Injury rehabilitation and return to play criteria in South African schoolboy rugby union

C.M. Wall (B.Sc Hons.)
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Supervisor: E.J. Bruwer
Co-supervisor: Prof. C.J. Wilders

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Declaration

This dissertation is submitted in article format and includes a research article (Chapter 3) entitled 'The prevalence and management of injuries in South African schoolboy rugby union players'.

Hereby, the co-authors of this dissertation, Ms. E.J. Bruwer and Prof. C.J. Wilders, give their permission to the candidate, Ms. C.M. Wall, to include the research article as part of a Masters dissertation. The contribution (advisory and support) of the co-author was kept in reasonable limits, thereby enabling the candidate to submit this dissertation for examination purposes. This dissertation, therefore, serves as fulfillment of the requirements for the M.Sc. degree in Human Movement Science within the School for Biokinetics, Recreation and Sport Science in the Faculty of Health Sciences at the North-West University (Potchefstroom Campus).

_____	_____
Ms. E.J. Bruwer	Prof. C.J. Wilders
Supervisor	Co-author (Chapter 3)
Co-author (Chapter 3)	

Summary

Background

Professional rugby union has grown to become the third most popular team contact sport in the world. The physical nature of the game results in a high prevalence of injuries on all levels of play. Injury prevalence as high as 83.9 injuries per 1000 playing hours has been reported for the 2007 Rugby World Cup in France. Although research indicates schoolboy rugby union to be safer than professional rugby, injury rates as high as 65.8 injuries per 1000 playing hours have been reported. These injuries are mostly caused by the tackle situation, with the knee- and shoulder-joints being the most injured site.

The risk of injuries in rugby union is heightened by professionalism, previous injuries, higher training demands, intrinsic factors and psychological issues. Due to the professional nature the game has taken on, the management of rugby union injuries has become increasingly more important. This should include prehabilitation or injury prevention programs, rehabilitation up until the final, sport specific phase as well as structured return to play testing. Another important aspect of injury management is the education of coaches, players and other persons involved in the sport.

Objectives

The first objective of the study was to observe the prevalence and nature of injuries in South African schoolboy rugby union players. Secondly, the treatment of these injuries was observed as well as the return to play criteria used to determine readiness to return to play after injury. The association between the treatment of injuries and the severity of injuries was then obtained. Lastly re-injury prevalence was compared to treatment received and return to play criteria used to determine readiness.

Methods

Ten schools from across South Africa partook in the study. The schools were all identified by the NWU-PUK as elite schools due to performances in the previous year

(2008). Only the first team squad of each school was participated, amounting to a total number of 194 boys answering questionnaires conducted by the researcher for each of their injuries. The questionnaires included injury severity and site, recurrence of injury, cause of injury, treatment procedures and criteria used for return to play. Severity was defined in terms of game and training days missed due to injury and are describe as slight (0 - 1 day), minimal (2 – 3 days), mild (4 – 7 days), moderate (8 – 28 days) or severe (>28 days). The results were then analyzed and presented through descriptive statistics. Statistical significance was indicated by $p \leq 0.05$. Practical significance was described by the Phi-coefficient. The practical significance indicated by phi, was indicated as large if phi ≥ 0.5.

Results

A total number of 118 injuries were reported amounting to 78.51 injuries per 1000 playing hours. New injuries accounted for 68.64% (n=81) while recurrent injuries was reported to be 31.36% (n=37). The most frequent site of injury was the knee (n=26), followed by the shoulder (n=21). The event leading to injury that was most frequently reported, was the tackle (including making the tackle and being tackled) (n=49). Most injuries were slight (48%) but a high rate of moderate and severe injuries (39%) were reported. These moderate to severe injuries resulted in a minimum total of 360 days missed. Severe injuries were more likely to be treated by a doctor. Treatment by a doctor for severe injuries indicated the only significance in the study ($p = 0.7$). No fixed return to play protocol was in place for deciding if a player should be allowed to return to play. Thirteen of the injuries were however investigated through further testing (either through isokinetic or on-field testing).

Conclusion

Injury prevalence amongst top teams in South African schoolboy rugby union is very high. Rehabilitation does not follow a structured program or guidelines and there is no definite return to play protocols available. Re-injury rates are high, possibly due to the lack of structured rehabilitation and return to play protocols.

Keywords

Rugby union; injuries; prehabilitation; rehabilitation; return to play.

Opsomming

Agtergrond

Professionele rugby het ontwikkel tot die derde mees populêre kontak sport in die wêreld. Die fisieke natuur van die spel veroorsaak ‘n baie hoë voorkoms van beserings op alle vlakke van die spel. Beseringsvoorkoms so hoog as 83.9 beserings per 1000 speel ure is gedurende die 2007 Rugby Wêreldbeker in Frankryk gerapporteer. Navorsing op skolegebeid is beperk, maar word gerapporteer as veiliger met beseringsvoorkoms van 65.8 beserings per 1000 speel ure. Beserings word hoofsaaklik veroorsaak tydens die duik situasie. Knie en skouerbeserings is die mees algemeen.

Die risiko van rugbybeserings word verhoog deur professionalisme, vorige beserings, hoër oefen volumes, intrinsieke- en psigologiese faktore. As gevolg van die professionele wending in rugby, het die hantering van besering soveel belangriker geword. Die hantering van beserings moet prehabilitasie of beseringsvoorkomende programme, rehabilitasie tot en met die finale-, sport spesifieke fase, asook gestruktureerde terugkeer na spel toetse insluit. Nog ‘n belangrike aspek van beserings hantering is die opleiding van afrigters, spelers en ander persone betrokke by die spel.

Doelstellings

Die eerste doelstelling van die studie was om die voorkoms van beserings op Suid-Afrikaanse skoolvlak vas te stel. Tweedens is die behandeling van hierdie beserings aangeteken en so ook die protokolle wat gebruik is om gereedheid vir terugkeer na spel te bepaal. Die verband tussen behandeling van beserings en die ernstigheidsgraad van die beserings is vervolgens vasgestel. Laastens is die herbeseringsvoorkoms vergelyk met die behandeling ontvang na ‘n besering, asook die terugkeer na spel protokolle wat gebruik is.

Metode

Tien skole van regoor Suid-Afrika is by die studie ingesluit. Die skole is almal as elite skole deur die NWU-PUK geidentifiseer weens hul prestasies gedurende die vorige jaar (2008). Slegs die eerste spanne of oefengroepe van elke skool is gebruik en ‘n totaal van 194 seuns het met behulp van die navorser vraelyste voltooi. Die vraelyste sluit in: tipe en ergheidsgraad van die beserings, herbeserings, oorsaak, behandeling en kriteria vir terugkeer na die besering. Die ergheidsgraad van beserings is gedefinieer in terme van wedstryd en/of oefen dae gemis en word as volg uiteengesit: lig (0 - 1 dag), minimaal (2 – 3 dae), matig (4 – 7 dae), redelik ernstig (8 – 28 dae) of ernstig (>28 dae). Die resultate is verwerk en deur middle van beskrywende statistiek aangebied. Statistiese betekenisvolheid is aangedui deur $p \leq 0.05$, terwyl praktiese betekenisvolheid deur die Phi-koeffisiënt aangedui word. Praktiese betekenisvolheid is aangedui indien phi ≥ 0.5 was.

Resultate

‘n Totaal van 118 beserings is gerapportteer, dus 78.51 beserings per 1000 speel ure. Nuwe beserings het 68,64% (n=81) van die beserings verteenwoordig, terwyl herbeserings 31.36% (n=37) van die beserings voorstel. Die areas wat meestal beseer is, is die knie (n=26) en skouer (n=21). Die meganisme van besering is meestal aangedui as die duikslag (insluitend om die duikslag te maak en om geduik te word). Die meeste beserings was lig (48%) van aard, maar redelike ernstige en ernstige beserings het 39% van die beserings aangedui. Die redelik ernstige en ernstige beserings het ‘n minimum van 360 dae uit aksie tot gevolg gehad. Ernstige beserings is meer geneig om deur ‘n dokter behandel te word. Die enigste betekenisvolle verband is dan ook tussen die ernstigheidsgraad en dokters behandeling gevind ($p = 0.7$) Geen protokolle vir die terugkeer na spel was in plek nie. Dertien van die beserings het egter een of ander vorm van toetsing ondergaan (isokineties of veld toetse).

Gevolgtrekking

Die voorkoms van beserings by top Suid-Afrikaanse skole rugby spanne is baie hoog. Daar bestaan geen gestruktureerde rehabilitasie programme op skoolvlak nie en geen terugkeer na spel protokolle is beskikbaar nie. Herbeseringsvoorkoms is

hoog, moontlik as gevolg van die tekort aan gestruktureerde rehabilitasie en terugkeer na spel protokolle.

Sleutelterme

Rugby, beserings, prehabilitasie, rehabilitasie, terugkeer na spel

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List of abbreviations

ACSM: American College of Sports Medicine

IRB: International Rugby Board

NWU: North-West University

p: Pearson's Chi-square (statistical significance)

Phi: Phi-coefficient (practical significance)

PUK: Potchefstroom University Campus

RICE: Rest, Ice, Compression and Elevation

ROM: Range of Motion

SA: South Africa

SAID: Specific Adaptation to Imposed Demands

SD: Standard deviation

TRIPP: Translating Research into Injury Prevention Practice

U/15: Under 15 years

U/16: Under 16 years

U/18: Under 18 years

Chapter 1

Problem statement and objectives of the study

1. Introduction

Ever since rugby union became a professional sport in 1995, the interest in the sport has grown worldwide (Bathgate *et al.*, 2002:265). Higher injury rates has since been reported amongst professional rugby union players, to the magnitude of 83.9 injuries per 1000 playing hours during the 2007 Rugby World Cup (Fuller *et al*., 2008:452). Commercialism and professionalism have become powerful forces undermining the wholesome nature of amateur athletic programs in schools (Roberts, 2007:63). The already high training and game demands of sport are becoming increasingly more adult like (Hollander *et al*., 1995:14; Hartwig *et al.,* 2008:102), resulting in higher injury rates at amateur level. Injury rates as high as 65.8 injuries per 1000 playing hours has been reported in schoolboy rugby union players in New Zealand (Durie & Munroe, 2000:84). Musculoskeletal injuries accounts for most of the injuries within rugby union, with the knee (25%) and shoulder (19%) frequently being indicated as the most injured sites (Kaplan *et al*., 2008:90; Gianotti *et al.,* 2009:372; Nicol *et al*., 2010:4). The cost of injuries in rugby union has been reported by Gianotti *et al*. (2009:372) to accumulate to $NZ 40,385,034 in the 2005/2006 financial year alone.

