



# **Injury Surveillance Studies**

## **Women's Sevens Series**

Summary of Results: 2022/23

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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 for the Women's Sevens Series have reported the incidence and nature of match and training injuries sustained over the period from 2011/12 to 2021/22 (Fuller and Taylor, 2022). This current report continues the on-going study of the Women's Sevens Series by reporting match and training injuries and illnesses sustained during the 2022/23 Series. This report also combines the women's 2022/23 injury data with the data reported previously in order to provide an updated, long-term overview of the risks of injury in the Women's Sevens Series (Fuller and Taylor, 2021).

## 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 Sevens World Series Tournament match or training activity 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'*. A recurrent injury was defined as: *'An injury (as defined above) of the same type and at the same site as an index injury and which occurs after a player's return to full participation from the index injury'*.

Specific injuries were classified using OSICS 10 (Orchard et al, 2010). Injury location, type and cause together with the event leading to the injury were also recorded.

The definition of an illness used in this study was: *'Any medical condition sustained while travelling to a Sevens World Series Tournament, while at a Tournament or while travelling home at the end of a Tournament that prevents a player from taking a full part in all training activities and/or match play for more than one day following the day of onset of the illness.'*

Injuries and illnesses that were not related directly to Sevens World Series rugby-related activities are not included in this report.

Injury/illness severity was determined by the number of days a player was injured/ill: a player was deemed to be 'injured/ill' until she could undertake full, normal training and be available for match selection, whether or not she was actually selected. Medical staff were required to make an informed clinical judgement about a player's fitness to train/play on those days when players were not scheduled to train or play. Injured/ill players were followed up after each tournament to obtain their return to play date: the return to play dates for players with injuries/illnesses that remained unresolved 3 months after the final day of the final tournament in the Series were defined on the basis of the clinical judgement and prognosis provided by the injured player's medical staff. The complete lists of categories and sub-categories used for categorising 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 incidences, mean severity and proportions of injuries using z-tests; and differences in median severity using a Mann-Whitney U test. Differences in injury numbers were assessed using the chi-squared test. Trends in data over time were assessed using linear regression analyses. Statistical significance was accepted at the  $p \leq 0.05$  level; it is recognised, however, that this approach could identify some differences as being statistically significant when they in fact occur by chance, due to the number of comparisons being made in the study. For this reason, exact p values (to 3 decimal places) are reported.

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

### 4 Results

In total, data for the 11 core teams participating in the 2022/23 Women's Sevens Series are included in the report: Australia, Brazil, Canada, Fiji, France, Great Britain, Ireland, Japan, New Zealand, Spain, USA.

During the 2022/23 Women's Sevens Series, tournaments took place in 7 countries: Dubai, South Africa, New Zealand, Australia, Canada, Hong Kong and France.

#### 4.1 Players' anthropometric data

All teams provided players' anthropometric data. Table 1 summarises the numbers and anthropometric data for players categorised as backs, forwards and all players in the 2022/23 Women's Sevens Series together, for comparison, with values averaged over the period 2011/12 to 2022/23.

Table 1: Players' anthropometric data: 2022/23 Sevens Series.

| Series / Measure                      | Mean (Standard deviation, number of players) |                  |                   |
|---------------------------------------|--|------------------|-------------------|
|                                       | Backs  | Forwards         | ALL players       |
| <b>2022/23</b>                        |  |                  |                   |
| Stature, cm                           | 165.8 (5.5, 119)                             | 170.0 (5.3, 86)  | 167.5 (5.6, 205)  |
| Body mass, Kg                         | 65.3 (6.2, 119)                              | 70.9 (6.6, 86)   | 67.6 (6.9, 205)   |
| Age, years                            | 23.9 (3.7, 119)                              | 24.9 (4.0, 86)   | 24.3 (3.8, 205)   |
| <b>All Series (2011/12 – 2022/23)</b> |  |                  |                   |
| Stature, cm                           | 166.9 (5.4, 1195)                            | 170.5 (5.6, 917) | 168.5 (5.8, 2112) |
| Body mass, Kg                         | 65.4 (5.8, 1196)                             | 71.1 (6.4, 920)  | 67.9 (6.7, 2116)  |
| Age, years                            | 23.7 (3.8, 1197)                             | 24.6 (3.9, 920)  | 24.1 (3.8, 2117)  |

For the 2022/23 Series, forwards were significantly heavier ( $p < 0.001$ ) and taller ( $p < 0.001$ ) than backs but the higher age of forwards compared to backs did not reach statistical significance ( $p = 0.066$ ). Based on the all-Series data, forwards are significantly older ( $p < 0.001$ ), heavier ( $p < 0.001$ ) and taller ( $p < 0.001$ ) than backs.

Trends in players' age, stature and body mass over the period 2011/12 to 2022/23 are shown in Figures 1 to 3, respectively. There are no statistically significant long-term trends in the players' age (backs:  $p = 0.492$ ; forwards:  $p = 0.355$ ), stature (backs:  $p = 0.837$ ; forwards:  $p = 0.514$ ) or body mass (backs:  $p = 0.439$ ; forwards:  $p = 0.455$ ).

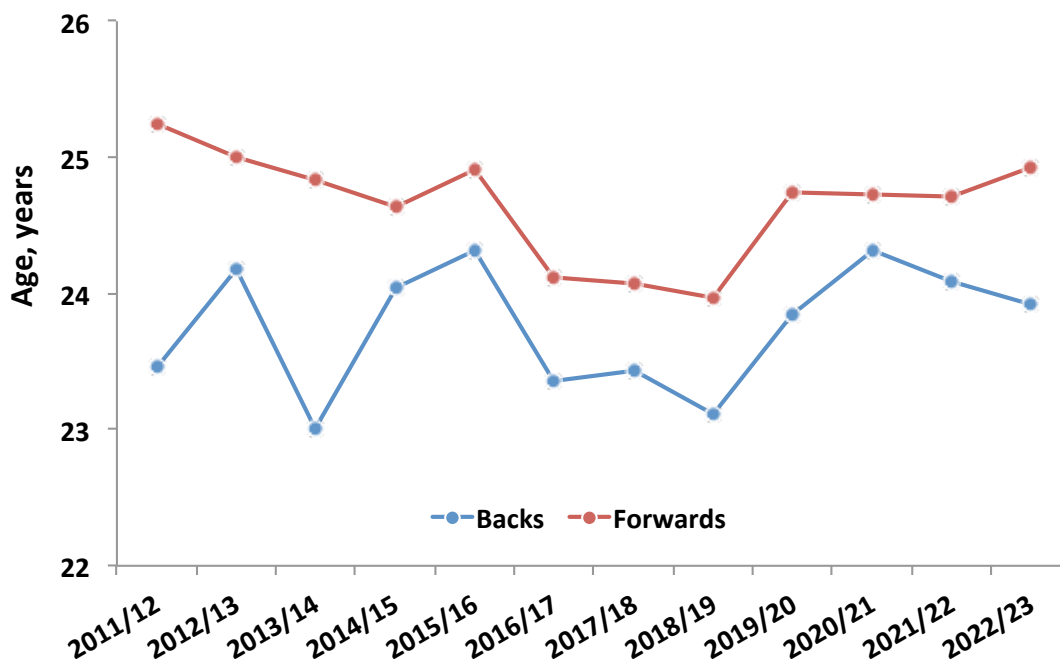


Fig 1. Long-term trends in players' age (years)

