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A comparison of catastrophic injury incidence rates by Provincial Rugby Union in South Africa

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ABSTRACT

Objectives: To compare catastrophic injury rates between the 14 South African Provincial Rugby Unions. **Design:** A prospective, population-based study conducted among all South African Unions between 2008–2014.

Methods: Player numbers in each Union were obtained from South African Rugby's 2013 Census. Catastrophic injuries were analysed from BokSmart's serious injury database. Incidence rates with 95% Confidence Intervals were calculated. Catastrophic injuries (Acute Spinal Cord Injuries and catastrophic Traumatic Brain Injuries) within Unions were compared statistically, using a Poisson regression with Incidence Rate Ratios (IRR) and a 95% confidence level ($p < 0.05$).

Results: Catastrophic injury incidence rates per Union ranged from 1.8 per 100 000 players (95% CI: 0.0–6.5) to 7.9 (95% CI: 0.0–28.5) per 100 000 players per year. The highest incidence rate of permanent outcome Acute Spinal Cord Injuries was reported at 7.1 per 100 000 players (95% CI: 0.0–17.6). Compared to this Union, five ($n = 5/14$, 36%) of the Unions had significantly lower incidence rates of Acute Spinal Cord Injuries. Proportionately, three Unions had more Acute Spinal Cord Injuries and three other Unions had more catastrophic Traumatic Brain Injuries.

Conclusions: There were significant differences in the catastrophic injury incidence rates amongst the Provincial Unions in South Africa. Future studies should investigate the underlying reasons contributing to these provincial differences.

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1. Introduction

Safety in sports is an important requirement for continued participation.¹ Prevention, reduction and control of sports injuries are therefore important points of concern for clinicians, researchers and inevitably society as a whole.¹ Rugby Union (henceforth "Rugby") is one of the most popular team sports and has one of the highest reported match-related injury incidence rates amongst professional team sports.^{2,3} It is a fast-paced game, characterised by high physical demands and frequent exposure to physical contact and high impact collisions.⁴

Though catastrophic injuries are rare, the results are emotionally and financially devastating, for the player and their family, and also negatively affects the image of the sport.⁴ These injuries are also of public concern, although the magnitude of concern may be dominated by perception of risk rather than actual risk.⁵ In South Africa, the incidence of catastrophic injuries (excluding cardiac events) has previously been reported as 2.0 per 100 000 players (95% CI: 0.9–3.1),⁶ while the incidence of permanently disabling Acute Spinal Cord Injuries (ASCI) was reported as 1.0 per 100 000 players (95% CI: 0.3–1.8).⁶ These rates are comparable with other rugby-playing nations such as New Zealand, Ireland, Australia, and the United Kingdom.^{5,7}

Nonetheless, it is the responsibility of governing bodies, teams, and individuals involved to monitor and reduce the risk of injury where possible.⁸ The most common risk mitigation strategy is the "compromise approach", which introduces a strategy for the

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general population, but also needs to recognise that certain groups of participants may present with higher or unique risks.² It is these definable groups of participants that may need additional and specific control measures to mitigate risk.²

To achieve this risk mitigation, the South African Rugby Union (SA RUGBY) introduced the BokSmart nationwide injury prevention programme in 2009. This intervention requires that all coaches and referees undergo biennial training as a core component of BokSmart. As with any intervention, the effectiveness of an injury prevention programme could be assessed by comparing injury rates before and after implementation.⁹ Subsequently, BokSmart was found to be associated with a significant improvement in serious injury rates in junior, but not in senior players.⁷ The authors postulated that the absence of effect in senior players may be a result of either differences in effectiveness of BokSmart, or due to fewer player numbers in this age group.^{6,7} Thus, this senior age group may be one of these previously mentioned groups that require additional/specific control measures. Similarly, other authors identified certain Provincial regions of South Africa as presenting greater risk to the player.¹⁰ These authors proposed that these regional differences might reflect the fact that certain socioeconomic groups are at greater risk of rugby-related catastrophic injury. However, these authors acknowledged that their player numbers were based on loose estimates available at the time and that they did not have a measure of socioeconomic status. Subsequent to their (and other) investigations, SA RUGBY commissioned a census of all affiliated rugby playing schools and clubs in South Africa, to determine accurate player numbers (SA RUGBY development survey 2013).

Thus, the aim of this study was to compare the catastrophic injury rate between the 14 South African Provincial Rugby Unions between 2008 and 2014.

2. Methods

A prospective, population-based study was conducted among all Provincial Rugby Unions in South Africa. SA RUGBY is the governing body for Rugby in South Africa, consisting of 14 Provincial Rugby Unions dispersed across the country. In 2012, SA RUGBY commissioned a census of all affiliated Rugby playing schools and clubs in South Africa, to determine accurate player numbers. A telephonic survey was conducted nationwide to collect the data. In addition to the telephonic survey, a verification process was also conducted. The aim of the verification process was to assess the accuracy of these data by physically visiting at random a limited number of the schools and clubs that had been telephonically interviewed. The overall data collection process lasted for one year, from March 2012 until March 2013.¹¹ For the purpose of the current data analysis, player numbers were assumed to be stable over the seven years of investigation.