The alarming high rate of injuries, especially in rugby union, has proposed the need for injury prevention programs. A vicious cycle of chronic injuries or permanent disability could be the result when an athlete in not fully recovered or if return to play is made to soon (Wilkstrom *et al*., 2006:393). Recent years has seen the

development of various rugby union injury prevention programs in leading rugby countries, such as *RugbySmart*, a New Zealand initiative and *BokSmart*, the South African equivalent. These programs mainly focus on prevention of catastrophic injuries in rugby union and are implemented through an educational basis (Posthumus & Viljoen, 2008:64; Gianotti ***et al***., 2009:371). *RugbySmart* has been evaluated and found to be successful in reducing such injuries (Gianotti ***et al***., 2009:371). As musculoskeletal injuries accounts for much of the training and game time lost in rugby union, the need exists for research to investigate the management of these injuries already at school level to promote the future of upcoming talent.

2. Problem statement

Surveillance studies on rugby union injuries show that the intense physical nature of the game results in a high prevalence of musculoskeletal injuries, especially since the introduction of professionalism (Bathgate *et al.*, 2002:265; McManus & Cross, 2004:438; Best *et al.,* 2005:812). Younger players experience enormous pressure as they want to secure initial playing contracts or bursaries given by tertiary institutions (Sheard & Golby, 2009:104; Sack, 1987:31). Durie and Munroe (2000:84) indicated that 65.8 injuries per 1000 playing hours was sustained by 1st teams, whilst only 35.0 injuries per 1000 playing hours was sustained by 2nd teams on schoolboy level in New Zealand. A study done by McManus and Cross (2004:443) in Australia showed an injury incidence of 13.26 per 1000 playing hours for elite junior rugby union players over 26 weeks. The professional approach to rugby union has also brought about a higher incidence of recurrent injuries (Garraway *et al*., 2000:349). Brooks *et al.* (2005:767) indicated that recurrent injuries sustained by professional players during match play as well as during training were more severe than the new injuries obtained.

Correct and timely rehabilitation of injuries is a vital component of sport (Stracciolini *et al.,* 2007:43). Rehabilitation includes restoring function, pain-free full range of motion, achieving complete muscle strength and sporting endurance (Stracciolini *et al.,* 2007:43). Positional differences occur within rugby union and should also be taken into account for rehabilitative, preventive and fitness programs (Eaton & George, 2006:26). There are no foolproof criteria for accurately estimating recovery time, as it varies according to the severity of injury, prior injuries, effectiveness of rehabilitation and the motivation and compliance of the athlete (Stevens & Harmon,

2002:36). Fuller and Walker (2006:155) state that injured professional athletes often return to play without completing a structured rehabilitation program and that return to play criteria used by clubs are not transparent. According to Strickland (1998:397), the same applies to schoolboys, as athletes and their parents, coaches, sponsors and schools are often vocal and unreasonable in their desire for returning to the sporting arena after injury. Research done on the return to play practices of rugby union is very limited. In one study done by Beardmore *et al*. (2005:27) the lack of sufficient return to play practices in New Zealand was confirmed as a major contributing factor to re-injuries in this sport. Beardmore *et al.* (2005:29) further emphasized the compromises being made for returning to play after an injury and the lack of a standardized protocol for fitness testing. Before returning to play, pre-injury parameters of range-of-motion, flexibility, strength, balance, proprioception and endurance as well as specific demands required upon returning to competitive activity should be confirmed (Beam, 2002:207).

BokSmart was implemented in South Africa in 2006 (SA RUGBY, 2010) and has become a prerequisite for all rugby union coaches and referees on all levels of play in South Africa. This program focuses mainly on the prevention of neck and spine injuries (Posthumus & Viljoen, 2008:64) and gives very little attention to the prevention of other musculoskeletal injuries commonly associated with rugby union. As development of injury preventative programs are still in progress in rugby union, management teams should focus on effective rehabilitation, as well as fixed return to play criteria to limit the occurrence of re-injuries.

Given the limited information available on management of musculoskeletal injuries in rugby union, this study will strive to answer the following questions: Firstly, what is the prevalence and nature of injuries in South African schoolboy rugby union? Secondly, what is the treatment obtained after injury and what kind of criteria is used to determine readiness to return to play after an injury? Thirdly, is there an association between injury severity and treatment of injuries? Lastly, is there an association between kind of treatment obtained, as well as return to play criteria used, with resultant re-injuries?

The results resolved from this study will help to identify the limitations of injury management in South African schoolboy rugby union and create awareness of the importance of professional multi-disciplinary and sport specific rehabilitation after

injury. The findings will indicate the importance of implementing and evaluating fixed return to play criteria and the potential effect thereof will also be explored.

3. Objectives

The objectives of this study were to determine:

1. The prevalence and nature of injuries in schoolboy rugby union players in selected schools across South Africa.
2. The treatment obtained and return to play criteria used following injury in South African schoolboy rugby union players.
3. The association between treatment and injury severity in South African schoolboy rugby union players.
4. The associations between treatment, as well as return to play criteria used and re-injury occurrence in South African schoolboy rugby union.

4. Hypotheses

This study is based on the following hypotheses:

1. The prevalence of injuries amongst South African schoolboy rugby union players are high and the nature of these injuries varies greatly.
2. Treatment following injury is incomprehensive and no definite criteria for return to play exist in South African schoolboy rugby union.
3. South African schoolboy rugby union players who sustained severe injuries were more likely to seek treatment from different disciplines within the multi-disciplinary rehabilitation team.
4. South African schoolboy rugby union players who did not follow comprehensive rehabilitation and was not subjected to transparent return to play criteria have a higher occurrence of re-injuries.

5. Structure of the dissertation

This dissertation will be presented in article format and consists of four chapters.

Chapter 1: Problem statement. This chapter serves as the introduction to the study and includes a problem statement, objectives and hypotheses. The references in this chapter are according to the guidelines of the North-West University, Potchefstroom Campus. Harvard style.

Chapter 2: Injury management in rugby union: a review. This literature review was written in accordance with the guidelines of the North-West University, Potchefstroom Campus. Harvard style.

Chapter 3: Research article. The prevalence and management of injuries in South African schoolboy rugby union players. This article will be submitted to the South African Journal of Sports Medicine and are written in accordance to the guidelines for authors of this journal.

Chapter 4: Summary, Conclusion, Limitations and Recommendations. This chapter gives a summary of the results obtained from this study and conclusions drawn based on the hypotheses set. Limitations of the study is also included as well as recommendations for further research.

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Chapter 2

Injury management in rugby union: a review

2.1 INTRODUCTION

Rugby union has unique physical demands with different risk factors contributing to injury (Sheard & Golby, 2009:104; Meir *et al.,* 2007:50 & Garraway *et al.,* 2000:348). For adolescents, the training and game demands of the sport are becoming increasingly more adult like (Hollander *et al*., 1995:14) and the training demands on adolescent rugby union players are already very high (Hartwig *et al.,* 2008:102). Younger players experience enormous pressure as they want to secure initial playing contracts (Sheard & Golby, 2009:104) or bursaries given by tertiary institutions

(Sack, 1987:31). According to Strickland (1998:397), athletes and their parents, coaches, sponsors and schools are often vocal and unreasonable in their desire for returning to the sporting arena after injury. A vicious cycle of chronic injuries or permanent disability could be the result when an athlete is not fully recovered or if return to play is too soon (Wilkstrom *et al*., 2006:393). Many epidemiological studies have been performed to describe injury patterns in rugby union, expressing considerable concern over the increasing number of injuries (Brooks *et al.,* 2008:863; Holtzhausen *et al.,* 2006:1265; Brooks *et al*., 2005a:757; Brooks *et al*., 2005b:767; Best *et al*., 2005:812; Bathgate *et al*., 2002:265; Lee *et al.*, 2001a:41 & Garraway *et al.,* 2000:348). However, only a few studies focused on management strategies (Gianotti *et al*., 2009:371; Klopper & De Wet, 2008; Posthumus & Viljoen, 2008:64; Chalmers *et al*., 2002:74) and interventions to prevent injuries are introduced as a rapid response to an acknowledged problem, but not properly studied (McIntosh & McCrory, 2005:317).

2.2 INJURY PREVALENCE IN RUGBY UNION

After rugby union received professional status in 1995, the sport has grown to the third most popular team contact sport, with the Rugby World Cup indicated as the third largest sporting event, in the world (Bathgate *et al.*, 2002:265;Kaplan *et al*., 2008:86 & Mellalieu, 2008:791). This in turn brought along changes in the game and its demands as well as injuries associated with the game.

An injury is defined by Collard *et al.* (2008:399) as the presence of a new symptom or complaint, decreased function of a body part or a decreased athletic performance. Furthermore, an injury exceeds the body's ability to maintain structural and/or functional integrity (Fuller *et al*., 2007b:329). Prevalence is defined as the number of all new and old cases or injuries during a particular period (Mosby, 2009). Incidence is the number of new cases or injury that arises during a specific period of time (Mosby, 2009), for the purpose of rugby injury surveillance usually indicated as injuries per 1000 playing or player hours (Fuller *et al*., 2007b:331). Playing hours is indicative of the total training and game time for a team whereas player hours are defined as the incidence of injuries per hours of match play (Nicol *et al.,* 2010:2). Due to the difference between playing and player hours, it is difficult to compare some literature and hence future injury reporting of injuries should be consistent (Fuller *et al*., 2007b:331).

2.2.1 Injuries in professional rugby union

The incidence, severity and epidemiology of injuries in rugby union have been proven to be very high with a wide variety of mechanisms (Meir *et al*., 2007:50; McManus & Cross, 2004:438; Bathgate *et al.*, 2002:265). The 1995 Rugby World Cup, held in South Africa was reported to have an injury rate of 30 injuries per 1000 player hours for the preliminary 48 matches and 43 injuries per 1000 player hours for the 7 final-round matches (Jakoet & Noakes, 1998:46). The higher injury rate during the latter matches can be ascribed to the competitiveness and increased quality of the final-round matches as well as fatigue of the players. During the 1999 Rugby World Cup in Wales, Wilson *et al*. (2002:235) conducted a study focusing on the identification of risk factors during the tackle. Of the 755 tackles used in the study, 151 tackles caused injury to 153 players (Wilson *et al*., 2002:235). During the 2003 Rugby World Cup in Australia, Best *et al.* (2005:812) reported an injury incidence of 97.9 injuries per 1000 playing-hours. They attributed the higher rate of injuries to mismatches in the areas of skill, fitness and the availability of resources for medical care of players. In France, during the 2007 Rugby World Cup, Fuller *et al*. (2008:452) reported an injury incidence of 83.9 injuries per 1000 playing-hours.