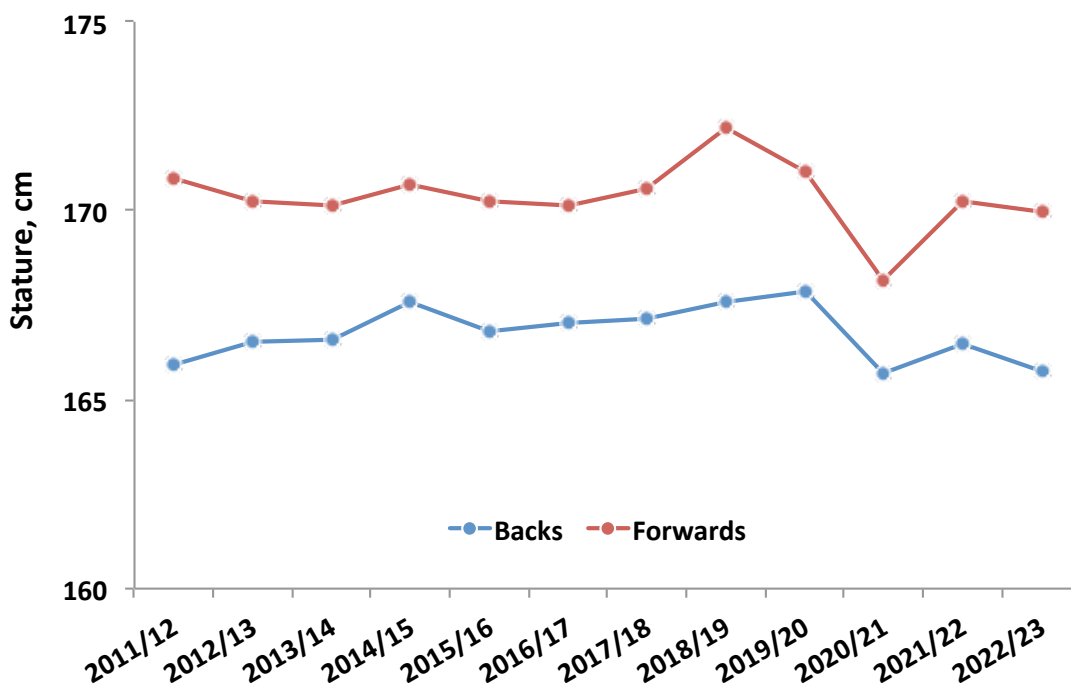


Fig 2. Long-term trends in players' stature (cm)

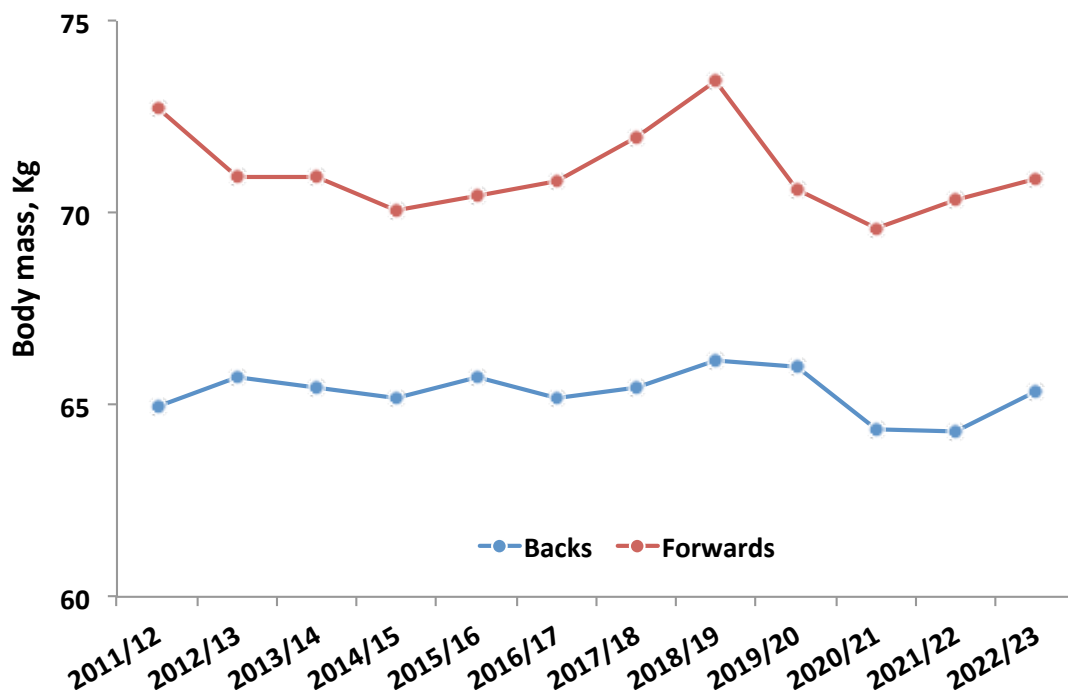


Fig 3. Long-term trends in players' body mass (Kg)

## 4.2 Match injuries

### 4.2a Incidence of injury

Table 2 summarises the numbers of match injuries, match exposures and incidences of match injuries recorded for backs, forwards and all players during the 2022/23 Women's Sevens Series and the equivalent values for all data over the period 2011/12 to 2022/23.

Table 2: Number, match exposure (player-hours) and incidence (injuries/1000 player-match-hours, 95% confidence interval) of match injuries: 2022/23 Sevens Series.

| Series / Measure                      | Backs                 | Forwards             | ALL players          |
|---------------------------------------|-----------------------|----------------------|----------------------|
| <b>2022/23</b>                        |                       |                      |                      |
| Injuries                              | 43                    | 32                   | 75                   |
| Exposure                              | 411.6                 | 308.7                | 720.3                |
| Incidence                             | 104.5 (77.5 – 140.9)  | 103.7 (73.3 – 146.6) | 104.1 (83.0 – 130.6) |
| <b>All Series (2011/12 – 2022/23)</b> |                       |                      |                      |
| Injuries                              | 347                   | 203                  | 551                  |
| Exposure                              | 3058                  | 2293                 | 5351                 |
| Incidence                             | 113.5 (102.1 – 126.1) | 88.5 (77.1 – 101.6)  | 103.0 (94.7 – 111.9) |

10.7% of all injuries (backs: 11.6%, forwards: 9.4%) sustained in 2022/23 were recurrent injuries. This compares to the long-term value of 9.7% of all injuries (backs: 9.7%; forwards: 9.7%) over the period 2011/12 to 2022/23.

