
# World Rugby

## Surveillance Studies

# Pacific Nations Cup

### Summary of Results: 2012 - 2015

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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.

World Rugby's Pacific Nations Cup (PNC) is an international tournament involving six Tier 2 countries located in the Pacific Ocean region. Because the total match exposure in this tournament each year is relatively small, apart from the incidence of injury and the players' anthropometric parameters, which are reported on an annual basis, accumulated data from these tournaments are updated each year to provide a more meaningful analysis of the available information. A previous report summarised the incidence and nature of match injuries sustained during the PNC over the period 2012 to 2014 (Fuller and Taylor, 2014).

# 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 PNC 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 PNC match were not included. A recurrent injury was defined as: '*An injury (as defined above) of the same type and at the same site as an index injury and which occurs after a player's return to full participation from the index injury'.* Injuries were classified using the appropriate OSICS 8 Code (Orchard, 1995). Injury location, type and cause together with the event leading to the injury were also recorded.

Injury severity was determined by the number of days a player was injured. A player was deemed to be 'injured' until he could undertake full normal training and be available for match selection, whether or not he was actually selected. Medical staff were required to make an informed clinical judgement about players' fitness to train/play on those days when players were not scheduled to train or play. Injured players were followed up after the tournament to obtain their return-to-play date. The return-to-play dates for players with injuries that remained unresolved 90 days after the final match were estimated on the basis of the player's medical staff's clinical judgement and prognosis.

The complete lists of categories and sub-categories used for injury locations and 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. Statistical significance was accepted at the $p \leq 0.05$ level, although it is recognised that this could identify some differences that occurred by chance due to the number of statistical comparisons made in the study.

# 3 Data collection

At the beginning of the 2015 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 PNC match on a Tournament Summary of Injuries Report Form, which was returned to the study co-ordinator immediately following the end of the tournament. A member of the team's medical staff also recorded information about each injury on an Injury Report Form (date of injury, date of return to play, location and type of injury, cause of injury, event leading to injury). Injury Report Forms were returned to the study co-ordinator when the final piece of information had been entered on the Form (normally the return-to-play date).

# 4 Results

Results for previous PNC tournaments (2012 to 2014) have been presented in an earlier report (Fuller and Taylor, 2014).

PNC 2015 took place in the period 18 July to 3 August 2015 and involved six countries (Canada, Fiji, Japan, Samoa, Tonga and USA). Teams were divided into two Groups: Group 1: (Japan, Samoa, Tonga) and Group 2: (Canada, Fiji, USA). Each team from Group 1 played each team from Group 2 and then teams played a final game to decide tournament standings based on the number of points obtained in the group games. Of the 12 games played in the tournament, 7 were played in Canada, 4 in USA and 1 in Fiji.

This study recorded players' anthropometric data and match injuries supplied by all six teams taking part in the tournament.

## 4.1 Players' anthropometric data

Table 1 summarises the numbers and anthropometric data for players categorised as backs, forwards and all players taking part in PNC 2015, together with the combined PNC data for the period 2012 to 2015. Forwards were significantly heavier ($p<0.001$), taller ($p<0.001$) and older ($p<0.001$) than backs at the 2015 PNC and in all tournaments over the period 2012 to 2015.

Table 1: Players' anthropometric data: PNC 2012 to 2015 tournaments.

| Year / Measure | **Mean** (*Standard deviation, number of players*) | | |
|---|---|---|---|
| | ***Backs*** | ***Forwards*** | ***ALL players*** |
| **2015** | | | |
| Stature, cm | 180.8 (6.8, 87) | 186.9 (7.6, 113) | 184.3 (7.9, 200) |
| Body mass, Kg | 94.1 (10.6, 87) | 112.9 (9.3, 113) | 104.7 (13.6, 200) |
| Age, years | 27.0 (3.2, 87) | 28.3 (3.6, 113) | 27.7 (3.5, 200) |
| **ALL tournaments** | | | |
| Stature, cm | 181.0 (6.9, 252) | 187.4 (7.4, 317) | 184.5 (7.9, 569) |
| Body mass, Kg | 92.9 (9.6, 252) | 111.9 (9.2,317) | 103.5 (13.3, 569) |
| Age, years | 26.4 (3.5, 252) | 27.7 (3.5, 317) | 27.1 (3.6, 569) |

## 4.2 Match injuries

### 4.2a Incidence of injury

Table 2 summarises the number of match injuries sustained, match exposure and incidence of match injuries for backs, forwards and all players at PNC 2015 together with values for the period 2012 to 2015.