According to Holtzhausen (2001:1) the mean injury incidence for professional rugby union is 86.4 injuries per 1000 player hours. This was calculated by using data from the Super 12 competition, which was the first fully professional rugby tournament played between teams for New Zealand, Australia and South Africa (currently ranked first, second and third in the world by the IRB). Brooks *et al*. (2005a:757) indicated a total injury incidence of 91 injuries per 1000 player hours amongst English professional rugby union. Due to injury 18% of players are unavailable for selection (Brooks *et al.,* 2005a:759).

2.2.2 Injuries in amateur and schoolboy rugby union

Professionalism leads to a higher prevalence of injuries in both professional and amateur players (Garraway *et al*., 2000:348). Davidson (1987:119) conducted a seven year study in Australia on the prevalence of injuries in schoolboy rugby union players between the ages of 11 and 18. The results showed an injury incidence of 176 injuries per 1 000 playing-hours. Another study on the prevalence of injuries amongst elite junior rugby union players (u/15 and u/16) was done by McManus and

Cross (2004:438). An injury prevalence of 13.26 injuries per 1 000 player hours was found during a 26 week period. Furthermore, Carter and Muller (2007:168) reported that half of all the injuries presented to public hospitals in Queensland from participation in rugby union were children between the ages of 5 and 14.

However, a study done by Lee and Garraway (1996:213) amongst schoolboy and club rugby players, found that schoolboy rugby was much safer and injuries was less disruptive. Reasons for this might include the smaller body size of the schoolboys as well as the shorter rugby season and less matches played by the schoolboys in comparison with club rugby players. Collins *et al.* (2008:50) indicated that injury incidence was also influenced by the type of rugby exposure, since injury incidence during practice was limited to 1.3 injuries per 1000 player exposures while match injuries came to 15.2 injuries per 1000 player exposures. A study on Scottish schoolboy rugby union found an injury incidence of 10.8 injuries per 1000 player hours (Nicol *et al*., 2010:3).

2.2.3 Nature of rugby union injuries

Nature is inclusive of the type and location of injury, frequency of injury, as well as the injury event or mechanism. (Frequency of injury is discussed above)

Nicol *et al*. (2010:3) indicated the tackle as the phase of play most likely to cause injury amongst schoolboys – implicating tackles in 62,1% of injuries, whilst the ruck caused 24,3% of injuries and scrums caused only 5,4% of injuries. Hendricks *et al.* (2010) confirms the danger of the rugby tackle by assigning 61% of all injuries to be caused by the tackle. Tackles causes 5 times more injuries than any other contact event in the game of rugby union (Fuller *et al*., 2007a:866). Tackle injuries also account for the majority of fractures and dislocations in rugby union as well as soft tissue injuries (MacQueen & Dexter, 2010:140).

The head and face is the most injured part of the body in schoolboy rugby union, closely followed by the shoulder and knee (Nicol *et al*., 2010:3; Durie & Munroe, 2000:84). Sprains or ligament injuries was found to be the most common type of injury in schoolboy rugby union (Nicol *et al*., 2010:1). Amongst English professional rugby players, the greatest causes of days missed for backline players was hamstring injuries while forwards suffered from anterior cruciate ligament injuries (Brooks *et al*., 2005a:758). Again, as for schoolboy and amateur rugby union, the

most common mechanism of injury was contact events, more specifically tackles for backline players and ruck or maul situations amongst forwards (Brook *et al*., 2005a:758).

2.3 FACTORS CONTRIBUTING TO INJURY PREVALENCE

2.3.1 Professionalism

Professionalism in rugby union has brought on a new dimension in the competitiveness of the amateur game (Lee *et al.*, 2001a:41). As a result of the enhanced competitiveness an increase in the demands of physical and mental robustness brought along a greater compliance to the expanded needs (Garraway *et al.,* 2000:348) such as being skilled in attack, defense and other positional responsibilities (Sheard & Golby, 2009:104).

Professionalism also brought about a model of industrial relations including determined wages and employment conditions in this popular sport (Dabscheck, 2003:105). Professional careers, initial playing contracts and college scholarships motivate young sportsmen to specialize in rugby union very early on (Anderson *et al.,* 2000:150; Sack, 1987:31; Sheard & Golby, 2009:104). This early specialization and professionalism in the sport adds to 'wear and tear' of the athlete and has now caused exercise to become a risk factor with adverse consequences (Hyman, 2004:142 & Timpka *et al.,* 2006:733). It is critical for a professional athlete to maximize compensation as their careers are short and health risks are high (Hilpirt *et al*., 2007: 9). Thus, an injury does not only hold a health concern for the player, but also financial challenges (Beardmore *et al.,* 2005:24). Hickey and Kelly (2008:477) stated: "within the volatile world of high profile male contact sports, such as rugby, careers can sit, literally, on knife-edge".

2.3.2 Previous injuries and training demands

Quarrie *et al.* (2001:163) suggests that players enter a season injury free. Players coming into a new season with an injury are more likely to be re-injured (Beardmore *et al*., 2005:25; Lee *et al.,* 2001b:412; Quarrie *et al.,* 2001:163). Previous injury has also been indicated as the strongest predictor of future injury (Gerrard *et al*., 1994:229).

Premature returns to the sporting arena is worrying for administrators and medical insurers since players returning to play prematurely face a greater risk for further harm and re-injury (Beardmore *et al*., 2005:25). Various reasons can be given for players not coming into a season injury free, such as long seasons with short off-season periods, financial and psychological factors. Quick return to training and playing by athletes could be because of income related factors or sporting professionalism (Lafferty *et al*., 2008:302). Verrall *et al*. (2006:88) reported that Australian football players' performances were reduced in the immediate return to play after a hamstring injury because return was made before complete resolution of the injury.

Training demands on adolescent rugby union players are already very high (Hartwig *et al.,* 2008:102). This high level of competition requires longer, harder and more intelligent training regimes for children that could already be considered as being hard for adults (Anderson *et al.,* 2000:150). Rotem and Davidson (2002:2) states that a greater prevalence of injuries is recorded amongst more skilled players due to a more aggressive approach to the game, dangerous style of play and greater impacts. Lee *et al.,* (2001b:412) indicated that preseason rugby training was associated with an increased risk of injury in the following season. Lee, *et al.,* (2001b:412) contributed this to more intensive play and more injury prone maneuvers attempted by players who participated in preseason training. There is a reduced injury rate reported over a season, thus a higher rate of injuries was found at the beginning of a season (Alsop *et al*., 2000:108).

2.3.3 Intrinsic factors and the nature of rugby union

Intrinsic factors such as physiological, biomechanical, anatomical and genetics may play a role in risk for injury as well as prior injury, muscle weakness, inflexibility and kinetic chain breakage (Herring *et al*., 2007:2058 & Lee *et al*., 2001b:412). Other intrinsic factors include stress, aerobic and anaerobic performance (Quarrie *et al*., 2001:163) and also personality, which affect the risks players are willing to take (Lee *et al*., 2001:412).

Sports involving impact, collisions at speed and vigorous body contact is generally associated with a higher injury risk (Beardmore *et al.,* 2005:24) as well as risk of head and neck injuries (McIntosh & McCrory, 2005:314). Heavy body contact and

collisions characterize both offensive and defensive play in rugby union (Meir *et al.,* 2007:50). Hickey and Kelly (2008:477) reports that an unexpected knock, twist, bend or bone break can profoundly impact a player's career in various football codes. The rugby tackle account for approximately half of all rugby union injuries (McIntosh & McCrory, 2005:316), with the greatest associated loss of playing time (Fuller *et al*., 2007a: 867). High tackles or tackles involving a shoulder charge was also identified as further risk factors (Wilson *et al*., 2002:236).

Garraway *et al*. (2000:348) suggests that attention should be given to the tackle to reduce injury, such as rule revisions and changes made by the International Rugby Board (IRB). One such scrummaging rule, the four-stage 'crouch, touch, pause, engage' sequence, was implemented on the first of January 2007 in all rugby-playing countries and found to be successful in the reduction of scrum-related injuries (Gianotti *et al.*, 2010:427). It is, however, difficult to change tackle laws without altering the nature of the game (Holtzhausen *et al.,* 2006:1265).

2.3.4 Psychological issues

Psychological readiness is indicated by Herring *et al*. (2002:1213) as vital for return to play after injury. An important part of every athlete's performance is also thoughts, feelings and spirit, and it is no different when it comes to injuries (Brehm, 2008:52). Athletes may have a stronger negative psychological response to injury as they tend to rely on their physical abilities and this in turn could have a negative impact on rehabilitation adherence and subsequent return to play (Brehm, 2008:52).

Liston *et al*. (2006:392) found that the attitudes and behavior regarding injury and pain of non-elite rugby players are similar to those of elite and professional athletes. Individuals who are mentally tough cope better with pain during rehabilitation, but they tend to see their injuries as less threatening and less susceptible to further injury (Levy *et al.,* 2006:251b). This could implicate a negative impact on rehabilitation adherence and recovery outcomes (Levy *et al.,* 2006:252b; Brehm, 2008:52). College and university athletes feel pressure to speed up recovery (Hamson-Utley *et al*., 2008:263).

Behavioral outcomes concerning rehabilitation continue to be a problem in terms of adherence (Hamson-Utley *et al*., 2008:263). Podlog and Eklung (2009:543) suggests that coaches give positive feedback regarding rehabilitation and return to

play to provide athletes with connectedness and competence. Athletes should be made to feel as if they are contributing to the team as to promote perceptions of post injury success (Podlog & Eklung, 2009:544). Promoting and maintaining a positive mind set, focusing on healing and decreased stress and anxiety through positive self-talk and visualizations have been shown to benefit the injured athlete (Hamson-Utley et al., 2008:263).

Rugby promotes team spirit, abidance to rules, respect for oneself and others, self-control and humbleness (Romand & Pantaleon, 2007:75). Love of the game, bonding with teammates and maintaining fitness levels are amongst some of the motives for return to practice and play (Podlog & Eklund, 2006:53; Lee *et al*., 2001:41). Furthermore, it is important for athletes to regain pre-injury performance levels or to regain a position in a particular team (Podlog & Eklund, 2006:53). Anxiety and insecurity is experienced due to the unknown factors upon return to competition (Podlog & Eklund, 2006:56). Athletes are sometimes encouraged not to rush their returns by medical practitioners, coaches and others, but athletes still perceive an amount of pressure from coaches, teammates and even medical staff to return to competition (Podlog & Eklund, 2006:53). Financial implications in turn, put coaches under pressure for their team to perform (Brooks *et al.,* 2008:863).