Permission to analyse the data was obtained, with SA RUGBY and Chris Burger/Petro Jackson Players' Fund (CBPJPF)'s permission, by the University of Cape Town (UCT) Human Research Ethics Committee. The following definitions were adopted for this article:

A catastrophic injury is defined by BokSmart and the CBPJPF as: *“Any head, neck, spine or brain injury that is life threatening, or has the potential to be permanently debilitating and results in the emergency admission of a rugby player to a hospital or medical care center.”*

Acute Spinal Cord Injuries (ASCI) and catastrophic Traumatic Brain Injuries (cat-TBI) of all outcomes (full recovery/neurological deficit/quadruplegic and fatal) in both junior and senior levels, which fit the above definition, were included in the analysis. Cardiac events were not included in this study.

The term ASCI with permanent outcome describes ASCI with resultant neurological deficit, quadriplegia or death. Cases with full recovery outcomes are therefore excluded from this category. ASCI

Table 1

Catastrophic injury numbers, permanent outcome and “near miss” Acute Spinal Cord injuries (ASCI) and catastrophic Traumatic Brain Injuries (cat-TBI) per Provincial Rugby Union.

| Provincial Rugby Union | Player numbers | Catastrophic injuries | ASCI permanent outcome injuries | ASCI “near miss” injuries | Catastrophic TBI |
|--------------------------|----------------|-----------------------|---------------------------------|---------------------------|------------------|
| Boland | 24 310 | 13 | 12 | – | 1 |
| Bulldogs | 35 772 | 8 | 6 | 1 | 1 |
| Bulls | 27 544 | 7 | 5 | 2 | – |
| Cheetahs | 17 050 | 3 | – | 2 | 1 |
| Eagles | 13 442 | 5 | 1 | 4 | – |
| Griffons | 7656 | 2 | 1 | 1 | – |
| Griquas | 7216 | 4 | 1 | 3 | – |
| Kings | 31 416 | 4 | 2 | – | 2 |
| Leopards | 11 638 | 2 | 1 | 1 | – |
| Lions | 26 752 | 7 | 1 | 2 | 4 |
| Pumas | 11 022 | 3 | – | 3 | – |
| Sharks | 20 108 | 4 | 1 | 3 | – |
| Valke | 15 202 | 3 | 1 | 1 | – |
| WP | 42 812 | 15 | 5 | 7 | 2 |
| National (all provinces) | 291 940 | 80 | 37 | 30 | 11 |

with “Near miss” outcome refers to cases of ASCI fitting the above catastrophic injury definition, that had a full recovery outcome/no resultant neurological deficit remaining.

Catastrophic injury data for this study were analysed from the serious injury database that is managed jointly by the BokSmart programme, and the CBPJPF. The Serious Injury Case Manager (SICM) of the CBPJPF records the final diagnosis one month after injury, during a follow-up visit or consultation with the Medical Doctor in charge of the case. The CBPJPF is a non-profit organisation that provides assistance for players who have sustained a permanently disabling injury, while playing Rugby in South Africa. Catastrophic injury data for this study were collected prospectively from 2008–2014.

Incidence rates were presented as an annual average (over the seven-year period) per 100 000 participating players. The numerator was calculated from the number of injuries collected prospectively from 2008–2014 and the denominator was the population at risk (i.e. the total number of Rugby players per Provincial Rugby Union as verified by the 2013 census). These player numbers included males and females and under-seven to adult (amateur and professional). Incidence rates with 95% Confidence Intervals (95% CI) were calculated using the standard formulae suggested for Rugby Union injury studies.¹² Any negative lower bound 95% confidence limits were presented as ‘0’. Catastrophic injuries, ASCIs with permanent outcome, ASCIs with “near miss” outcomes and cat-TBIs within Provincial Rugby Unions were compared statistically using a Poisson regression with Incidence Rate Ratios (IRR) and a 95% level of confidence ($p < 0.05$).

3. Results

The total number of verified players in South Africa was reported at 291 940,¹¹ which is less than the previously documented 651 146 players, as estimated on the IRB/World Rugby website that was used to calculate incidence rates in earlier studies.⁶

In the period between 2008 and 2014 there were eighty ($n = 80$) catastrophic injuries, excluding cardiovascular events (Table 1). The overall average incidence rate of catastrophic injury was 3.9 per 100 000 players (95% CI: 1.7–6.2) per year. Incidence rates amongst Provincial Rugby Unions ranged from 1.8 per 100 000 players (95% CI: 0.0–6.5) in the Kings to 7.6 per 100 000 players (95% CI: 0.0–18.6) in Boland and 7.9 per 100 000 players (95% CI: 0.0–28.5) in Griquas

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