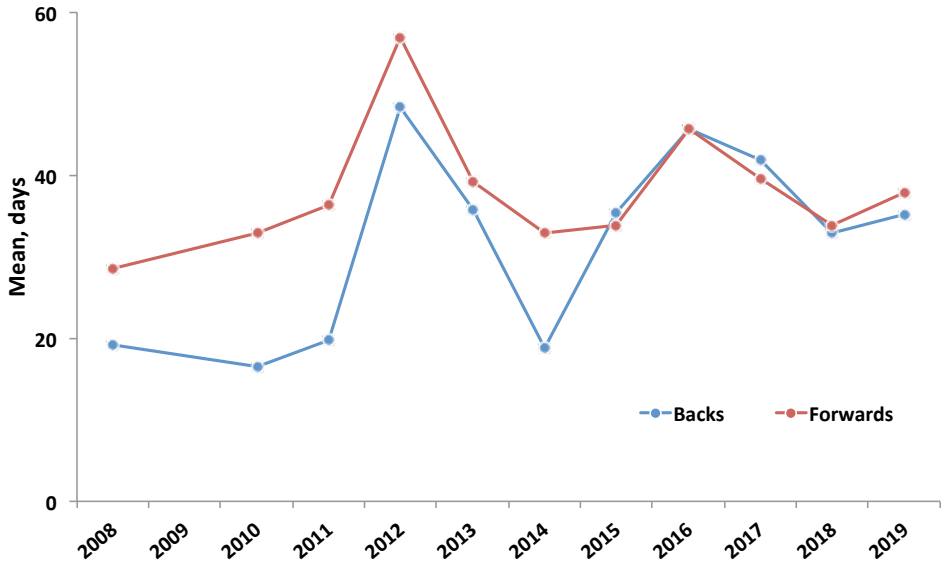

Figure 4. Trends in the mean severity of injury in the period 2008 to 2019.

The median severities of injury sustained by backs and forwards over the period 2008 to 2019 are presented in Figure 5. There has been an increasing but non-significant trend in the median severity of injuries sustained by backs over this period (p=0.057) but not significant trend in for forwards (p=0.304).

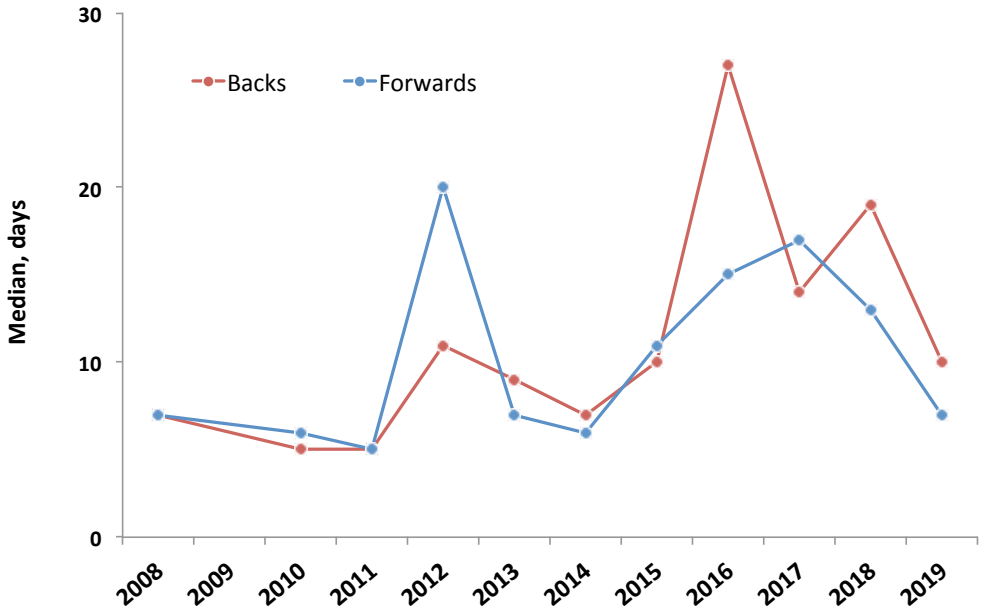

Figure 5. Trends in the median severity of injury in the period 2008 to 2019.