Support should also be available for athletes to cope with rugby and money hassles to help prevent burnout (Cresswell, 2009: 398). Burnout is characterized by physical and emotional exhaustion, a devaluation of the sport and reduced accomplishments (Cresswell, 2009: 398). Rugby players willingly expose themselves to the risk of injury and when injured will continue to play for the 'good of the team', as it is socially valued and shows their commitment to the team (Liston *et al.,* 2006:394). These players will even continue to play with injury when there is risk of long-term consequences for their health (Liston *et al.,* 2006:395).

2.4 MANAGEMENT OF RUGBY UNION INJURIES

Rehabilitation is commonly defined as facilitation of injury recovery (Meir *et al.,* 2007:51). As prehabilitation is a relatively new term, it has yet to be fully and clearly defined. Meir *et al*. (2007:51) suggested it to include a program that is preventive in nature designed to minimize common injuries in a specific sport while also providing a conditioning stimulus for the athlete. Return to play is defined by the Herring *et al.*

(2002:1212) to be a process by which it is decided if an injured or ill athlete may return to practice or competition safely.

2.4.1 Prehabilitation or injury prevention

Professional sportsman is highly skilled and relatively expensive to employ, thus risk of injury must be evaluated and if possible reduced (Gissane *et al*., 2003:516). It is essential to identify the injury problem and risk factors specifically in children and to develop and evaluate preventive measures that are expected to reduce physical activity injuries (Collard *et al*., 2008:399). Four stages of injury prevention were traditionally indicated by Van Mechelen *et al*., (1992:82):

1. Establishing the extent of the sports injury problem
2. Establishing the aetiology and mechanisms of injuries
3. Introducing the preventive measures
4. Assessing the effectiveness of the preventive interventions

Finch (2006:4) indicated limitations to this model of Van Mechelen *et al*. (1992:82), such as implementation issues as well as the lack of moving beyond stage 2 due to methodological limitations and thus introduced the TRIPP framework or Translating Research into Injury Prevention Practice framework. The TRIPP framework consists of 6 stages, described by Finch (2006:5) as follows:

1. Injury surveillance – should allow for routine and ongoing reporting and monitoring.
2. Establish aetiology and mechanisms of injury – biomechanical, clinical rehabilitative research, behaviorism and epidemiological studies should form part of the multidisciplinary approach to understanding the aetiology of a sport's injuries.
3. Develop preventive measures – again a multidisciplinary approach should be used in correlation with TRIPP stage 2 to scientifically put these preventive measures in place.
4. 'Ideal conditions' or scientific evaluation – this is usually done with smaller sample groups in laboratory conditions but should not be directly related to real-world injury prevention.

5. Describe intervention context to inform implementation strategies – understanding how the efficacy research can be translated into actions that can be implemented in the real-world context.

6. Evaluate effectiveness of preventive measures in implementation context – implementation and evaluation of effectiveness in a real-world context.

Performance is achieved by implementing effective training programs (Hartwig *et al.,* 2008:94). Professional sport is continually developing and scientific methods are being integrated to support coaches (James *et al.,* 2005:63). The volume of training should be managed as to minimize risk of injury (Brooks *et al.,* 2008:863). There are many components adding up to performance in sport, this not only includes strength, but also neuromuscular qualities which should be addressed individually for each player (Berg, 2006:17). Prevention should be an integral part of athletic training (Beam, 2002:205). Selection of appropriate body types, physical preparation and skills training remain important strategies to fundamentally prevent injuries (Rotem & Davidson, 2001:8). Individual and team skills should be developed with a fundamental element of player to player contact to help reduce the incidence of injuries (Brooks *et al*., 2008:870). Prehabilitation or injury prevention programs should further address any imbalances due to poor posture or repetitive movements as well as areas that lack mobility and stability (Cook, 2003:30). Balance and proprioception in multiple planes of movement should also be addressed (Meir *et al.,* 2007:51).

Prehabiliatation programs are currently being introduced in rugby union to target vulnerable areas of the body and in so doing theoretically reduce the incidence of common injuries (Meir *et al.,* 2007:50). Examples of such programs include:

- *Tackling rugby injury* was introduced in 1995 in New Zealand to reduce rugby union injuries (Chalmers *et al*., 2002:74). The focus of the program was coaching, fitness, injury management, tackling and foul play (Chalmers *et al*., 2002:74). A positive profile on injury prevention was gained during the five years of implementation (Chalmers *et al*., 2002:82). Chalmers *et al*. (2002:74) stresses the importance of basing injury prevention strategies on scientific evidence and having the coach play the central role in the implementation thereof.

- *RugbySmart* was designed and implemented in New Zealand in 2001 as an injury prevention program (Gianotti *et al*., 2009:371). The goal of the program was to reduce the number and severity of injuries in rugby union through evidence-based information delivered to coaches and referees (Gianotti *et al*., 2009:371). The main focus of the information given was on physical conditioning, techniques (more particularly tackling and scrummaging) and injury management. It showed a significant decrease in injuries associated with contact aspects of the game such as scrums, which was credited to better technique (Gianotti *et al*., 2009:375). This confirms that preventive conditioning programs can reduce injuries commonly sustained in rugby union or at least lessen the severity of these injuries, as suggested by Meir *et al.* (2007:51). In turn, this potentially maximizes a player's playing time (Meir *et al.,* 2007:53).

- *BokSmart* was adapted and implemented in South Africa in 2006 with the strategic framework built round 5 pillars, namely: coaches and referees, medical protocols, research, legislation and marketing and communications (SA RUGBY 2010). Regarding injury prevention, the main focus is on serious and/or catastrophic head, neck or spine injuries (Posthumus & Viljoen, 2008:64). The goal of the program was to reduce the number of serious or catastrophic injuries and making the game safer for all (Klopper & De Wet, 2008). This is done by teaching better contact phase techniques, such as the scrum, tackle, line-out, rucks and malls (Posthumus & Viljoen, 2008:64).

All the above mentioned programs focus on prevention of injury through the common mechanisms associated with rugby union. Very little focus is, however, put on preventing common rugby injuries, such as knee injuries, which is reported by Gianotti *et al.* (2009:372) to add up to 25% of all reported injuries and 31% of injury management costs, while shoulder injuries contributed 19% in number and 20% in cost. This indicates a limitation – regarding both the player's career and financial implications – in the existing programs, which should be addressed.

2.4.2 Rehabilitation

Participation in training and competition may be at risk without proper diagnoses and treatment of injuries (Kannus *et al.,* 2003:150). Recovery is essential to prevent disturbances in skill and performance as well as re-injury (Stone, 1999:18). When there is no access to sports-related medical provision, players tend to self-diagnose which leads players and coaches alike, to downplay the symptoms which involves potentially serious health risks (Liston *et al.,* 2006:399). After injury, the body must repair the damaged tissue and restore its integrity through its own mechanisms or with assistance (Stone, 1999:18).

In 1960, Logan and Wallis (as reported by Prentice, 2004:4) introduced the SAID principle of rehabilitation. SAID or 'Specific Adaptation to Imposed Demands' states that an injured structure will gradually adapt over time, to whatever demands placed upon it (Prentice, 2004:4). The objective of rehabilitation should thus be to facilitate recovery of the injured athlete as the injured structure adapts to the specific increased demands (Meir *et al.,* 2007:51; Prentice, 2004:4). In 1980 Hughston (1980:1611) already indicated that rehabilitation accounts for 50% of success after an injury or surgery. Kannus *et al*. (2003:150) summarizes that an active approach to the treatment of musculoskeletal injuries in athletes are needed. This is obtained by three phases of rehabilitation that overlap each other, namely: the acute management phase, intermediate phase and the functional or sport specific phase (Stracciolini, 2007:43). During these phases emphasis is put on increasing or maintaining range of motion (ROM), strength and sport specific exercises (Stracciolini, 2007:43).

In sport there are no foolproof criteria for accurately estimating recovery time as it varies according to the severity of injury, prior injuries, effectiveness of rehabilitation and the motivation and compliance of the athlete (Anderson, 2002:36). Fuller and Walker (2006:155) state that injured professional athletes often return to play without completing a structured rehabilitation program. The success of rehabilitation relies greatly on the athlete's adherence to prescribed regiments (Spetch & Kolt, 2001:88). Education, treatment efficacy and social support of the athlete are necessary to optimize rehabilitation adherence (Spetch & Kolt, 2001:88). The athlete should actively be involved in the design and implementation of the rehabilitation program for better motivation and commitment (Wayda *et al*., 1998:21). Herring *et al*. (2002:1213) strongly suggests that an individualized plan should be followed after

injury. Injured players should be rehabilitated to the point where it is possible for them to handle the demands of the game (Eaton & George, 2006:28).

2.4.3 Sport specific rehabilitation

Full flexibility, strength and proprioception are needed, but not synonymous with full and safe return to sport (Hergenroeder, 1998:1061). The simulation of sports-related skills (Middlemas *et al*., 2009:83) and importance of final rehabilitation through on-field training, progressively exposing the player to rugby specific demands should not be underestimated (SA Rugby 2010). The *BokSmart* initiative also acknowledges that the process should be gradual in return to full game time. The effectiveness of this program is yet to be tested.

Sport specific assessment and training should be provided and should serve as a basis of conditioning and rehabilitation (Herring *et al*., 2002:1213). Functional progression of sport-specific tasks minimizes the risk of recurrence of injury once return to play has been made (Eaton & George, 2006:30). These sport-specific exercises should be used to supplement general exercises and not to replace them (Berg, 2006:14). Rehabilitation, however should not only be sport specific, but James *et al*. (2005:63) states that individual decision making could also have an effect on demands that exists inside a specific position. It should be considered before a player returns to play (Eaton & George, 2006:28). Different therapeutic techniques can be used during the rehabilitation of an injured athlete, however, Beam (2002:218) stresses the importance of sport-specific functional exercises during rehabilitation to subject a player to demands as challenging as competition demands (Eaton & George, 2006:30).

2.4.4 Return to play

Stevenson (2003:519) indicated the particular need for the development of consistent, evidence-based guidelines with the focus on ensuring safe participation of athletes because return to play criteria used by clubs is not transparent or consistent (Fuller & Walker, 2006:155). As a result of lacking criteria, management often make decisions based on their own perceived strengths and expertise (Handcock *et al.,* 2009:180). Medical personnel, who are part of the sports-net, tend to make medical compromises (Liston *et al.,* 2006:396) such as the use of local anesthetics to reduce

matches missed, which could increases the risk of worsening the injury (Orchard, 2002:209). Physiotherapists perceive pressure from owners, managers and coaches for returning players to the sporting arena (Lafferty *et al.,* 2008:302). In this regard Fuller and Walker (2006:151) suggested that a structured, quantified rehabilitation program be used and that rehabilitation exit point should be transparent.