Table 2: Number, match exposure (player-match-hours) and incidence (injuries/1000 player-match-hours, 95% confidence interval) of match injuries: PNC 2012 to 2015 tournaments.

| Year / Measure | ***Backs*** | ***Forwards*** | ***ALL players*** |
|---|---|---|---|
| **2015** | | | |
| Injuries | 15 | 17 | 32 |
| Exposure | 223.9 | 255.9 | 479.9 |
| Incidence | 67.0 (40.4 – 111.1) | 66.4 (41.3 – 106.8) | 66.7 (47.2 – 94.3) |
| **ALL tournaments** | | | |
| Injuries | 39 | 34 | 73 |
| Exposure | 578.6 | 661.2 | 1239.9 |
| Incidence | 67.4 (49.2 – 92.3) | 51.4 (36.7 – 71.9) | 58.9 (46.8 – 74.1) |

There are no statistically significant differences in the incidences of injury for backs and forwards for either the 2015 PNC tournament (p=0.986) or for all tournaments over the period 2012 to 2015 (p=0.246).

### 4.2b Severity of injury

Table 3 summarises the mean and median severities of all injuries sustained at PNC tournaments from 2012 to 2015, as a function of playing position.

Table 3: Mean and median severities of match injuries: PNC 2012 to 2015 tournaments.

| Year / Measure | *Severity (95% Confidence interval), days* | | |
|---|---|---|---|
| | ***Backs*** | ***Forwards*** | ***ALL players*** |
| **ALL tournaments** | | | |
| Mean | 43.4 (24.4 – 62.4) | 31.6 (18.1 – 45.1) | 37.9 (26.0 – 49.8) |
| Median | 19 (10 - 46) | 18 (6 - 32) | 19 (11 - 32) |

There were no statistically significant differences in the mean (p=0.320) or median (p=0.482) severities of injury for forwards and backs over the period 2012 to 2015.

### 4.2c Location of injury

Table 4 summarises the locations of injuries sustained at PNC tournaments from 2012 to 2015. Although injuries have now been recorded at four PNC tournaments, the number of injuries remains small and confidence intervals remain wide; therefore the sub-location data should still be viewed with caution.

Table 4: Locations of match injuries: PNC 2012 to 2015 tournaments.