Figure 6 compares the severity of all injuries sustained in the period 2008 to 2019 within injury categories for backs and forwards. The 'severe' category (>28 days) of injury used in earlier reports has been split into two sub-categories 'severe (29 to 90 days)' and 'major (>90 days)' in order to provide more detail about this group of injuries, as they are responsible for the greatest loss of time.

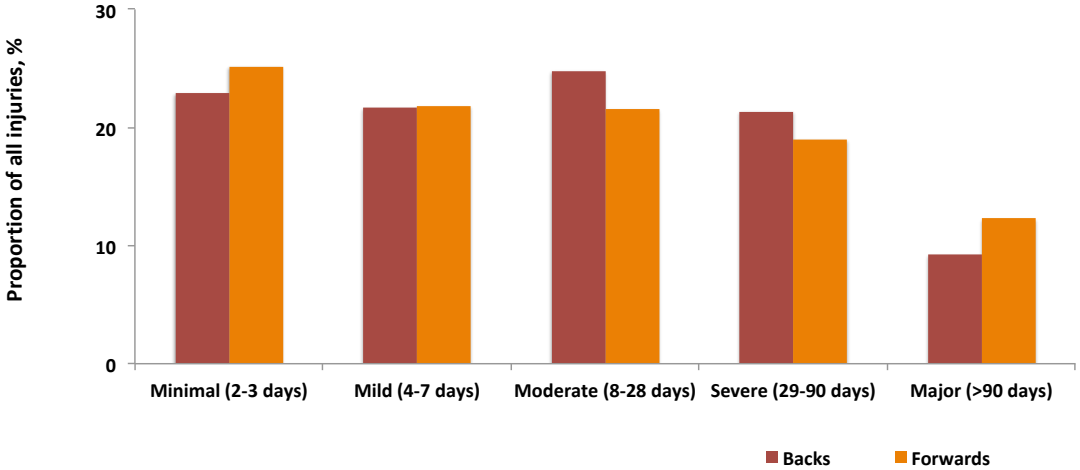

Figure 6. Severity of all injuries sustained in the period 2008 to 2019 presented within grouped injury categories for backs and forwards.

There are no statistically significant differences (p=0.236) between the distributions of the backs and forwards.

4.2c Location of injury

Table 4 summarises the locations of all injuries sustained at WRC tournaments over the period 2008 to 2019, as a function of playing position.

Table 4: Locations of all match injuries sustained in the period 2008 to 2019.