Podlog and Eklund (2007:224) stress the importance of effective coach practitioner communication to maximize decision-making when considering return to sport after injury. Herring *et al*. (2002:1213) suggested that the criteria for return to play should include:

- anatomical and functional healing
- restoration of sport-specific skills
- psychological readiness
- ability to perform safely with no added risk to self or other participants

Returning to sport after injury without proper criteria, could be a great risk factor for professional athletes (Fuller & Walker, 2006:151; Eaton & George, 2006:23). Even the pressure on high school athletes to return to play after injury is high (Strickland, 1998:397). Consequently athletes as well as outside influences, such as parents, coaches and sponsors are often uninformed and unreasonable in their desire for the athlete to return to play (Strickland, 1998:397). Short term commercial interests of a club or team is often a reason for athletes to return to play prematurely (Fuller & Walker, 2006:151).

Successful return to sport should also be defined as return to pre-injury levels (Podlog & Eklund, 2009:542). Return to sport decisions should always be made secondary to formal medical clearance (Podlog & Eklund, 2007:224).

2.5 EDUCATION

According to Gianotti et al. (2009:375) educational strategies has successfully been used in different public health areas, such as diabetes and cardiovascular disease to reduce risk of illness and the same should be done in rugby union. The effectiveness of a program such as *RugbySmart* or *BokSmart* relies greatly on the educating of coaches in safe, but effective contact situations (Posthumus & Viljoen, 2008:64). A

study done by Carter and Muller (2008:168) focused on the injury knowledge of registered rugby union coaches for junior teams in Queensland and found that only 46% of the participants identified the correct management of soft tissue injuries. Coaches and players could benefit from coach education in early management of minor injuries as they are ideally placed for prompt management of these injuries (Carter & Muller, 2008:171).

Players, parents and coaches should be educated in the role of equipment, such as mouth guards, scrum caps etcetera, for injury prevention (Herring *et al*., 2007:2066). Information given to coaches and referees, concerning injury prevention should be in plain language, thus suitable for the audience (Gianotti *et al*., 2009:375). Players could benefit from improved efficacy of self-treatment of injuries through education of injury management (Carter & Muller, 2008:171). Athletes should also be educated concerning the consequences of the injury and the risk and potential consequences of re-injury (Strickland, 1998:400). Rugby players should also be educated on the possible long term effects of rugby injuries, especially the necessity of initial treatment and comprehensive physical training during recovery (Lee *et al*., 2001:40a). The education based, community-focused injury prevention program, *RugbySmart,* was found to be successful by Gianotti *et al*. (2009:375).

2.6 SUMMARY

A wide variety of studies has focused on injury prevalence in rugby union. This included the type and location of injury, frequency of injury, as well as the events causing injury. Reasons for these injuries include the nature of the game, professionalism and premature return to play after an injury. There have been suggestions by Finch (2006:5) as well as Van Mechelen *et al*. (1992:82) for the management of injuries in sport, but more research on the efficacy of rugby specific prehabilitative programs is needed. Various injury prevention programs has been implemented by different countries and teams, mainly focusing on common mechanisms of injury, while little focus is put on the prevention of specific injuries commonly associated with rugby union. Injuries, that do however occur, should be rehabilitated up until final, sport specific phase, where after consistent, quantifiable and transparent return to play criteria should be used to determine the safety of returning to play.

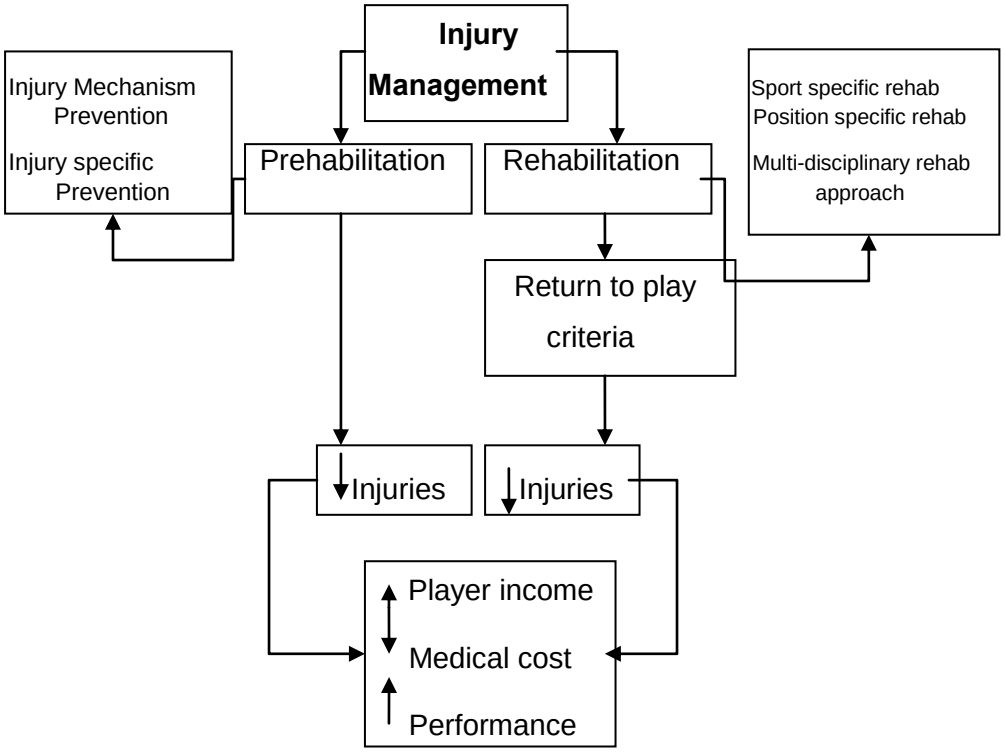

Figure 1: Suggested model of injury management in rugby union

Figure 1 suggests that injury management should be seen as a whole in order for it to be successful in the reduction of injuries. If these areas are to be well investigated, implemented and evaluated, the game of rugby can be more enjoyable and safer for players of all ages.

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Chapter 3

Prevalence and management of injuries in South African schoolboy rugby union players

Authors: Wall, C.M., Bruwer, E.J. & Wilders, C.J.

Physical Activity, Sport and Recreation, Norht-West University, (Potchefstroom Campus), South Africa

Corresponding author:

E.J. Bruwer
Private bag X 6001
North-West University
Potchefstroom
2522

E-mail: Erna.Bruwer@nwu.ac.za
Tel: + (27) 18 299 2034

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Abstract

Objectives: To define the prevalence and nature of injuries amongst South African schoolboy rugby union players and to determine if any definite protocols exists for the rehabilitation and return to play after injuries. Furthermore, to understand the association between injury severity and treatment obtained, as well as associations between rehabilitation, return to play criteria and re-injury occurrence in the same population. ***Design:*** A once-off cross sectional study was performed. ***Setting:*** Ten elite schools' first teams from across South Africa were recruited. A validated rugby union injury report questionnaires were used. Questions regarding rehabilitation and return to play criteria used after injury were added. ***Subjects:*** All participants were U/18 boys (17 years 8 months ±0.62) playing rugby union for their respective school's first teams. ***Outcome measures and results:*** A total of 78.51 injuries per 1000 playing hours (N=118) were reported with moderate and severe injuries (>28 days missed) adding up to 39% of the injuries. The knee and shoulder were identified as the most frequently injured sites and the tackle was the main cause of injury. Severity showed a large practical significant (phi = 0.7) association with treatment by a doctor, indicating that the more severe an injury was, the more likely a player was to seek help from a medical doctor. Only 18 of the reported 118 injuries underwent final phase rehabilitation while only 13 injuries underwent any kind of return to play testing. ***Conclusions:*** This study indicated a high prevalence of injuries amongst South African schoolboy rugby union players. No definite rehabilitation structures or return to play criteria were in place, and subsequently re-injury occurrence was also high.

Keywords: Rugby union; injuries; prehabilitation; rehabilitation; return to play

Introduction

Since the dawn of the professional era in 1995, there has been an increase in the physical demands of the game of rugby union.[1,2] Consequently, a higher prevalence of injuries in both the professional and amateur game occur.[2] Injury incidence of 86.4 and 91 injuries per 1000 player game hours have been reported amongst professional rugby union in South Africa [3] and England [4] respectively. It was estimated that during the 1993 and 1994 seasons schoolboy rugby union players were less prone to serious injuries in comparison with club rugby players.[5] However, the professional era also affected schoolboy rugby union injury rates, as 65.8 injuries per 1000 playing hours were reported in 2000 for schoolboy 1st teams in New Zealand.[6] The cost associated with the treatment of injuries is often very high [7] and contributes to the morbidity of players, coaches and parents.[8] Unfortunately, injuries in rugby union is inevitable due to the impact nature of the game,[9] therefore the management of injuries is crucial, especially since professionalism impacted injury prevalence on all levels of play.

The prevention of injuries should form the first major focus point in injury management.[10] Preventive or prehabilitation programs are globally being introduced in rugby union. Programs such as *Tackling Rugby Injuries*, *BokSmart* and *RugbySmart* focus on potentially dangerous situations [7,11] within the game (such as the tackle and scrum) in order to reduce the incidence of common injuries.[12] The strategies surrounding these programs focus on the mechanisms commonly associated with rugby injuries as well as preventing catastrophic (head and neck) injuries. *RugbySmart*, which was implemented in New Zealand by means of the education of coaches and referees, was found to be successful in the reduction of specific mechanism related injuries.[7] The focus of these programs however does not automatically lead to the prevention of specific injuries, such as knee and shoulder injuries, which are some of the main sites injured in rugby union [1,7] with major associated time lost. Anterior cruciate ligament injuries for instance have a mean of 235 days missed.[1]

The recovery of musculoskeletal injuries that does occur in sport should be facilitated [12] by means of a more active approach.[13] Such an approach is embedded in the 'Specific Adaptation to Imposed Demands' principle, as gradually increasing demands will take place over time to subject a player to the sport specific demands

of the game.[10,14,15] Once sport specific tasks is mastered the decision to return the injured player to the sporting arena should be transparent [16] and quantifiable in order to reduce the risk of further damage or re-injury.[9] The existing return to play protocols used by clubs is not transparent, and there still exists a particular need for the development of consistent, evidence-based guidelines for return to play,[17] and until that is finalized, premature return is to be expected.[18] The reasons for players returning to sport prematurely, could be due to short term commercial interests of a team,[16] income related factors, sporting professionalism[19] or wanting to ensure initial playing contracts.[20]

Playing contracts and college scholarships [20] add to the pressure on both professional and schoolboy rugby union players to play regardless of injury.[21] This contributes to an increased risk for further, more severe injury, that might result in catastrophic or career ending injuries [4] even on schoolboy level. Data concerning the management of injuries in schoolboy rugby union, both locally and internationally, is very limited. This is concerning, as the professionals of tomorrow lies within in the schoolboys of today. Accordingly the purpose of this study is to highlight the extent of injuries in schoolboy rugby union and investigate rehabilitation and return to play criteria in South African schoolboy rugby union. Furthermore, to investigate whether treatment obtained and the use of return to play criteria after injury have an effect on the prevalence of re-injuries.