There was no statistically significant difference between the 2022/23 incidences of injury for backs and forwards ( $p=0.976$ ). The long-term incidence values, however, confirm the significantly higher injury incidence of injury experienced by backs compared to forwards ( $p<0.001$ ).

There are no statistically significant trends in the incidences of injury for either backs ( $p=0.774$ ) or forwards ( $p=0.720$ ) over the period 2011/12 to 2022/23 (Figure 4).

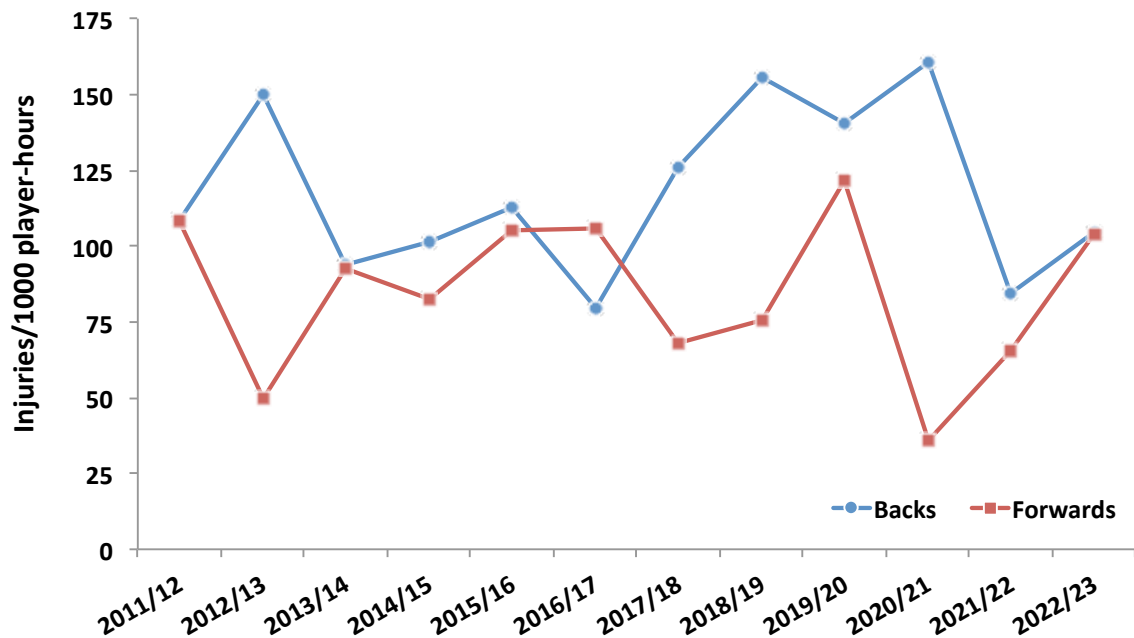


Fig 4. Long-term trends in the incidence of injury

### 4.2b Severity of injury

Table 3 summarises the mean and median severities of injuries sustained during the 2022/23 Women's Sevens Series for backs, forwards and all players and the equivalent average values observed over the period 2011/12 to 2022/23.

Table 3: Mean and median severities of match injuries: 2022/23 Sevens Series.

| Series / Measure                      | Severity (95% Confidence interval), days |                    |                    |
|---------------------------------------|--|--------------------|--------------------|
|                                       | Backs                                    | Forwards           | ALL players        |
| <b>2022/23</b>                        |  |                    |                    |
| Mean                                  | 41.1 (27.3 – 55.0)                       | 37.3 (15.7 – 58.9) | 39.5 (27.4 – 51.6) |
| Median                                | 28.0 (17.0 – 40.0)                       | 22.0 (14.0 – 31.0) | 25.0 (21.0 – 32.0) |
| <b>All Series (2011/12 – 2022/23)</b> |  |                    |                    |
| Mean                                  | 50.9 (44.4 – 57.5)                       | 52.4 (42.4 – 62.4) | 51.5 (45.9 – 57.6) |
| Median                                | 30.0 (26.0 – 34.0)                       | 28.0 (22.0 – 31.0) | 29.0 (25.0 – 31.0) |

There were no statistically significant differences between backs and forwards for the mean ( $p=0.772$ ) or median ( $p=0.319$ ) injury severities during the 2022/23 Women's Sevens Series. There are also no statistically significant differences in the long-term (2011/12 – 2022/23) mean ( $p=0.952$ ) and median ( $p=0.636$ ) severities of injuries sustained by backs and forwards.

There are no statistically significant long-term trends in the mean severity values for backs ( $p=0.155$ ) or forwards ( $p=0.334$ ) (Figure 5). Long-term median severity values (Figure 6) show a significant downward trend for backs ( $p=0.043$ ) and an indication of a downward trend for forwards ( $p=0.065$ ).