Location of injury	*% (95% Confidence interval)*		
	Backs	***Forwards***	***ALL players***
ALL tournaments (2008 – 2019)			
Head/neck	15.9 (11.9 – 19.9)	20.8 (16.8 – 24.9)	18.6 (15.7 – 21.5)
Head/face	15.3 (11.3 – 19.2)	18.8 (14.8 – 22.7)	17.2 (14.4 – 19.9)
Neck/cerv[l] spine	0.6 (0 – 1.5)	2.1 (0.7 – 3.5)	1.4 (0.5 – 2.3)
Upper limbs	21.8 (17.3 – 26.3)	28.6 (24.1 – 33.2)	25.5 (22.3 – 28.8)
Shoulder/clavicle	14.6 (10.8 – 18.5)	21.6 (17.5 – 25.7)	18.4 (15.6 – 21.3)
Upper arm	0.0 (-)	0.3 (0 – 0.8)	0.1 (0 – 0.4)
Elbow	0.9 (0 – 2.0)	2.1 (0.7 – 3.5)	1.6 (0.6 – 2.5)
Forearm	0.0 (-)	1.0 (0.0 – 2.1)	0.6 (0.0 – 1.1)
Wrist	0.3 (0 – 0.9)	0.8 (0 – 1.7)	0.6 (0.0 – 1.1)
Hand/fingers	5.9 (3.3 – 8.5)	2.9 (1.2 – 4.5)	4.3 (2.8 – 5.7)
Trunk	6.2 (3.6 – 8.9)	6.8 (4.3 – 9.3)	6.5 (4.7 – 8.3)
Ribs/upper back	4.4 (2.1 – 6.6)	3.1 (1.4 – 4.9)	3.7 (2.3 – 5.1)
Abdomen	0.3 (0 – 0.9)	1.6 (0.3 – 2.8)	1.0 (0.3 – 1.7)
Low back	0.6 (0 – 1.5)	0.8 (0 – 1.7)	0.7 (0.1 – 1.3)
Sacrum/pelvis	0.9 (0 – 2.0)	1.3 (0.2 – 2.4)	1.1 (0.4 – 1.9)
Lower limbs	56.1 (50.6 – 61.5)	43.8 (38.8 – 48.7)	49.4 (45.7 – 53.1)
Hip/groin	2.8 (1.0 – 4.6)	1.3 (0.2 – 2.4)	2.0 (1.0 – 3.0)
Thigh, anterior	4.7 (2.4 – 7.0)	4.9 (2.8 – 7.1)	4.8 (3.2 – 6.4)
Thigh, posterior	9.7 (6.4 – 12.9)	3.9 (2.0 – 5.8)	6.5 (4.7 – 8.3)
Knee	13.1 9.4 – 16.8)	14.3 (10.8 – 17.8)	13.8 (11.2 – 16.3)
L-leg/Achilles	5.3 (2.8 – 7.7)	2.6 (1.0 – 4.2)	3.8 (2.4 – 5.2)
Ankle	16.5 (12.4 – 20.6)	13.8 (10.4 – 17.3)	15.0 (12.4 – 17.7)
Foot/toe	4.0 (1.9 – 6.2)	2.9 (1.2 – 4.5)	3.4 (2.1 – 4.7)

Based on the 'All tournament' data, the majority of injuries sustained by backs and forwards are lower limb (backs: 56.1%; forwards: 43.8%) and upper limb (backs: 21.8%; forwards: 28.6%) injuries. The shoulder/clavicle is the most vulnerable structure for forwards (21.6%) followed by the head/face (18.8%) and knee (14.3%); whereas, for backs the most vulnerable is the ankle (16.5%) followed by the head/face (15.3%) and shoulder/clavicle (14.6%). Based on the 95% confidence intervals, the only statistically 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 from 2008 to 2019, as a function of playing position.

Table 5: Types of all match injuries sustained in the period 2008 to 2019.

Type of injury	% (95% Confidence interval)		
	Backs	*Forwards*	*ALL players*
ALL tournaments (2008 – 2019)			
Bone	8.7 (5.6 – 11.8)	5.7 (3.4 – 8.0)	7.1 (5.2 – 9.0)
Fracture	8.1 (5.1 – 11.1)	3.9 (2.0 – 5.8)	5.8 (4.1 – 7.5)
Other bone	0.6 (0 – 1.5)	1.8 (0.5 – 3.2)	1.3 (0.5 – 2.1)
C/PNS	13.1 (9.4 – 16.8)	16.9 (13.1 – 20.6)	15.2 (12.5 – 17.8)
Concussion	11.8 (8.3 – 15.4)	14.8 (11.3 – 18.4)	13.5 (10.9 – 16.0)
Nerve	1.2 (0.0 – 2.5)	2.1 (0.7 – 3.5)	1.7 (0.7 – 2.7)
Joint (non-bone)/lig[t]	40.5 (35.1 – 45.9)	50.1 (45.1 – 55.1)	45.8 (42.1 – 49.4)
Dislocation/sublux[n]	6.5 (3.8 – 9.2)	6.0 (3.6 – 8.3)	6.2 (4.5 – 8.0)
Lesion meniscus	1.2 (0.0 – 2.5)	4.9 (2.8 – 7.1)	3.3 (2.0 – 4.6)
Sprain/ligament	32.7 (27.6 – 37.8)	39.2 (34.3 – 44.1)	36.3 (32.7 – 39.8)
Muscle/tendon	35.8 (30.6 – 41.1)	24.4 (20.1 – 28.7)	29.6 (26.2 – 33.0)
Haematoma/etc	19.3 (15.0 – 23.6)	14.3 (10.8 – 17.8)	16.6 (13.8 – 19.3)
Muscle rupture/etc	12.8 (9.1 – 16.4)	6.8 (4.2 – 9.3)	9.5 (7.3 – 11.7)
Tendon injury/etc	3.7 (1.7 – 5.8)	3.4 (1.6 – 5.2)	3.5 (2.2 – 4.9)
Skin	1.2 (0.0 – 2.5)	2.1 (0.7 – 3.5)	1.7 (0.7 – 2.7)
Abrasion	0.0 (-)	0.3 (0 – 0.8)	0.1 (0 – 0.4)
Laceration	1.2 (0.0 – 2.5)	1.8 (0.5 – 3.2)	1.6 (0.6 – 2.5)
Other types	0.6 (0 – 1.5)	0.8 (0 – 1.7)	0.7 (0.1 – 1.3)
Other	0.6 (0 – 1.5)	0.8 (0 – 1.7)	0.7 (0.1 – 1.3)