Methods

Study design and participants

A once-off, cross sectional study was performed on an available population of schoolboy rugby union players. A total of 194 under 18 boys (17 years 8 months ±0.62) from 10 elite schools across South Africa were included in this study. The first teams of all participating schools were identified as elite schools by the Rugby Institute of the North-West University, Potchefstroom Campus (NWU-PUK) based on their performances during the previous year. Seven of the schools participated in the NWU-PUK's Elite Schoolboy Rugby Union Tournament in Potchefstroom. The remaining 3 teams however chose not to partake in the tournament due to previous commitments and were thus visited for the completion of the questionnaires. Participation was voluntary and consent was obtained from players and coaches.

Questionnaire

A validated rugby union injury report questionnaire by Fuller [22] was used for the purpose of this study. Questions regarding rehabilitation (treatment obtained) and return to play criteria used were added. An injury was defined as an injury occurring during training or playing rugby that caused a player to be unable to take full part in the training or match. All injuries sustained during the 2008 season as well as the first three months of the 2009 season were included as the questionnaires were completed in April 2009. Every reported injury was subsequently recorded on a separate questionnaire. The questionnaire includes: severity and site of injury, recurrence of injury, mechanism of injury, treatment procedures and criteria used for return to play. The questionnaires were conducted by the researcher and a total of 208 questionnaires were completed. The total number of injuries was expressed per 1000 playing hours and not divided into game and training injuries, as the purpose of the article is to evaluate the rehabilitation and return to play criteria used within schoolboy rugby union. Injury prevalence was accordingly calculated by the overall number of injuries sustained divided by the combined sum of hours exposed multiplied by 1000. Also note that the N-value indicates the number of injuries reported and not the number of players. Severity was defined in terms of calendar days, including game and training days missed due to injury and are described as slight (0 - 1 day), minimal (2 – 3 days), mild (4 – 7 days), moderate (8 – 28 days) or severe (>28 days). [22]

Treatment of injuries was divided into injuries treated by a doctor, a physiotherapist or other person involved in rehabilitation (this was usually a biokineticist or a coach). Players indicated whether they received any treatment as well as the frequency of treatments obtained. For the purpose of this study, however, the distinction was only made between treated and not treated by the different professionals as the frequency of treatment depends on the severity and type of injury.

Statistical analysis

The statistical consultation services of the NWU assisted in the statistical analysis of the data. Descriptive statistics were used to determine the incidence and nature of the injuries sustained by the participants. Descriptive statistics were also used to calculate and describe the use of treatment obtained, as well as return to play criteria used following injury.[23] The effect of treatment of different rehabilitation professionals on the re-injury rates was calculated, with the statistical significance given by Pearson's Chi-square. Statistical significance was accepted when $p \leq 0.05$.

Practical significance was described by Phi-coefficient. The practical significance indicated by phi, is more relevant in this study as the sample group were not randomly selected, but rather all volunteers of the 10 schools were used. Phi-values are categorized as 0.1 indicating a small significance and 0.3 and 0.5 referring to a medium and large practical significance, respectively.

Results

A total of 78.51 injuries per 1000 playing hours (N=118) were reported by the 10 participating schools. New injuries accounted for 68.64% (n=81) while recurrent injuries represented 31.36% (n=37). The most frequent site of injury was the knee (n=26), followed by the shoulder (n=21). The ankle and low back injuries both had a prevalence of 11 injuries. The event leading to injury that was most frequently reported, was the tackle (including making the tackle and being tackled) (n=49). Running related injuries accounted for 34 injuries, while ruck and maul injuries added up to 13 injuries.

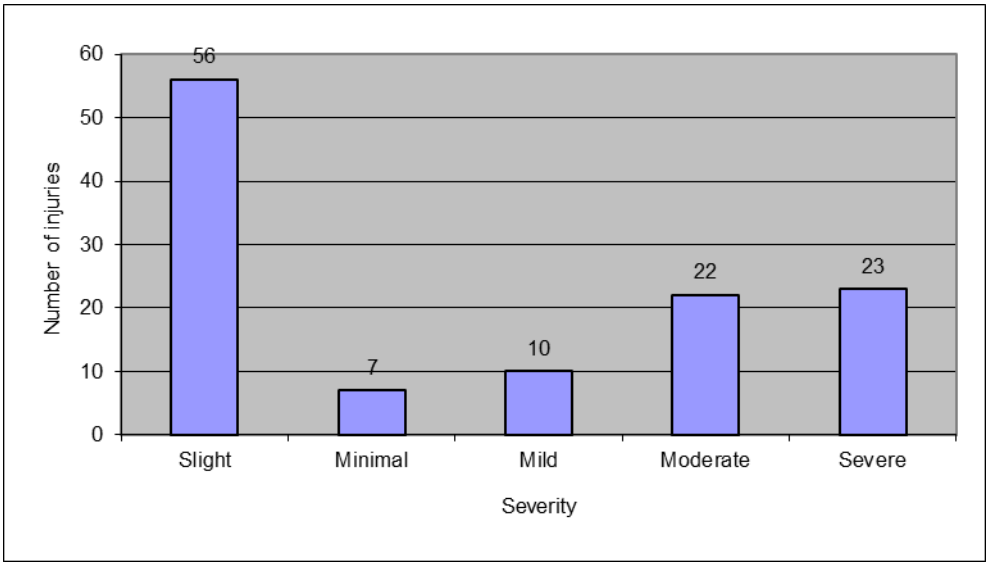

Figure 1: Distribution of the severity of injuries sustained. (Slight: 0-1 day missed; minimal: 2- 3 days; mild: 4 – 7 days; moderate: 8 – 28 days or severe: >28 days missed)

The severity of injuries attained is given in Figure 1. Most injuries were slight (48%) but the moderate and severe injuries added up to 39% of the total number of injuries

reported. These moderate to severe injuries resulted in a minimum total of 360 days missed.

Table 1 indicates the severity of injuries as well as the number of treatments by a doctor, a physiotherapist or other person responsible for rehabilitation, such as a biokineticist, or coach.

Table 1: Severity and treatment of sustained injuries

Severity of injuries	Doctor		Physiotherapist		Other (Coach or Biokineticist)	
	% Not Treated (n)	Treated % (n)	% Not Treated (n)	Treated % (n)	% Not Treated (n)	Treated % (n)
Slight	80% (45)	20% (11)	61% (34)	29% (22)	96% (54)	4% (2)
Minimal	86% (6)	14% (1)	29% (2)	71% (5)	100% (7)	0% (0)
Mild	60% (6)	40% (4)	60% (6)	40% (4)	80% (8)	20% (2)
Moderate	18% (4)	82% (18)	50% (11)	50% (11)	86% (19)	14% (3)
Severe	13% (3)	87% (20)	22% (5)	78% (18)	52% (12)	48% (11)
Total	54% (64)	46% (54)	49% (58)	51% (60)	85% (100)	15% (18)

Note that a severe injury for example could have been treated by a doctor, physiotherapist, as well as biokineticist or coach. The severity of an injury had an influence on whether treatment was acquired, as well as the kind of treatment acquired. A large practical significant association (phi = 0.7) was found between treatment by a doctor and severity of the injury. This indicates that the more severe the injury, the more likely to be treated by a doctor.

Table 2 indicates the relationship between the treatment of injuries and the prevalence of re-injuries obtained.

Table 2: Re-injury occurrence following treatment in South-African schoolboy rugby union

	Not re-injured % (n)	Re-injured % (n)	Statistical significance P	Practical significance phi
Doctor	**59% (32)**	**41% (22)**	**0.03**	**0.3**
Physiotherapist	**63% (38)**	**37% (22)**	**0.08**	**0.4**
Other (Biokineticist or Coach)	**56% (10)**	**44% (8)**	**0.16**	**0.1**

Amongst the injuries treated by a doctor (n=54) there was a 41% re-injury occurrence while injuries treated by physiotherapists (n=60) showed a re-injury rate of 37%. Re-

injury after treatment by both professions indicating a medium practical significance (phi = 0.3 and phi = 0.4 respectively) indicating that treatment by a doctor and physiotherapist alone is possibly not sufficient in preventing re-injuries.

Table 3: Criteria for return and re-injury prevalence

Criteria for return	Not re-injured (%)	Re-injured (%)	n
1. No criteria used	68.57	31.43	105
2. On-field testing	80.00	20.00	10
3. Isokinetic testing	66.67	33.33	3

Table 3 indicates the return to play criteria and the resultant re-injuries. Of the 118 injuries reported, 105 of the injuries returned to the rugby field without undergoing any kind of return to play tests to determine readiness. Only 3 injuries underwent objective isokinetic testing to determine readiness. Although it is probably not necessary for slight, minimal and even mild injuries to undergo specialized, scientific testing before returning to play, it should be noted that there is an alarming high rate of moderate and severe injuries (n=45), which should be subjected to testing due to the magnitude of the injuries. In the current study, no distinction was made in this regard, due to the small sample group used. Because of the very small size of the sample group, a very small practical significance was calculated (phi = 0.07).