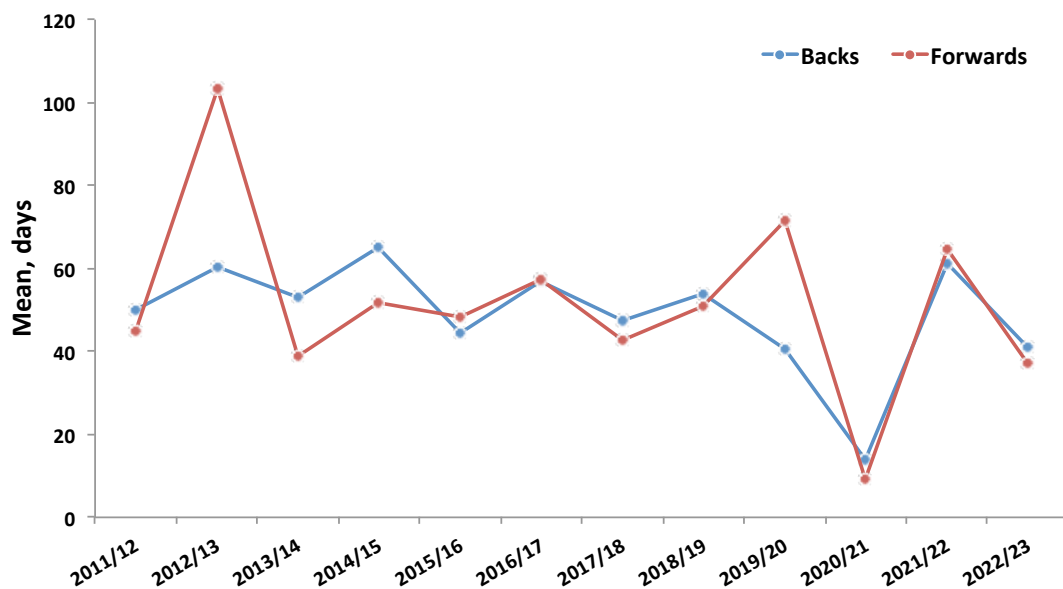


Fig 5. Long-term trends in mean severity



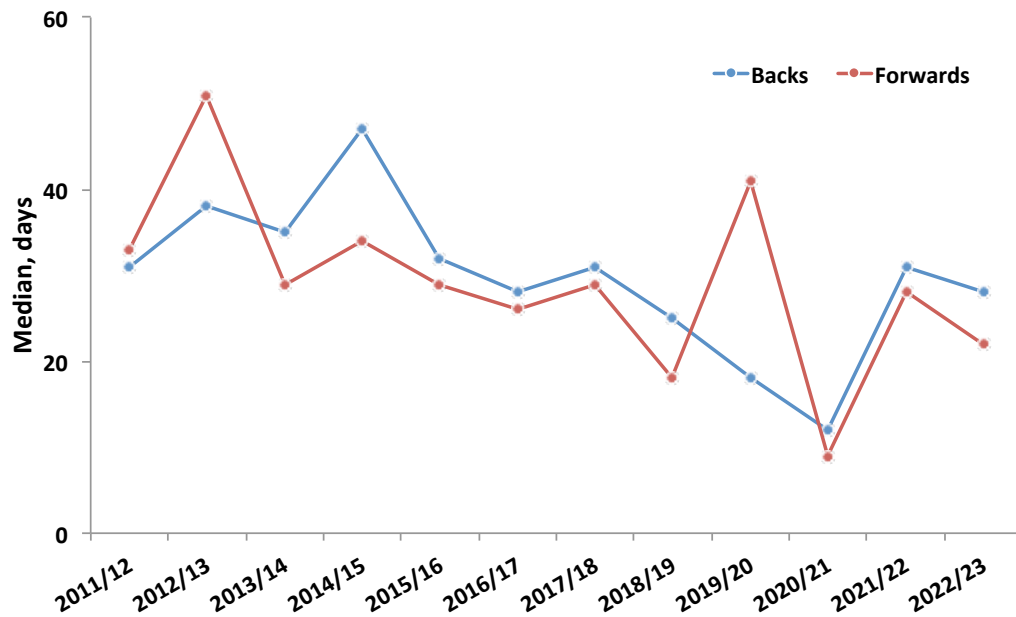


Fig 6. Long-term trends in median severity

#### 4.2c Injury burden

There was no significant difference ( $p=0.653$ ) between the injury burden values for backs (4297 days-absence/1000 player-match-hours; 95% CI: 3187 - 5794) and forwards (3864 days-absence/1000 player-match-hours; 95% CI: 2733 - 5464) during the 2022/23 Women's Sevens Series. However, the long-term injury burden for backs (5,778 days-absence/1000 player-match-hours; 95% CI: 5201 - 6419) is significantly ( $p=0.013$ ) greater than that for forwards (4,638 days-absence/1000 player-match-hours; 95% CI: 4042 - 5321).

Figure 7 shows that there are no significant long-term trends in injury burden for either backs ( $p=0.177$ ) or forwards ( $p=0.593$ ) over the period from 2011/12 to 2022/23.

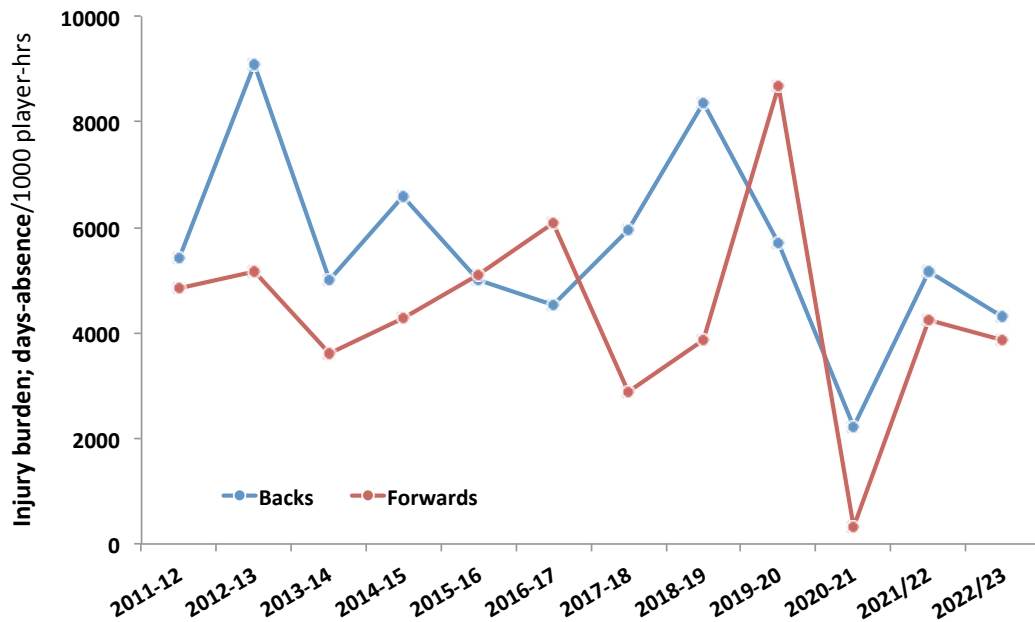


Fig 7. Long-term trends in injury burden for backs and forwards

#### 4.2d Location of injury

Table 4 summarises the main and sub-locations for injuries sustained by backs, forwards and all players during the 2022/23 Women's Sevens Series. Table 5 shows the equivalent long-term values for the period 2011/12 to 2022/23.

The majority of injuries sustained in 2022/23 by both backs (65.1%) and forwards (46.9%) were located in the lower limbs. Overall, the knee (23.3%) and ankle (23.3%) were the most common injury sub-locations for backs. For forwards, the most common sub-locations were the head/face (37.5%) and ankle (15.6%). Based on the 95% confidence intervals for each sub-location, there were no statistically significant differences in injury sub-locations between backs and forwards.