C/PNS: Central and peripheral nervous systems

Joint (non-bone)/ligament (backs: 40.5%; forwards: 50.1%) and muscle/tendon (backs: 35.8%; forwards: 24.4%) injuries are the most common main categories of injury sustained by backs and forwards. Sprain/ligament (32.7%) and muscle haematoma (19.3%) injuries are the most common sub-types sustained by backs: for forwards, the most common are sprain/ligament (39.2%) and concussion (14.8%).

Based on the 95% confidence intervals, muscle rupture/strains is the only injury category that is significantly different between backs (12.8%) and forwards (6.8%).

Concussions, in terms of both the proportion of all injuries (Figure 7) and incidence of injury (Figure 8), showed large reductions during the 2018 WRC compared to previous tournaments. Unfortunately, this improvement was not maintained during the 2019 WRC, as concussion levels returned to the previous high values seen between 2013 and 2017.

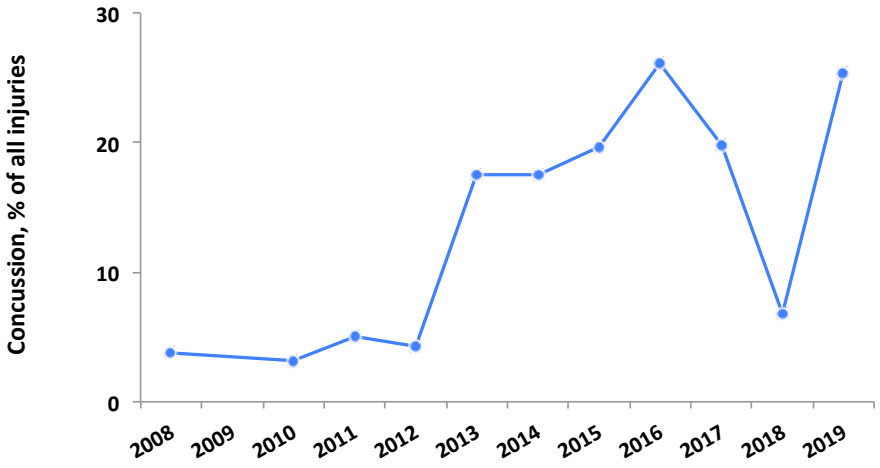

Figure 7. Concussions as a proportion of all injuries sustained in the period 2008 to 2019.