| Year / Location of injury | *% (95% Confidence interval)* | | |
|---|---|---|---|
| | ***Backs*** | ***Forwards*** | ***ALL players*** |
| **ALL tournaments** | | | |
| **Head/neck** | 17.9 (5.9 – 30.0) | 11.8 (0.9 – 22.6) | 15.1 (6.9 – 23.3) |
| Head/face | 15.4 (4.1 – 26.7) | 8.8 (0 – 18.4) | 12.3 (4.8 – 19.9) |
| Neck/cerv[l] spine | 2.6 (0 – 7.5) | 2.9 (0 – 8.6) | 2.7 (0 – 6.5) |
| **Upper limbs** | 33.3 (18.5 – 48.1) | 32.4 (16.6 – 48.1) | 32.9 (22.1 – 43.7) |
| Shoulder/clavicle | 17.9 (5.9 – 30.0) | 20.6 (7.0 – 34.2) | 19.2 (10.1 – 28.2) |
| Upper arm | 0.0 ( - ) | 0.0 ( - ) | 0.0 ( - ) |
| Elbow | 7.7 (0 – 16.1) | 2.9 (0 – 8.6) | 5.5 (0.3 – 10.7) |
| Forearm | 0.0 ( - ) | 2.9 (0 – 8.6) | 1.4 (0 – 4.0) |
| Wrist | 0.0 ( - ) | 0.0 ( - ) | 0.0 ( - ) |
| Hand/fingers | 7.7 (0 – 16.1) | 5.9 (0 – 13.8) | 6.8 (1.1 – 12.6) |
| **Trunk** | 7.7 (0 – 16.1) | 8.8 (0 – 18.4) | 8.2 (1.9 – 14.5) |
| Ribs/upper back | 5.1 (0 – 12.1) | 8.8 (0 – 18.4) | 6.8 (1.1 – 12.6) |
| Abdomen | 0.0 ( - ) | 0.0 ( - ) | 0.0 ( - ) |
| Low back | 2.6 (0 – 7.5) | 0.0 ( - ) | 1.4 (0 – 4.0) |
| Sacrum/pelvis | 0.0 ( - ) | 0.0 ( - ) | 0.0 ( - ) |
| **Lower limbs** | 41.0 (25.6 – 56.5) | 47.1 (30.3 – 63.8) | 43.8 (32.5 – 55.2) |
| Hip/groin | 2.6 (0 – 7.5) | 2.9 (0 – 8.6) | 2.7 (0 – 6.5) |
| Thigh, posterior | 2.6 (0 – 7.5) | 0.0 ( - ) | 1.4 (0 – 4.0) |
| Thigh, anterior | 0.0 ( - ) | 2.9 (0 – 8.6) | 1.4 (0 – 4.0) |
| Knee | 28.2 (14.1 – 42.3) | 20.6 (7.0 – 34.2) | 24.7 (14.8 – 34.5) |
| L-leg/Achilles | 2.6 (0 – 7.5) | 11.8 (0.9 – 22.6) | 6.8 (1.1 – 12.6) |
| Ankle | 5.1 (0 – 12.1) | 5.9 (0 – 13.8) | 5.5 (0.3 – 10.7) |
| Foot/toe | 0.0 ( - ) | 2.9 (0 – 8.6) | 1.4 (0 – 4.0) |

Based on the all tournament data the majority of injuries sustained by both backs and forwards are located in the lower limbs (backs: 41.0%; forwards: 47.1%) with the major injury sub-location for backs being the knee (backs: 28.2%) and for forwards the knee and the shoulder/clavicle (20.6%). There are no statistically significant differences between backs and forwards in the proportions of injuries sustained at each injury location.

### 4.2d Type of injury

Table 5 summarises the types of injuries sustained at PNC tournaments from 2012 to 2015. Although injuries have now been recorded at four PNC tournaments, the number of injuries remains small and confidence intervals remain wide; therefore the sub-type data should still be viewed with caution.

Table 5: Types of match injuries: PNC 2012 to 2015 tournaments.