Table 4: Locations of match injuries: 2022/23 Sevens Series.

| Series /<br>Location of injury | Proportion, % (95% Confidence interval) |                    |                    |
|--------------------------------|---|--------------------|--------------------|
|                                | <i>Backs</i>                            | <i>Forwards</i>    | <i>ALL players</i> |
| <b>2022/23</b>                 |   |                    |                    |
| <b>Head/neck</b>               | 16.3 (5.2 – 27.3)                       | 40.6 (23.6 – 57.6) | 26.7 (16.7 – 36.7) |
| Head/face                      | 11.6 (2.0 – 21.2)                       | 37.5 (20.7 – 54.3) | 22.7 (13.2 – 32.1) |
| Neck/cerv <sup>l</sup> spine   | 4.7 (0 – 10.9)                          | 3.1 (0 – 9.2)      | 4.0 (0 – 8.4)      |
| <b>Upper limbs</b>             | 16.3 (5.2 – 27.3)                       | 6.3 (0 – 14.6)     | 12.0 (4.6 – 19.4)  |
| Shoulder/clavicle              | 11.6 (2.0 – 21.2)                       | 3.1 (0 – 9.2)      | 8.0 (1.9 – 14.1)   |
| Upper arm                      | 0.0 ( - )                               | 0.0 ( - )          | 0.0 ( - )          |
| Elbow                          | 2.3 (0 – 6.8)                           | 0.0 ( - )          | 1.3 (0 – 3.9)      |
| Forearm                        | 0.0 ( - )                               | 0.0 ( - )          | 0.0 ( - )          |
| Wrist/hand                     | 2.3 (0 – 6.8)                           | 3.1 (0 – 9.2)      | 2.7 (0 – 6.3)      |
| <b>Trunk</b>                   | 2.3 (0 – 6.8)                           | 6.3 (0 – 14.6)     | 4.0 (0 – 8.4)      |
| Ribs/upper back                | 0.0 ( - )                               | 0.0 ( - )          | 0.0 ( - )          |
| Abdomen                        | 0.0 ( - )                               | 3.1 (0 – 9.2)      | 1.3 (0 – 3.9)      |
| Low back                       | 0.0 ( - )                               | 3.1 (0 – 9.2)      | 1.3 (0 – 3.9)      |
| Sacrum/pelvis                  | 2.3 (0 – 6.8)                           | 0.0 ( - )          | 1.3 (0 – 3.9)      |
| <b>Lower limbs</b>             | 65.1 (50.9 – 79.4)                      | 46.9 (29.6 – 64.2) | 57.3 (46.1 – 68.5) |
| Hip/groin                      | 0.0 ( - )                               | 0.0 ( - )          | 0.0 ( - )          |
| Thigh, anterior                | 4.7 (0 – 10.9)                          | 3.1 (0 – 9.2)      | 4.0 (0 – 8.4)      |
| Thigh, posterior               | 0.0 ( - )                               | 3.1 (0 – 9.2)      | 1.3 (0 – 3.9)      |
| Knee                           | 23.3 (10.6 – 35.9)                      | 9.4 (0 – 19.5)     | 17.3 (8.8 – 25.9)  |
| L-Leg/Achilles                 | 7.0 (0 – 14.6)                          | 6.3 (0 – 14.6)     | 6.7 (1.0 – 12.3)   |
| Ankle                          | 23.3 (10.6 – 35.9)                      | 15.6 (3.0 – 28.2)  | 20.0 (10.9 – 29.1) |
| Foot/toe                       | 7.0 (0 – 14.6)                          | 6.3 (0 – 14.6)     | 6.7 (1.0 – 12.3)   |
| Other                          | 0.0 ( - )                               | 3.1 (0 – 9.2)      | 1.3 (0 – 3.9)      |

Table 5: Locations of match injuries: 2011/12 to 2022/23 Sevens Series.

| Series /<br>Location of injury        | <i>Proportion, % (95% Confidence interval)</i> |                    |                    |
|---------------------------------------|--|--------------------|--------------------|
|                                       | <i>Backs</i>                                   | <i>Forwards</i>    | <i>ALL players</i> |
| <b>All Series (2011/12 – 2022/23)</b> |  |                    |                    |
| <b>Head/neck</b>                      | 21.0 (16.7 – 25.3)                             | 30.0 (23.7 – 36.4) | 24.4 (20.8 – 28.0) |
| Head/face                             | 18.4 (14.4 – 22.5)                             | 29.1 (22.8 – 35.3) | 22.4 (18.9 – 25.8) |
| Neck/cerv <sup>1</sup> spine          | 2.6 (0.9 – 4.3)                                | 1.0 (0 – 2.3)      | 2.0 (0.8 – 3.2)    |
| <b>Upper limbs</b>                    | 18.2 (14.1 – 22.2)                             | 18.7 (13.4 – 24.1) | 18.4 (15.1 – 21.6) |
| Shoulder/clavicle                     | 6.6 (4.0 – 9.2)                                | 9.9 (5.8 – 14.0)   | 7.8 (5.6 – 10.1)   |
| Upper arm                             | 0.6 (0 – 1.4)                                  | 0.5 (0 – 1.5)      | 0.5 (0 – 1.2)      |
| Elbow                                 | 2.0 (0.5 – 3.5)                                | 1.0 (0 – 2.3)      | 1.6 (0.6 – 2.7)    |
| Forearm                               | 1.2 (0.0 – 2.3)                                | 1.5 (0 – 3.1)      | 1.3 (0.3 – 2.2)    |
| Wrist/hand                            | 7.8 (5.0 – 10.6)                               | 5.9 (2.7 – 9.2)    | 7.1 (4.9 – 9.2)    |
| <b>Trunk</b>                          | 5.8 (3.3 – 8.2)                                | 7.4 (3.8 – 11.0)   | 6.4 (4.3 – 8.4)    |
| Ribs/upper back                       | 4.0 (2.0 – 6.1)                                | 3.9 (1.3 – 6.6)    | 4.0 (2.4 – 5.6)    |
| Abdomen                               | 0.3 (0 – 0.9)                                  | 1.0 (0 – 2.3)      | 0.5 (0 – 1.2)      |
| Low back                              | 0.6 (0 – 1.4)                                  | 2.0 (0.1 – 3.9)    | 1.1 (0.2 – 2.0)    |
| Sacrum/pelvis                         | 0.9 (0 – 1.8)                                  | 0.5 (0 – 1.5)      | 0.7 (0.0 – 1.4)    |
| <b>Lower limbs</b>                    | 55.0 (49.8 – 60.3)                             | 43.8 (37.0 – 50.7) | 50.9 (46.7 – 55.1) |
| Hip/groin                             | 0.9 (0 – 1.8)                                  | 2.0 (0.1 – 3.9)    | 1.3 (0.3 – 2.2)    |
| Thigh, anterior                       | 4.3 (2.2 – 6.5)                                | 2.0 (0.1 – 3.9)    | 3.5 (1.9 – 5.0)    |
| Thigh, posterior                      | 4.6 (2.4 – 6.8)                                | 6.9 (3.4 – 10.4)   | 5.5 (3.6 – 7.4)    |
| Knee                                  | 22.2 (17.8 – 26.6)                             | 14.3 (9.5 – 19.1)  | 19.3 (16.0 – 22.6) |
| L-Leg/Achilles                        | 4.6 (2.4 – 6.8)                                | 4.9 (1.9 – 7.9)    | 4.7 (3.0 – 6.5)    |
| Ankle                                 | 14.1 (10.5 – 17.8)                             | 10.8 (6.6 – 15.1)  | 12.9 (10.1 – 15.7) |
| Foot/toe                              | 4.0 (2.0 – 6.1)                                | 2.5 (0.3 – 4.6)    | 3.5 (1.9 – 5.0)    |
| Other                                 | 0.3 (0 – 0.9)                                  | 0.5 (0 – 1.5)      | 0.4 (0 – 0.9)      |

Over the period 2011/12 to 2022/23, the majority of injuries sustained by both backs (55.0%) and forwards (43.8%) were located in the lower limbs. Overall, the knee (22.2%), head/face (18.4%) and ankle (14.1%) were the most common injury sub-locations for backs. For forwards, the most common sub-locations were the head/face (29.1%), knee (14.3%) and ankle (10.8%). Based on the 95% confidence intervals for each sub-location, head/face injuries sustained by forwards was the only sub-location that was statistically more common than for backs.