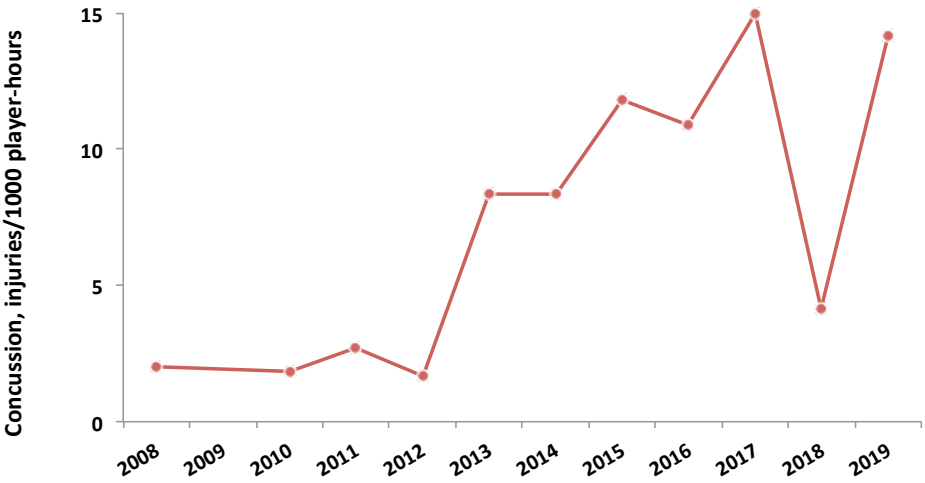

Figure 8. Incidence of all concussions as a function of year of tournament.

Of interest, however, is that concussion severity, which had been following an upward trend in the 5 previous competitions, showed a significant reduction back to levels previously seen in the period 2012 to 2014 (Figure 9). Whether these two contrasting effects are inter-related is worthy of further investigation.

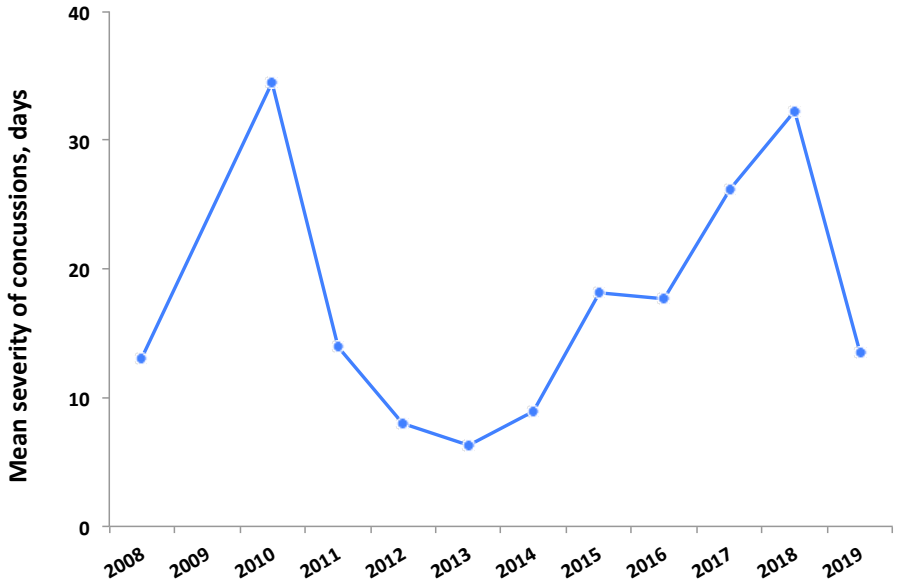

Figure 9. Mean severity of all concussions as a function of year of tournament.

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.

Table 6: Most common injuries sustained and the injuries causing the greatest burden (days lost) in the period 2008 to 2019 as a function of playing position.

Backs	***%***	***Forwards***	***%***
All tournaments (2008 – 2019)			
Most common injuries, % of total number			
Concussion	12.2	Concussion	15.3
Hamstring muscle strain	8.7	Acromioclavicular joint injuries	8.8
Ankle lat[l] collateral ligament sprain	7.1	Inferior tib-fib syndesmosis sprain	6.4
Thigh haematoma	6.1	Knee MCL sprain	5.6
Acromioclavicular joint sprain	5.8	Thigh haematoma	5.4
Knee MCL sprain	5.1	Shoulder dislocation/subluxation	5.1
		Ankle lat[l] collateral ligament sprain	5.1
Injuries causing greatest burden, % of total days lost			
Anterior cruciate ligament sprain	18.5	Anterior cruciate ligament sprain	22.8
Shoulder dislocation/subluxation	11.7	Shoulder dislocation/subluxation	12.8
Hamstring muscle strain	11.0	Concussion	7.2
Knee MCL sprain	7.0	Inferior tib-fib syndesmosis sprain	6.7
Concussion	6.3	Acromioclavicular joint injuries	5.7
Ankle lat[l] collateral ligament sprain	5.7	Knee MCL sprain	5.6

The most common injuries and the injuries responsible for the greatest burden of injury remain broadly similar to those reported previously, with only minor movements in the ranking of the six injuries.