| Year / Type of injury | *% (95% Confidence interval)* | | |
|---|---|---|---|
| | ***Backs*** | ***Forwards*** | ***ALL players*** |
| **ALL tournaments** | | | |
| **Bone** | 10.3 (0.7 – 19.8) | 8.8 (0 – 18.4) | 9.6 (2.8 – 16.3) |
| Fracture | 10.3 (0.7 – 19.8) | 8.8 (0 – 18.4) | 9.6 (2.8 – 16.3) |
| Other bone | 0.0 ( - ) | 0.0 ( - ) | 0.0 ( - ) |
| **C/PNS** | 10.3 (0.7 – 19.8) | 8.8 (0 – 18.4) | 9.6 (2.8 – 16.3) |
| Concussion | 10.3 (0.7 – 19.8) | 5.9 (0 – 13.8) | 8.2 (1.9 – 14.5) |
| Nerve | 0.0 ( - ) | 2.9 (0 – 8.6) | 1.4 (0 – 4.0) |
| **Joint (non-bone)/lig[t]** | 56.4 (40.8 – 72.0) | 41.2 (24.6 – 57.7) | 49.3 (37.8 – 60.8) |
| Dislocation/sublux[n] | 7.7 (0 – 16.1) | 8.8 (0 – 18.4) | 8.2 (1.9 – 14.5) |
| Lesion meniscus | 2.6 (0 – 7.5) | 5.9 (0 – 13.8) | 4.1 (0 – 8.7) |
| Sprain/ligament | 46.2 (30.5 – 61.8) | 26.5 (11.6 – 41.3) | 37.0 (25.9 – 48.1) |
| **Muscle/tendon** | 17.9 (5.9 – 30.0) | 35.3 (19.2 – 51.4) | 26.0 (16.0 – 36.1) |
| Haematoma/etc | 7.7 (0 – 16.1) | 20.6 (7.0 – 34.2) | 13.7 (5.8 – 21.6) |
| Muscle rupture/etc | 2.6 (0 – 7.5) | 5.9 (0 – 13.8) | 4.1 (0 – 8.7) |
| Tendon injury/etc | 7.7 (0 – 16.1) | 8.8 (0 – 18.4) | 8.2 (1.9 – 14.5) |
| **Skin** | 5.1 (0 – 12.1) | 2.9 (0 – 8.6) | 4.1 (0 – 8.7) |
| Laceration | 5.1 (0 – 12.1) | 2.9 (0 – 8.6) | 4.1 (0 – 8.7) |
| **Other types** | 0.0 ( - ) | 2.9 (0 – 8.6) | 1.4 (0 – 4.0) |
| Dental | 0.0 ( - ) | 2.9 (0 – 8.6) | 1.4 (0 – 4.0) |
| Visceral | 0.0 ( - ) | 0.0 ( - ) | 0.0 ( - ) |
| Other | 0.0 ( - ) | 0.0 ( - ) | 0.0 ( - ) |

C/PNS: Central and peripheral nervous systems

Based on the all tournament data, the most common injury type sustained by both backs (56.4%) and forwards (41.2%) is a joint (non-bone)/ligament injury with the major sub-classification being a sprain/ligament injury (backs: 46.2%; forwards: 26.5%). There are no statistically significant differences in the proportions of injury types sustained by backs and forwards.

### 4.2e Most common and highest risk injuries

The number of injuries sustained during the PNC tournaments from 2012 to 2015 remains relatively small, consequently there were only five injuries that occurred more than twice: knee medial collateral ligament strain: 10 (backs: 6, forwards: 4); concussion: 6 (backs: 4, forwards: 2); knee haematoma: 3 (backs: 1, forwards: 2); knee ACL tear: 3 (backs: 3) and costal cartilage injury: 3 (backs: 1, forwards: 2).

### 4.2f Nature of onset of injury

Table 6 summarises the nature of injury-onset at PNC 2012 to 2015 tournaments, as a function of playing position.

Table 6: Nature of the injury-onset of match injuries: PNC 2012 to 2015 tournaments.

| Year / Nature of onset | *% (95% Confidence interval)* | | |
|---|---|---|---|
| | ***Backs*** | ***Forwards*** | ***ALL players*** |
| **All tournaments** | | | |
| Acute | 97.4 (92.5 - 100) | 94.1 (86.2 - 100) | 95.9 (91.3 – 100) |
| Gradual | 2.6 (0 – 7.5) | 5.9 (0 – 13.8) | 4.1 (0 – 8.7) |

Over 95% of all injuries sustained are acute injuries. There are no statistically significant differences between backs and forwards.

### 4.2g Cause of onset of injury

Table 7 summarises the cause of onset of match injuries sustained at PNC 2012 to 2015 as a function of playing position.

Table 7: Cause of onset of injuries: PNC 2012 to 2015 tournaments.

| Year / Cause of onset | *% (95% Confidence interval)* | | |
|---|---|---|---|
| | ***Backs*** | ***Forwards*** | ***ALL players*** |
| **All tournaments** | | | |
| Contact | 89.5 (79.8 – 99.1) | 96.9 (91.0 - 100) | 92.9 (86.9 – 98.8) |
| Non-contact | 10.5 (0.9 – 20.2) | 3.1 (0 – 9.0) | 7.1 (1.2 – 13.1) |
| Other | 0.0 ( - ) | 0.0 ( - ) | 0.0 ( - ) |

The majority of injuries sustained by backs (89.5%) and forwards (96.9%) are caused by contact events. There are no statistically significant differences between backs and forwards for the cause of injury onset.