#### 4.2e Type of injury

Table 6 summarises the main and sub-types for injuries sustained by backs, forwards and all players during the 2022/23 Women's Sevens Series. Table 7 shows the equivalent long-term values for the period 2011/12 to 2022/23.

Table 6: Types of match injuries: 2022/23 Sevens Series.

| Series /<br>Type of injury              | Proportion, % (95% Confidence interval) |                    |                    |
|---|---|--------------------|--------------------|
|   | Backs                                   | Forwards           | ALL players        |
| <b>2022/23</b>                          |   |                    |                    |
| <b>Bone</b>                             | 11.6 (2.0 – 21.2)                       | 6.3 (0 – 14.6)     | 9.3 (2.7 – 15.9)   |
| Fracture                                | 11.6 (2.0 – 21.2)                       | 6.3 (0 – 14.6)     | 9.3 (2.7 – 15.9)   |
| Other bone                              | 0.0 ( - )                               | 0.0 ( - )          | 0.0 ( - )          |
| <b>C/PNS</b>                            | 11.6 (2.0 – 21.2)                       | 31.3 (15.2 – 47.3) | 20.0 (10.9 – 29.1) |
| Brain injuries                          | 11.6 (2.0 – 21.2)                       | 31.3 (15.2 – 47.3) | 20.0 (10.9 – 29.1) |
| Nerve injuries                          | 0.0 ( - )                               | 0.0 ( - )          | 0.0 ( - )          |
| <b>Joint (non-bone)/lig<sup>t</sup></b> | 46.5 (31.6 – 61.4)                      | 34.4 (17.9 – 50.8) | 41.3 (30.2 – 52.5) |
| Dislocation/sublux <sup>n</sup>         | 0.0 ( - )                               | 0.0 ( - )          | 0.0 ( - )          |
| Lesion meniscus                         | 11.6 (2.0 – 21.2)                       | 0.0 ( - )          | 6.7 (1.0 – 12.3)   |
| Ligament sprain                         | 32.6 (18.6 – 46.6)                      | 34.4 (17.9 – 50.8) | 33.3 (22.7 – 44.0) |
| Other injuries                          | 2.3 (0 – 6.8)                           | 0.0 ( - )          | 1.3 (0 – 3.9)      |
| <b>Muscle/tendon</b>                    | 27.9 (14.5 – 41.3)                      | 18.8 (5.2 – 32.3)  | 24.0 (14.3 – 33.7) |
| Haematoma/etc                           | 4.7 (0 – 10.9)                          | 0.0 ( - )          | 2.7 (0 – 6.3)      |
| Muscle strain/etc                       | 16.3 (5.2 – 27.3)                       | 15.6 (3.0 – 28.2)  | 16.0 (7.7 – 24.3)  |
| Tendon injury/etc                       | 7.0 (0 – 14.6)                          | 3.1 (0 – 9.2)      | 5.3 (0.2 – 10.4)   |
| <b>Skin</b>                             | 2.3 (0 – 6.8)                           | 6.3 (0 – 14.6)     | 4.0 (0 – 8.4)      |
| Abrasion                                | 2.3 (0 – 6.8)                           | 6.3 (0 – 14.6)     | 4.0 (0 – 8.4)      |
| Laceration                              | 0.0 ( - )                               | 0.0 ( - )          | 0.0 ( - )          |
| <b>Pain (undiagnosed)</b>               | 0.0 ( - )                               | 3.1 (0 – 9.2)      | 1.3 (0 – 3.9)      |
| <b>Other injuries</b>                   | 0.0 ( - )                               | 0.0 ( - )          | 0.0 ( - )          |

C/PNS: Central and peripheral nervous systems

Joint (non-bone)/ligament injuries were the most common main injury type sustained by backs (46.5%) and forwards (34.4%). For backs, ligament sprain (32.6%) and muscle strain (16.3%) were the most common injury sub-types. For forwards, the most common injury sub-types were ligament sprain (34.4%) and brain (concussion) injuries (31.3%). Based on the 95% confidence intervals for each sub-type, there were no statistically significant differences in injury sub-types between backs and forwards during the 2022/23 Sevens Series.

Over the period 2011/12 to 2022/23 (Table 7), the majority of injuries sustained by both backs (45.5%) and forwards (37.9%) were joint (non-bone)/ligament injuries. Overall, ligament sprain (34.9%), brain (concussion) (13.8%) and haematoma (10.7%) were the most common injury sub-types for backs. For forwards, the most common sub-types were ligament sprain (29.1%), brain (concussion) (21.7%) and muscle strain (12.8%) injuries. Based on the 95% confidence intervals for each sub-type, there were no significant differences between backs and forwards in the types of injuries sustained.

Table 7: Types of match injuries: 2011/12 to 2022/23 Sevens Series.