The most common, specific injury sustained by both backs (12.2%) and forwards (15.3%) is concussion. However, anterior cruciate ligament injuries (18.5%), shoulder dislocation/subluxation (11.7%) and hamstring muscle strain (11.0%) for backs and anterior cruciate ligament injuries (22.8%), shoulder dislocation/subluxation (12.8%) and concussion (7.2%) for forwards are responsible for 41% of total time lost through injury by backs and for 43% of total time lost by forwards.

4.2f Nature of onset of injury

Table 7 summarises the nature of injury-onset at WRC tournaments from 2008 to 2019, as a function of playing position.

Table 7: Nature of the injury-onset of all match injuries sustained in the period 2008 to 2019.

Nature of onset	*% (95% Confidence interval)*		
	Backs	***Forwards***	***ALL players***
All tournaments (2008 – 2019)			
Acute	97.5 (95.8 – 99.2)	95.3 (93.2 – 97.4)	96.3 (94.9 – 97.7)
Gradual	2.5 (0.8 – 4.2)	4.7 (2.6 – 6.8)	3.7 (2.3 – 5.1)

Although over 95% of all injuries sustained by both backs and forwards were acute in nature, significantly more acute injuries were sustained by backs than forwards (p=0.126).

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 2019

Cause of onset	*% (95% Confidence interval)*		
	Backs	***Forwards***	***ALL players***
All tournaments (2008 – 2019)			
Contact	82.2 (78.0 – 86.4)	89.2 (86.0 – 92.3)	86.0 (83.4 – 88.6)
Non-contact	17.8 (13.6 – 22.0)	10.8 (7.7 – 14.0)	14.0 (11.4 – 16.6)

Eighty-six per cent of all injuries sustained are the result of contact events. Backs, however, sustain significantly more non-contact and fewer contact injuries than forwards (p=0.009).

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 2019.

Cause of onset	% (95% Confidence interval)		
	Backs	*Forwards*	*ALL players*
All tournaments (2008 – 2019)			
Collision	12.9 (9.2 – 16.6)	17.2 (13.4 – 20.9)	15.2 (12.6 – 17.9)
Kicking	0.9 (0 – 2.0)	0.0 (-)	0.4 (0 – 0.9)
Lineout	0.0 (-)	2.9 (1.2 – 4.6)	1.6 (0.7 – 2.5)
Maul	0.6 (0 – 1.5)	3.7 (1.8 – 5.6)	2.3 (1.2 – 3.4)
Ruck	5.7 (3.1 – 8.2)	11.6 (8.4 – 14.8)	8.9 (6.8 – 11.0)
Running	14.2 (10.4 – 18.0)	5.8 (3.5 – 8.2)	9.6 (7.4 – 11.8)
Scrum	0.0 (-)	6.6 (4.1 – 9.1)	3.6 (2.2 – 5.0)
Tackled	37.2 (31.9 – 42.5)	23.2 (19.0 – 27.5)	29.6 (26.2 – 33.0)
Tackling	22.7 (18.1 – 27.3)	25.3 (21.0 – 29.7)	24.1 (21.0 – 27.3)
Other	5.7 (3.1 – 8.2)	3.7 (1.8 – 5.6)	4.6 (3.0 – 6.2)

Being-tackled (37.2%), tackling (22.7%) and running (14.2%) are the events responsible for most injuries sustained by backs and tackling (25.3%), being-tackled (23.2%) and collisions (17.2%) for forwards.

Two-thirds of all concussion injuries resulted from either tackling (49.5%) or collision (17.9%) match events.

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 2019.