### 4.2h Match events leading to injury

Table 8 provides a summary of the match events leading to injury at PNC 2012 to 2015 as a function of playing position.

Table 8: Match events leading to injuries: PNC 2012 to 2015 tournaments.

| Year / Cause of onset | % (95% Confidence interval) | | |
|---|---|---|---|
| | *Backs* | *Forwards* | *ALL players* |
| **All tournaments** | | | |
| Collision | 15.4 (4.1 – 26.7) | 11.8 (0.9 – 22.6) | 13.7 (5.8 – 21.6) |
| Kicking | 0.0 ( - ) | 0.0 ( - ) | 0.0 ( - ) |
| Lineout | 0.0 ( - ) | 2.9 (0 – 8.6) | 1.4 (0 – 4.0) |
| Maul | 2.6 (0 – 7.5) | 5.9 (0 – 13.8) | 4.1 (0 – 8.7) |
| Ruck | 7.7 (0 – 16.1) | 5.9 (0 – 13.8) | 6.8 (1.1 – 12.6) |
| Running | 7.7 (0 – 16.1) | 0.0 ( - ) | 4.1 (0 – 8.7) |
| Scrum | 0.0 ( - ) | 5.9 (0 – 13.8) | 2.7 (0 – 6.5) |
| Tackled | 33.3 (18.5 (48.1) | 35.3 (19.2 – 51.4) | 34.2 (23.4 – 45.1) |
| Tackling | 28.2 (14.1 – 42.3) | 23.5 (9.3 – 37.8) | 26.0 (16.0 – 36.1) |
| Other | 5.1 (0 – 12.1) | 8.8 (0 – 18.4) | 6.8 (1.1 – 12.6) |

Being tackled and tackling are the events responsible for the most injuries to backs (tackled: 33.3%; tackling: 28.2%) and forwards (tackled: 35.3%; tackling: 23.5%). Apart from position-specific activities (scrum and lineout) there are no statistically significant differences in the events leading to injury for backs and forwards.

### 4.2i Time of injury

Table 9 provides a summary of the period in a match when injury events take place as a function of playing position.

Table 9: Time during matches injuries sustained: PNC 2012 to 2015 tournaments.

| Time of injury, min | % (95% Confidence interval) | | |
|---|---|---|---|
| | *Backs* | *Forwards* | *ALL players* |
| **All tournaments** | | | |
| 0-20 | 10.8 (0.8 – 20.8) | 14.7 (2.8 – 26.6) | 12.7 (4.9 – 20.4) |
| 21-40+ | 27.0 (12.7 – 41.3) | 44.1 (27.4 – 60.8) | 35.2 (24.1 – 46.3) |
| 41-60 | 37.8 (22.2 – 53.5) | 17.6 (4.8 – 30.5) | 28.2 (17.7 – 38.6) |
| 61-80+ | 24.3 (10.5 – 38.1) | 23.5 (9.3 – 37.8) | 23.9 (14.0 – 33.9) |

There are significantly fewer injuries sustained in the first quarter of the game but there are no statistically significant differences between backs and forwards in the proportions of injuries sustained in each of the quarters.

# 5 Summary

The current report builds on the epidemiological information collected at previous tournaments but the small numbers of teams and matches involved in each tournament continue to mean that confidence intervals associated with the reported data for the various parameters remain wide.

# 6. References

Fuller CW, Molloy MG, Bagate C, et al. Consensus statement on injury definitions and data collection procedures for studies of injuries in rugby union. *Br J Sports Med* 2007;**41**;328-331.

Fuller CW, Taylor A. International Rugby Board – Injury Surveillance Studies: Pacific Nations Cup – Injury Epidemiology Results: 2012 to 2014. IRB; Dublin 2014. Available at www.irbplayerwelfare.com.

Orchard J. Orchard Sports Injury Classification System (OSICS). *Sport Health* 1995;**11**:39-41.

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