| Series /<br>Type of injury              | Proportion, % (95% Confidence interval) |                    |                    |
|---|---|--------------------|--------------------|
|   | <i>Backs</i>                            | <i>Forwards</i>    | <i>ALL players</i> |
| <b>All Series (2011/12 – 2022/23)</b>   |   |                    |                    |
| <b>Bone</b>                             | 12.1 (8.7 – 15.5)                       | 13.8 (9.0 – 18.5)  | 12.7 (9.9 – 15.5)  |
| Fracture                                | 10.4 (7.2 – 13.6)                       | 12.3 (7.8 – 16.8)  | 11.1 (8.5 – 13.7)  |
| Other bone                              | 1.7 (0.4 – 3.1)                         | 1.5 (0 – 3.1)      | 1.6 (0.6 – 2.7)    |
| <b>C/PNS</b>                            | 15.0 (11.2 – 18.7)                      | 22.7 (16.9 – 28.4) | 17.8 (14.6 – 21.0) |
| Brain injuries                          | 13.8 (10.2 – 17.5)                      | 21.7 (16.0 – 27.3) | 16.7 (13.6 – 19.8) |
| Nerve injuries                          | 1.2 (0.0 – 2.3)                         | 1.0 (0 – 2.3)      | 1.1 (0.2 – 2.0)    |
| <b>Joint (non-bone)/lig<sup>t</sup></b> | 45.5 (40.3 – 50.8)                      | 37.9 (31.3 – 44.6) | 42.7 (38.6 – 46.9) |
| Dislocation/sublux <sup>n</sup>         | 4.3 (2.2 – 6.5)                         | 5.4 (2.3 – 8.5)    | 4.7 (3.0 – 6.5)    |
| Lesion meniscus                         | 5.8 (3.3 – 8.2)                         | 3.9 (1.3 – 6.6)    | 5.1 (3.3 – 6.9)    |
| Ligament sprain                         | 34.9 (29.9 – 39.9)                      | 28.1 (21.9 – 34.3) | 32.4 (28.5 – 36.3) |
| Other injuries                          | 0.6 (0 – 1.4)                           | 0.5 (0 – 1.5)      | 0.5 (0 – 1.2)      |
| <b>Muscle/tendon</b>                    | 24.5 (20.0 – 29.0)                      | 22.7 (16.9 – 28.4) | 23.8 (20.3 – 27.4) |
| Haematoma/etc                           | 10.7 (7.4 – 13.9)                       | 8.4 (4.6 – 12.2)   | 9.8 (7.3 – 12.3)   |
| Muscle strain/etc                       | 10.1 (6.9 – 13.3)                       | 12.8 (8.2 – 17.4)  | 11.1 (8.5 – 13.7)  |
| Tendon injury/etc                       | 3.7 (1.7 – 5.7)                         | 1.5 (0 – 3.1)      | 2.9 (1.5 – 4.3)    |
| <b>Skin</b>                             | 1.2 (0.0 – 2.3)                         | 3.0 (0.6 – 5.3)    | 1.8 (0.7 – 2.9)    |
| Abrasion                                | 0.0 ( - )                               | 0.0 ( - )          | 0.0 ( - )          |
| Laceration                              | 1.2 (0.0 – 2.3)                         | 3.0 (0.6 – 5.3)    | 1.8 (0.7 – 2.9)    |
| <b>Pain (undiagnosed)</b>               | 0.0 ( - )                               | 0.0 ( - )          | 0.0 ( - )          |
| <b>Other injuries</b>                   | 1.7 (0.4 – 3.1)                         | 0.0 ( - )          | 1.1 (0.2 – 2.0)    |

C/PNS: Central and peripheral nervous systems

Figure 8 shows the trends in the incidence and proportion of injuries that were diagnosed as brain (concussion) injuries for all players over the 12-year period from 2011/12 to 2022/23. Over this 12-year period there have been statistically significant increases in both the incidences ( $p=0.022$ ) and percentages ( $p=0.035$ ) of brain (concussion) injuries reported.



Fig 8. Long-term trends in incidences and percentages of brain/concussion injuries.

#### 4.2f Most common and highest risk injuries

Table 8 lists the five most common specific injuries sustained by backs and forwards over the period 2011/12 to 2022/23.

Table 8: The five most common specific injuries sustained by backs and forwards: 2011/12 – 2022/23 Sevens Series (% of all injuries reported).

| <b>Backs</b>                      |          | <b>Forwards</b>                   |          |
|-----------------------------------|----------|-----------------------------------|----------|
| <i>Injury</i>                     | <i>%</i> | <i>Injury</i>                     | <i>%</i> |
| Brain (concussion) injuries       | 13.9     | Brain (concussion) injuries       | 21.9     |
| Knee ligament sprains*            | 9.9      | Ankle ligament sprains            | 8.0      |
| Ankle ligament sprains            | 9.6      | Hamstring muscle strains          | 6.5      |
| Hamstring muscle strains          | 4.3      | Knee ligament sprains*            | 6.0      |
| Anterior cruciate ligament injury | 4.1      | Anterior cruciate ligament injury | 5.0      |

\*: excluding ACL injuries

The injuries listed in Table 8 represent 41.7% of all injuries sustained by backs and 47.3% of all injuries sustained by forwards.

Table 9 lists the five specific injuries resulting in the greatest injury burden (total days lost) for backs and forwards over the period 2011/12 to 2022/23.

Table 9: The five specific injuries resulting in the greatest injury burden (% of total reported days-absence) for backs and forwards: 2011/12 – 2022/23 Sevens Series.

| <b>Backs</b>                      |                        | <b>Forwards</b>                   |                        |
|-----------------------------------|------------------------|-----------------------------------|------------------------|
| <i>Injury</i>                     | <i>Injury burden %</i> | <i>Injury</i>                     | <i>Injury burden %</i> |
| Anterior cruciate ligament injury | 18.1                   | Anterior cruciate ligament injury | 27.3                   |
| Knee ligament sprains*            | 10.5                   | Hamstring muscle strains          | 8.9                    |
| Ankle ligament sprains            | 8.4                    | Brain (concussion) injuries       | 7.6                    |
| Knee cartilage injuries           | 5.2                    | Knee ligament sprains*            | 5.0                    |
| Brain (concussion) injuries       | 5.1                    | Ankle ligament sprains            | 4.0                    |

\*: excluding ACL injuries

The injuries listed in Table 9 are responsible for 47.3% of all days-absence by backs and 52.8% of all days-absence by forwards.

#### 4.2g Nature of onset of injury

Table 10 summarises the nature of onset of injuries sustained during the 2022/23 Series and over the period 2011/12 to 2022/23 by backs, forwards and all players.

Table 10: Nature of onset of injury: 2022/23 Sevens Series.

| Series / Measure                      | Severity (95% Confidence interval), days |                    |                    |
|---------------------------------------|--|--------------------|--------------------|
|                                       | Backs                                    | Forwards           | ALL players        |
| <b>2022/23</b>                        |  |                    |                    |
| Acute                                 | 90.7 (82.0 – 99.4)                       | 90.6 (80.5 – 100)  | 90.7 (84.1 – 97.3) |
| Gradual                               | 9.3 (0.6 – 18.0)                         | 9.4 (0 – 19.5)     | 9.3 (2.7 – 15.9)   |
| <b>All Series (2011/12 – 2022/23)</b> |  |                    |                    |
| Acute                                 | 93.4 (90.8 – 96.0)                       | 93.6 (90.2 – 97.0) | 93.5 (91.4 – 95.5) |
| Gradual                               | 6.6 (4.0 – 9.2)                          | 6.4 (3.0 – 9.8)    | 6.5 (4.5 – 8.6)    |

Ninety-four per cent of all match injuries sustained in the period from 2011/12 to 2022/23 have been acute in nature. Over the period 2011/12 to 2022/23, there are no statistically significant differences between the results for backs and forwards ( $p=0.920$ ).

#### 4.2h Cause of onset of injury

Table 11 summarises the cause of onset of injuries sustained during the 2022/23 Series and over the period 2011/12 to 2022/23 by backs, forwards and all players.