Time of injury, min	% (95% Confidence interval)		
	Backs	*Forwards*	*ALL players*
All tournaments (2008 – 2019)			
0-20	16.4 (12.3 – 20.4)	17.1 (13.3 – 20.8)	16.7 (14.0 – 19.5)
21-40+	27.7 (22.8 – 32.6)	28.9 (24.3 – 33.4)	28.3 (25.0 – 31.7)
41-60	29.9 (24.8 – 34.9)	29.4 (24.8 – 34.0)	29.6 (26.2 – 33.0)
61-80+	26.1 (21.3 – 30.9)	24.7 (20.3 – 29.0)	25.3 (22.1 – 28.5)

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 2019. A comparison of the match times when backs and forwards sustained injuries is presented in Figure 9.

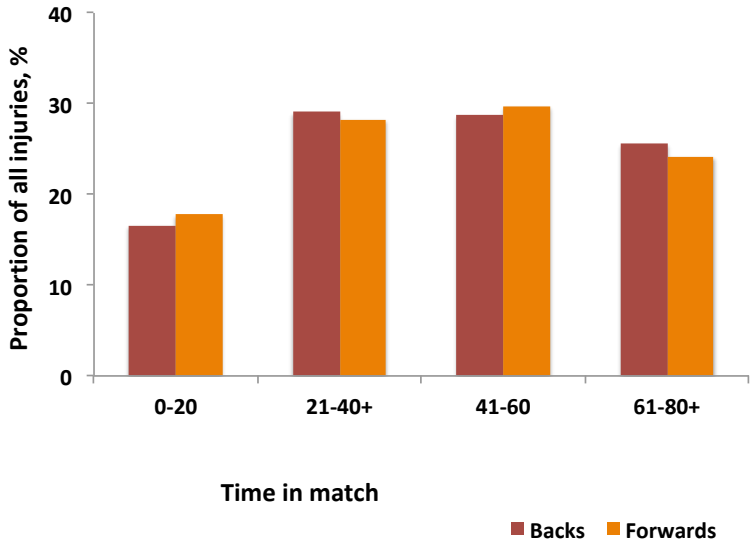

Figure 9. Periods in matches when backs and forwards sustain injuries.

There are no significant differences between backs and forwards in terms of the match time when injuries were sustained.

4.2j Removal of injured players from the pitch

Based on all injuries sustained over the period 2008 to 2019, 39% of players were removed from play immediately, 29% 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.

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 2019. 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 are increasing their body mass.

The changes in reported incidence and severity of injuries from tournament to tournament reflect the relative size of the U20 Championship, in terms of the number of competing teams, the number of games played and the number of injuries sustained. Consequently, relatively small changes in the number and nature of injuries can have an exaggerated effect on the incidence and severity values reported for individual tournaments. This may, at least in part, be one reason for the large shifts in the number of concussions reported in 2018 and again in 2019. It is important therefore, when interpreting the data presented in this report, to give priority to the long-term figures shown for the overall period from 2008 to 2019.

There was no evidence to suggest that playing half the matches at 2019 WRC on artificial turf increased the risk of injury, as there was no significant difference between the incidences of injuries on the two playing surfaces. However, as the level of exposure on both surfaces was relatively small, this result should not be interpreted as providing a definitive verdict on the artificial turf v grass playing surface issue.

There have been no significant changes in the incidences of injury for backs or forwards over the 2008 to 2019 period. There is, however, an indication that the severity of injuries sustained by backs has been increasing over this period but there is no indication that injury severity has been increasing for forwards. Knee, ankle and shoulder locations, and sprain/ligament and haematoma injuries continue to be the most common injuries sustained at the WRC. The most common specific injury sustained by backs and forwards over the period 2008 to 2019 remains concussion; however, anterior cruciate ligament injuries are responsible for the greatest burden in terms of days-lost. The majority of injuries sustained at the WRC are acute in nature and result from contact match activities with the tackle remaining as the main match event leading to injury.

Of particular note is the increased incidence, coupled with a decreased mean severity, of concussions sustained at the 2019 WRC.

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