Discussion

Injury prevalence

Studies on schoolboy rugby union injury rates, reports the prevalence or incidence of injuries in terms of injuries per 1000 player hours or 1000 playing hours, making comparisons difficult.[22] The injury prevalence amongst the 10 participating schools was 78.51 injuries per 1000 playing hours, this included training and game hours for the 2008 as well as the first 3 months of the 2009 season. Although the current study included the 2008 and start of 2009 seasons, the prevalence are more in line with professional rugby union and somewhat higher than previous literature on schoolboy rugby union[3,4,6,7]. A study done on New Zealand schoolboy rugby union found 65.8 injuries per 1000 playing hours,[6] which is considered as a high injury rate. Higher injury rates were reported amongst professional rugby union,[3,4,7] such as the 2007 Rugby World Cup in France where an injury incidence of 83.9 injuries per 1000 playing-hours was reported.[25] Recurrent injuries in the current study were found to

be accountable for 31.36% of reported injuries which is a substantial amount as recurrent injuries are frequently under-reported.[4] The re-injury prevalence is much higher than the 13% reported by three professional Super 12 rugby union squads during the 1999 Super 12 competition.[3] A higher prevalence of new injuries is reported in professional rugby union, but the prevalence of re-injuries is lower. This is probably due to the availability of multi-disciplinary medical teams responsible for the rehabilitation of professional rugby squads, which are not normally available for schoolboy rugby union. The financial implications associated with such multi-disciplinary rehabilitation are extremely costly. Rugby union related claims made to the Accident Compensation Corporation during the 2005/2006 financial year (July-June) in New Zealand had an accumulating cost of NZD 40,385,034.[7]

The phase mostly contributing to injury in this study was found to be the tackle. In both schoolboy and professional rugby union, the tackle remains one of the most frequent mechanisms associated with injury due to, amongst other things, the high speed and physical impact of tackling.[3,7,11,24] This is concerning, as the tackle represents an inherent part of the nature of the game of rugby union.[3] Attention regarding safe tackling techniques is included in programs such as *Boksmart* and *Rugbysmart* (Posthumus & Gianotti). The knee and shoulder was found to be the site mostly injured. This is consistent with the high prevalence of knee (25%) and shoulder (19%) injuries reported by Gianotti.[7] Head and face injuries were reported to have the highest prevalence amongst Scottish schoolboys, although 60% of these injuries were concussions.[24] Because only musculoskeletal injuries were considered in the current study the findings are still in correlation with literature as the shoulder, knee and wrist or hand are also reported as having the highest prevalence following head and face injuries.[24]

Severity of injuries varies widely. The high prevalence of moderate to severe musculoskeletal injuries in this study, is however alarming. The injuries accumulated to a minimum of 360 training and game days missed for the entire group, which highlights the need for injury prevention amongst schoolboy, as well as professional rugby union. English professional rugby union clubs reported to have 18% of players unavailable for selection due to injury.[4] More recently, 13 Springbok players were unavailable for selection before the 2010 South African Outgoing tour to the United Kingdom due to injuries.[26] When taking into account that 31.36% of all reported injuries during this study were re-injuries, the need for effective rehabilitation as well as standardized return to play criteria for musculoskeletal injuries also arise.

Rehabilitation

Injuries should be rehabilitated according to the SAID-principle and should include a final, sports-specific phase.[10,14] The severe injuries were more likely to be treated by a doctor, indicating the only practical significance ($p = 0.7$) observed in the study which could be due to the large sample group in this category. Only a few of these injuries however adhered to a multi-disciplinary approach to rehabilitation. Only ten of the 118 injuries underwent treatment until final phase rehabilitation. Also, professional personnel (such as biokineticists or physiotherapists) did not necessarily conduct this final phase of rehabilitation. The lack of effective rehabilitation could probably contribute towards the high number of reported re-injuries (n=37). The reason for terminating rehabilitation prematurely could be ascribed to the exhaustion of medical-aids or the pressure on U/18 boys to secure bursaries from tertiary institutions or contracts from clubs for the following year. As no previous literature could be found by the author on the management of injuries in rugby union, no comparison could be made. Further studies should focus on the effect of multi-disciplinary rehabilitation on injury re-occurrence.

Due to limited access or the high cost of sports-related medical support, players tend to self-diagnose which leads players and coaches alike, to downplay the symptoms which involve potentially serious health risks.[21] Although it was not indicated in the questionnaires, the researcher noted that many coaches claimed that their players were not injured. However, when conducting the questionnaires the players did admit to certain injuries. It could also be that the coaches were unaware of the underlying injuries in their teams, as their main focus was on performance.

Return to play

No statistical or practical significant relationship was found between criteria used for return to play and the occurrence of re-injuries. The lack of significance could be ascribed to the small amount of participants undergoing objective testing, like isokinetic testing (n=3) to evaluate readiness for return to play. Additionally, only 10 injuries underwent a form of assessment, either by a biokineticist, physiotherapist or coach, to determine readiness for return. However, no standardized clearance protocols were used amongst the 10 schools. Only one study evaluating return to play practices could be found.[9] This study, conducted amongst club and 1st division teams in New Zealand, found that no fixed procedures were followed to return a player to the field after injury. In the event that some form of return to play criteria is

used, it is not transparent or quantifiable.[9,16] The lack of standardized return to play protocols may subjects injured players to the risk of not completing effective rehabilitation, resulted in higher re-injury rates.[9] The lack of standardized protocols could also cause coaches, administrators and medical personnel to compromising in their decision to return[8] a player to the rugby field, leading to premature return and ultimately a higher risk of re-injury.

Conclusion

The study showed a high prevalence of injuries (78.51 injuries per 1000 playing hours) in U/18 South African schoolboy rugby union. This is in line with what is expected in professional rugby union, but higher than available data on schoolboy rugby union. A large number of moderate and severe injuries were reported with the most injuries being to the knee and shoulder. No definite rehabilitation structures was in place after injuries has occurred in schoolboy rugby union. Subsequent return to play criteria was also not in place. Re-injury occurrence in this study was high (31%), probably due to the lack of structured rehabilitation and return to play criteria. There was however little or no significant correlation because of the small number of injuries that underwent return to play testing. The only significance found in this study was between treatment by a doctor and the severity of the injury because of the large sample group in this category.

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Chapter 4

Summary, Conclusions and Recommendations

Summary

A high risk for injury is commonly associated with rugby union. The extent of these injuries, including mechanisms, site and type of injuries is well documented. The management and rehabilitation of rugby union injuries is however not as well documented. This leaves a gap within literature which ranges from the prevention, the rehabilitation to return to play criteria. As rugby is now not only a sport, but also a career opportunity, the management of injuries has become crucially important, even on schoolboy level.

The objective of this study was to investigate the prevalence and management of injuries in rugby union, and more specifically amongst schoolboy rugby union players. Furthermore, the study aimed to establish whether any definite structures were in place to facilitate a player with recovery or rehabilitation after injury and whether the injury was objectively evaluated before return to the sport was made. The question also arises whether an association exists between the severity of an injury and the subsequent treatment of the injury. Investigation into the re-injury occurrence and return to play criteria was also made.

The majority of rugby union injuries on all levels of play, is directly associated with the tackle. In most phases of the game, the knee and shoulder is vulnerable and accordingly has the highest prevalence of all musculoskeletal injury. Professionalism, intensified training demands, previous injuries and premature return to play after an injury, are all contributing factors to the high injury prevalence in the

sport. Injury prevention programs such as *RugbySmart* and *BokSmart* has been introduced through an educational basis in rugby union playing countries, but the efficacy has not fully been evaluated. Nonetheless, injuries in rugby union are inevitable. Rehabilitation should therefore be structured and complete. Final, sport specific phases of rehabilitation should be followed by consistent, quantifiable and transparent return to play criteria to ensure safety of returning to play.

The current study conducted amongst South African schoolboy rugby union players, displayed a high prevalence of 78.51 injuries per 1000 playing hours. A large number of moderate (n=22) and severe (n=23) injuries were reported with the most injuries being to the knee (n=26) and shoulder (n=21). After injury, no structured rehabilitation procedures were indicated. Subsequent return to play criteria was also not in place. A re-injury prevalence of 31% was observed. The significance between return to play testing and re-injuries, displayed a small correlation. The only significant correlation found in this study indicated that the more severe an injury was, the more likely the player was to be treated by a doctor.

Conclusions

The conclusions drawn from this study are presented in accordance with the hypotheses set in Chapter 1.

Hypothesis 1: The prevalence of injuries amongst South African schoolboy rugby union players are high and the nature of these injuries varies greatly.

The first hypothesis is accepted as injury prevalence amongst South African schoolboy rugby union players is high. It is however found not to be as high as injuries amongst professional rugby union players. An overall injury prevalence of 78.51 injuries per 1000 playing hours was reported for the 10 schools. The majority (48%) of injuries were reported to be slight (0-1 day missed), while 20% of the injuries was severe (>28 days missed). The nature of injuries showed similarities between schoolboy and professional rugby union. Knee and shoulder injuries were identified as most prevalent in this study, as in correlation with other studies.

Hypothesis 2: Treatment following injury is incomprehensive and no definite criteria for return to play exist in South African schoolboy rugby union.

Hypothesis 2 is accepted, as injuries were not typically followed by rehabilitation of any kind. Of the 118 reported injuries, 100 injuries (85%) did not undergo any final phase rehabilitation supervised by a biokineticist or other rehabilitation specialist. Sixty injuries (51%) was treated by a physiotherapist and only 54 (46%) was treated by a doctor. No previous studies that focused on the regularity of rehabilitation after injury in rugby union could be found. Objective, repeatable and quantifiable return to play decision making was done on only three injured players. This was done by isokinetic testing. There were also 10 players who indicated that some kind of on-field test was done with them to decide whether return would be safe. No definite structured test was indicated for this.

Hypothesis 3: South African schoolboy rugby union players who sustained severe injuries were more likely to seek treatment from different disciplines within the multi-disciplinary rehabilitation team.

Players with severe injuries were more likely to seek treatment from a doctor and then from other professionals within the multi-disciplinary rehabilitation team, confirming the acceptability of hypothesis 3. A practical significance of 0.7 was found between the severity of injuries and treatment by a doctor.

Hypothesis 4: South African schoolboy rugby union players who did not follow comprehensive rehabilitation and was not subjected to transparent return to play criteria have a higher occurrence of re-injuries.

Hypothesis 4 is accepted. A re-injury prevalence of 31.36% was reported. Only 13 injured players partook in any kind of return to play testing with three of these players being re-injured. Players who did not partake in any return to play testing had a re-injury rate of 31.43%, indicating that players, who were not subjected to return to play criteria, had a higher occurrence of re-injuries. The sample group was however very small and no significance could be indicated for this correlation.

Study Limitations

The sample size of 10 schools and 194 players is not representative of South African schoolboy rugby union. The sample group was further narrowed by the injuries sustained and then again for the type of return to play criteria used, resulting in a loss of statistical power. The method of injury reporting in rugby union is still not standardized throughout literature, making comparisons difficult.

Recommendations

The information gathered from this study should be seen as a platform for further research.

Research should not only focus on rugby union injuries, but also on strategies to prevent these injuries and maybe even more importantly to reduce the risk of re-injuries. These strategies should be implemented and evaluated on both schoolboy rugby union level and professional level. A very important aspect to remember with these programs is that it should be easily adapted for teams without the assistance of fulltime medical personnel. This means that exercises, exercise techniques and playing techniques should form an integral part of education based preventative programs for coaches.