Table 11: Cause of onset of injury: 2022/23 Sevens Series.

| Series / Measure                      | Severity (95% Confidence interval), days |                    |                    |
|---------------------------------------|--|--------------------|--------------------|
|                                       | Backs                                    | Forwards           | ALL players        |
| <b>2022/23</b>                        |  |                    |                    |
| Contact                               | 91.7 (82.6 – 100)                        | 82.8 (69.0 – 96.5) | 87.7 (79.7 – 95.7) |
| Non-contact                           | 8.3 (0 – 17.4)                           | 17.2 (3.5 – 31.0)  | 12.3 (4.3 – 20.3)  |
| <b>All Series (2011/12 – 2022/23)</b> |  |                    |                    |
| Contact                               | 86.9 (83.2 – 90.5)                       | 87.0 (82.2 – 91.7) | 86.9 (84.0 – 89.8) |
| Non-contact                           | 13.1 (9.5 – 16.8)                        | 13.0 (8.3 – 17.8)  | 13.1 (10.2 – 16.0) |

Eighty-seven per cent of all injuries have been the result of contact match activities. Over the period 2011/12 to 2022/23, there is no statistically significant difference between the results for backs and forwards ( $p=0.968$ ).

#### 4.2i Match events leading to injury

Because of the large number of activity categories, it is not meaningful to present results for a single Series. Table 12, therefore, summarises the specific match activities leading to the injuries sustained by backs, forwards and all players during the period from 2011/12 to 2022/23.



Table 12: Match events leading to injury: 2022/23 Sevens Series.

| Series /<br>Cause of onset            | Proportion, % (95% Confidence interval) |                    |                    |
|---------------------------------------|---|--------------------|--------------------|
|                                       | Backs                                   | Forwards           | ALL players        |
| <b>All Series (2011/12 – 2022/23)</b> |   |                    |                    |
| Collision                             | 13.0 (9.4 – 16.7)                       | 17.2 (11.9 – 22.4) | 14.6 (11.6 – 17.6) |
| Kicking                               | 0.6 (0 – 1.4)                           | 1.0 (0 – 2.4)      | 0.8 (0.0 – 1.5)    |
| Lineout                               | 0.6 (0 – 1.4)*                          | 0.5 (0 – 1.5)      | 0.6 (0 – 1.2)      |
| Maul                                  | 0.0 ( - )                               | 0.0 ( - )          | 0.0 ( - )          |
| Ruck                                  | 8.2 (5.2 – 11.1)                        | 7.1 (3.5 – 10.6)   | 7.8 (5.5 – 10.0)   |
| Running                               | 10.0 (6.8 – 13.2)                       | 10.1 (5.9 – 14.3)  | 10.0 (7.5 – 12.6)  |
| Scrum                                 | 0.0 ( - )                               | 1.0 (0 – 2.4)      | 0.4 (0 – 0.9)      |
| Tackled                               | 38.5 (33.2 – 43.7)                      | 31.3 (24.9 – 37.8) | 35.8 (31.7 – 39.9) |
| Tackling                              | 24.2 (19.6 – 28.9)                      | 26.8 (20.6 – 32.9) | 25.2 (21.5 – 28.9) |
| Other                                 | 4.8 (2.5 – 7.2)                         | 5.1 (2.0 – 8.1)    | 4.9 (3.1 – 6.8)    |

\*: these players are assumed to have been playing out of position when injured in this activity

In the period 2011/12 to 2022/23, being-tackled (backs: 38.5%; forwards: 31.3%), tackling (backs: 24.2%; forwards: 26.8%) and collisions (backs: 13.0%; forwards: 17.2%) were the events responsible for most injuries sustained by backs and forwards.

The most common activities leading to brain (concussion) injuries have been tackling (backs: 40.4%; forwards: 40.9%), collisions (backs: 25.5%; forwards: 31.8%) and being-tackled (backs: 21.3%; forwards: 22.7%).

#### 4.2j Time of injury

Table 13 provides a summary of the period in a match when injury events took place during the 2022/23 Series and over the period 2011/12 to 2022/23 by backs, forwards and all players.

Table 13: Time that injuries are sustained during matches: 2022/23 Sevens Series.

| Series /<br>Measure                   | Severity (95% Confidence interval), days |                    |                    |
|---------------------------------------|--|--------------------|--------------------|
|                                       | Backs                                    | Forwards           | ALL players        |
| <b>2022/23</b>                        |  |                    |                    |
| First half                            | 34.9 (20.6 – 49.1)                       | 37.5 (20.7 – 54.3) | 36.0 (25.1 – 46.9) |
| Second half                           | 65.1 (50.9 – 79.4)                       | 62.5 (45.7 – 79.3) | 64.0 (53.1 – 74.9) |
| <b>All Series (2011/12 – 2022/23)</b> |  |                    |                    |
| First half                            | 38.2 (33.1 – 43.4)                       | 46.5 (39.5 – 53.4) | 41.3 (37.1 – 45.4) |
| Second half                           | 61.8 (56.6 – 66.9)                       | 53.5 (46.6 – 60.5) | 58.7 (54.6 – 62.9) |

Over all Series, significantly ( $p < 0.001$ ) more injuries have been sustained in the second half compared to the first half of matches (risk ratio=1.42) (Fuller et al., 2016).

#### 4.2k Removal from play

During the 2022/23 Series, 40% of all injured players were immediately removed from play, 32% were removed later in the game and 28% completed the game. Over the period 2011/12 to 2022/23, the equivalent values were immediately removed: 45.3%; removed later: 20.7%; completed the game: 34.0%.

During the 2022/23 Series, 40% of players sustaining a brain (concussion) injury were removed from play immediately, 32% were removed later and 28% completed the game. Over the period 2011/12 to 2022/23, the equivalent values were immediately removed: 53.8%; removed later: 22.0%; completed the game: 24.2%.

#### 4.3 Training injuries

Five training injuries were reported during the 2022/23 Women's Sevens Series (backs: 2; forwards: 3).

As 5,788 player-hours of training exposure were reported (backs: 3,011; forwards: 2,777) by the participating teams, the overall incidence of training injuries was 0.9 injuries/1000 player-training hours (backs: 0.7; forwards: 1.1). There was no significant difference ( $p = 0.617$ ) between the incidences of training injuries sustained by backs and forwards.

Of note, one anterior cruciate ligament injury (336 days-absence) was sustained during a contact-skills session and one lower leg muscle injury (84 days-absence) was sustained during a warm-up session. Due to the small number of training injuries reported, no further analyses were undertaken.

#### 4.4 Illnesses

Three illnesses were reported during the 2022/23 tournaments: these illnesses were contracted at separate tournament locations. One illness was gastritis, one was diarrhoea and one was a respiratory tract infection. The overall illness period prevalence during the 2022/23 Series was 1.5%. The overall number of illnesses reported remained small and no further analysis of these illnesses was undertaken.

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