The focus of most rugby union preventative programs is on the neck and spine injuries. Additions to preventative programs should be made in the form of knee and shoulder injury prevention, for example, as they are most frequently injured in rugby union. This could also have positive effects on the prevention of neck and spine injuries, as the body should be seen as a whole and not as a specific joint

Existing prevention programs should also be evaluated by rugby union players. This will give valuable feedback into the impact of coaching and refereeing before and after such program has been implemented.

This study has also indicated the massive lack of return to play protocols and should encourage research in this area. Return to play criteria should be set up in broad for the most frequent rugby union injuries and should be implemented in several schools in different provinces to evaluate the effectiveness of such protocols. These protocols should be developed by specialists in the field of rugby union rehabilitation,

but it should be kept in mind that it would not necessarily be implemented in schools etc. by specialists. In other words, people with no background of anatomy or rehabilitation should be able to successfully incorporate these programs in their teams' preparation.

Consequently, the need arise for more clinical trials on rugby union to establish the best possible rehabilitation procedures for common injuries. Subsequently, the development of return to play criteria should also be subjected to clinical trials.

Appendix A

Guidelines for authors

SOUTH AFRICAN MEDICAL JOURNAL
AUTHOR INSTRUCTIONS

All manuscripts and correspondence to:
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All named authors must give consent to publication. Authorship should be based only on substantial contribution to: (i) conception, design, analysis and interpretation of data; (ii) drafting the article or revising it critically for important intellectual content; (iii) final approval of the version to be published. All three of these conditions must be met (Uniform requirements for manuscripts submitted to biomedical journals; www.icmje.org/index.html).

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Authors must declare all sources of support for the research and any association with the product or subject that may constitute conflict of interest.

PROTECTION OF PATIENT'S RIGHTS TO PRIVACY

Identifying information should not be published in written descriptions, photographs, and pedigrees unless the information is essential for scientific purposes and the patient (or parent or guardian) gives informed written consent for publication. Informed consent for this purpose requires that the patient be shown the manuscript to be published. (www.icmje.org)

ETHNIC CLASSIFICATION

Work that is based on or contains reference to ethnic classification must indicate the rationale for this.

MANUSCRIPTS

Short items are more likely to appeal to our readers and therefore to be accepted for publication. *Please provide a word count for all submissions.*

Original articles of 3 000 words or less, with up to 6 tables or illustrations, should normally report observations or research of relevance to clinical medicine. References should preferably be limited to no more than 15.

Short reports or scientific letters, which include case reports, side effects of drugs and brief or negative research findings should be 1000 words or less, with 1 table or illustration and no more than 6 references.

Editorials, Opinions, Issues in Medicine, etc. should be about 800 words and are welcome, but unless invited, will be subjected to the SAMJ peer review process.

Review articles are rarely accepted unless invited.

Letters to the editor, if intended for the correspondence column, should be marked 'for publication', signed by all authors and presented in triple spacing. Letters should be no longer than 400 words with only one illustration or table.

Obituaries should not exceed 400 words and may be accompanied by a photograph.

MANUSCRIPT PREPARATION

1. Please send your manuscript on disc accompanied by three printouts, in triple spacing, with wide margins and paginated.
2. Research articles should have a structured abstract not exceeding 250 words (50 for short reports) comprising: Objectives, Design, Setting, Subjects, Outcome measures, Results and Conclusions.
3. Refer to articles in recent issues for guidance on the presentation of headings and subheadings.
4. Abbreviations should be spelt out when first used in the text and thereafter used consistently.
5. Scientific measurements should be expressed in SI units except: blood pressure should be given in mmHg and haemoglobin values in g/dl.
6. If in doubt, refer to 'uniform requirements' above.

ILLUSTRATIONS

1. Figures consist of all material that cannot be set in type, such as photographs and line drawings.
2. Tables and legends for illustrations should appear on separate sheets and should be clearly identified.
3. Line drawings should be arranged to conserve vertical space. Note that reduction to 80 mm for a single column or 170 mm for double columns should not render lettering illegible. Explanations should be included in the legend and not on the figure itself.
4. Figure numbers should be clearly marked on the back of prints and the top of illustrations should be indicated.
5. If any tables or illustrations submitted have been published elsewhere, written consent to republication should be obtained by the author from the copyright holder and the author(s).
6. A limited number of illustrations are free at the discretion of the editor. Colour illustrations are encouraged but are charged to the author. A quote will be provided on request. Consider sponsorship.

REFERENCES

References should be inserted in the text as superior numbers and should be listed at the end of the article in numerical and not in alphabetical order.
Authors are responsible for verification of references from the original sources.
References should be set out in the Vancouver style and approved abbreviations of journal titles used; consult the List of Journals in Index Medicus for these details.
Names and initials of all authors should be given unless there are more than six, in which case the first three names should be given followed by *et al*. First and last page numbers should be given.
Journal references should appear thus:

1. Price NC. Importance of asking about glaucoma. *BMJ* 1983; **286:** 349-350.

Book references should be set out as follows:

1. Jeffcoate N. *Principles of Gynaecology.* 4th ed. London: Butterworth, 1975: 96-101.
2. Weinstein L, Swartz MN. Pathogenic properties of invading microorganisms. In: Sodeman WA jun, Sodeman WA, eds. *Pathologic Physiology: Mechanisms of Disease.* Philadelphia: WB Saunders, 1974: 457-472.

Manuscripts accepted but not yet published can be included as references followed by (in press).

Unpublished observations and personal communications may be cited in the text, but not in the reference list

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Galley proofs will be forwarded to the author before publication and if not returned within 2 weeks will be regarded as approved. Pleas note that alterations to typeset articles are costly and will be charged to the authors.

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Sept 2003

Appendix B

Questionnaire

Injury Prevalence Report:
South African Schoolboy Rugby Union

_____

Study ID:_____

_____

Name: _____ School:_____

Position:_____ Date:_____

Race: _____ DOB: _____

_____

1. Date of injury_____

2. Date of return to full participation_____

3. Playing position at time of injury_____

4. Injured body part

Head/face	☐	Hand	☐
Neck	☐	Hip/groin	☐
Ribs/upper back	☐	Anterior thigh	☐
Lower back	☐	Posterior thigh	☐
Shoulder	☐	Knee	☐
Upper arm	☐	Lower leg	☐
Elbow	☐	Ankle	☐
Wrist	☐	Foot	☐

5. Side of body injured Left ☐ Right ☐ Not applicalbe ☐

6. Type of injury

Concussion	☐	Tendon injury/rupture	☐
Fracture	☐	Haematoma/contusion	☐
Other bone injury	☐	Abrasion	☐
Dislocation/subluxation	☐	Laceration	☐
Sprain/ligament injury	☐	Nerve injury	☐
Meniscus, cartilage or disc	☐	Visceral injury	☐
Muscle rupture, tear or cramps	☐		

7. Diagnosis made by Doctor ☐ Physio ☐ Other ☐

8. Is it a re-injury yes ☐ no ☐

9. Date of return to play after previous injury _____

10. Mechanism of injury

Tackle (making tackle or being tackled)	☐		
Kick	☐	Overuse	☐
Ruck	☐	Scrum	☐
Fall	☐	Maul	☐
Run	☐	Clean	☐
Collision	☐	Line-out	☐

11. Severity of the injury

Slight (0-1 day missed)	☐
Minimal (2-3 days missed)	☐
Mild (4-7 days missed)	☐
Moderate (8-28 days missed)	☐
Severe (>28 days missed)	☐

12.Injury occurred during game ☐ training ☐

13.Was the incident inside the law yes ☐ no ☐

14.What criteria was used to determine readiness to return to play_____

_____

_____

15.Treatment (indicate frequency of treatment):

Doctor _____

Physiotherapist _____

Other _____

_____ (specify)

16.Other notes:_____

_____

_____

(adopted from Fuller *et al*.,2007:331)

Appendix C

Informed consent

CONFIDENTIAL

INFORMED CONSENT

General information regarding the project:

- The project takes place within the School for Biokinetics, Recreation and Sport Science of the Faculty of Health Sciences.

- **The title**: the incidence of injuries and the rehabilitation procedures for high school rugby union players.

- **Aims of the project:**

  To determine the prevalence of injuries in schoolboy rugby union

  To define the rehabilitation procedures after injury

  To identify shortcomings in rehabilitation procedures at school level

  To determine if return to play criteria is in place following an injury

- **Procedures:** - Demographic information:
  All participating subjects' demographic information will be gathered through a demographic information questionnaire and will contain the following aspects: Date of birth, race, playing position and school.

  - Injury surveillance:

  The validated rugby report questionnaire of Fuller *et al* (2007:328 – 331) will be used to collect data. The data collection will take place before the schoolboy rugby union season starts, at the end of the PUK Prestige and inter-provincial leagues and once more after the completion of the schoolboy rugby union season. Self-reporting of injuries will take place as well as additional reporting done by the coach or coordinators of each school.

- **Benefits of this study:** The study hopes to create awareness of the importance of rehabilitation amongst schoolboy rugby league players, coaches and parents. The results will also determine if final phase

rehabilitation of rugby injury is needed or used by schoolboy rugby union players

To the subject signing the consent:

Participation in the project described above, is not compulsory. If you choose to participate, the following general principles must be kept in mind:

- Participation in voluntary
- You are free to withdraw from the project at any stage without giving a reason for the withdrawal. We would, however, request that you consider your decision thoroughly before withdrawing as it may have an effect on the project's results.
- Feel free to ask questions at any stage regarding the project or the procedures
- We require that you indemnify the University from any liability due to detrimental effects of treatment by University staff or students or other subjects to yourself or anybody else. We also require indemnity from liability of the University regarding any treatment to yourself or another person due to participation in this project, as explained above. Lastly it is required to abandon any claim against the University regarding treatment of yourself or another person due to participation in this project.

Consent:

Title of the project: Injury incidence and rehabilitation procedures in schoolboy rugby players.

I, the undersigned .....(full names) read all the information on the project and I declare that I understand the information. I had the opportunity to discuss aspects of the project with the leader and I declare that I participate in the project as a volunteer. I hereby give my consent to be a subject in this project.

I indemnify the university, also any employee or student of the university, of any liability against myself, which may arise during the course of the project.

I will not submit any claims against the University regarding personal detrimental effects due to the project, due to negligence by the University, its employees or students, or any other subjects.

..... (Signature or subject)

Signed at..... on .....

..... (Signature of guardian)

Signed at ..... on .....

Witnesses: 1. .....

2. .....

Signed at ..... on .....