FACTORS ASSOCIATED WITH INJURIES SUSTAINED BY PLAYERS DURING A CURRIE CUP RUGBY COMPETITION

by

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In fulfillment of the requirements for the degree

MAGISTER ARTIUM

in the

FACULTY OF SOCIAL STUDIES

for the

DEPARTMENT HUMAN MOVEMENT SCIENCE

at the

UNIVERSITY OF THE FREE STATE

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Bloemfontein
October 2004

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DECLARATION

I, Douglas Leonard le Roux, hereby declare that the work on which this dissertation is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work or any part of it has been, is being, or has to be submitted for another degree in this or any other university.

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(Signature)

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(Date)

ACKNOWLEDGEMENTS

I wish to thank the following persons for their help and support in undertaking this study:

- My wife, Petrolene, for her love, encouragement and support, and for being a mother and father to our two sons, Divan and Sean.
- My mother, Susie Putter, for always being there for me, believing in me, and most of all praying for me.
- Dr Louis Holtzhausen, for guidance, valuable assistance and for being my study leader during this project, also for the provision of valuable data that was used in this study.
- Dr Derik Coetzee, for valuable input, and for being my co-study leader.
- Dr Gerhard Jansen for valuable data that was used in this study.
- Dr Bertus Pretorius for analysis of the data for the study.
- Me Annemarie Ludick for the collection of questionnaires and reports.

This study would not have been possible without the strength of God, ***who is able to do exceedingly, abundantly, above all we ask or think****, according to the power that is at work within us.*

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CHAPTER 1

INTRODUCTION AND SCOPE OF THE THESIS

1.1 INTRODUCTION

The reasons for participation in sport are many and they vary, but there are two relatively common ones, namely health or fitness, and pleasure or relaxation (Manders & Kropman, 1979). It became increasingly apparent that as well as having a health-giving aspect; sport presented a danger to health in the form of accidents and injuries. Rugby union is an international sport ranking second in participation only to soccer as a football code (Bathgate et al., 2002), and when compared to other sports, is a collision sport with a high injury rate (Jakoet & Noakes, 1998; Bird et al., 1998). It is possible to prevent sports injuries (Parkkari et al., 2001), and to improve the sport participation record by reducing the burden of sport related injuries is a challenge for sports scientists, physicians and coaches. It includes the development and application of injury prevention models into a sport specific context and putting injury risk management strategies into place. Various models are developed and tested in this regard. Many of the models used for injury prevention have been taken from the public health sector (Goulet, 2003). Regardless of the model chosen, the systematic planning and application of preventive measures should include the following steps: 1 - assessment of the severity of the problem; 2 – identification of the risk factors; 3 – identification of behavioral determinants of injury; 4 – identification of preventive measures available to address targeted determinants; 5 – selection of preventive measures to put forward; 6 – implementation of the selected measures; 7 – assessment of their effectiveness (Kok & Bouter, 1990;

Van Meschelen et al., 1992). Therefore it is imperative that epidemiology and aetiology of injury in a given activity be determined, in this case provincial rugby.

1.2 PROBLEM

No study has been done on injury rate and frequency in the Currie Cup competition. Being the cornerstone of providing players for competitions like the Super 12 and Tri-nations, it is certainly appropriate to record the incidence and nature of injuries in the Currie Cup competition. This study will attempt to identify factors associated with injury, to direct further analytical research and suggest measures to reduce injury rate. It will also draw a comparison between results obtained through this study, and results obtained by other relevant studies in other competitions.

1.3 AIM

The aim of this study is to review the available literature on the epidemiology of injuries in professional rugby, and then to collect data on previous injuries and the influence of external factors on rugby injuries. Secondly, the incidence, nature and circumstances surrounding injuries in a cohort of professional South African provincial rugby players were documented. The data collected was compared with available data in order to determine trends of

injuries that, if taken into consideration, could possibly lead to the prevention of injuries to future rugby players.

1.4 METHOD OF INVESTIGATION

The method of investigation used in this study is primarily a literature study, where primary, relevant sources such as scientific articles, magazines, journals and theses were used. The epidemiological data used in this study were collected from two professional rugby teams that competed in the 2002 Currie Cup Rugby Competition. This competition is held annually in South Africa and includes provincial teams from 14 regions in South Africa. During the 2002 competition, the 14 teams were divided into two groups of seven, which within each group played against each other in a round robin tournament. The top 4 teams from each group then played against each other in a knockout quarterfinal, semi-final and final match. An almost equal number of “home” and “away” games were played.

Approval of the research protocol was obtained from the Ethics and Research Committee of the University of the Free State before commencement of the study. Statistical analysis was done by the University of the Free State, using the T- test and F-test.

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CHAPTER 2

RUGBY INJURIES AND EXTERNAL FACTORS THAT HAVE AN INFLUENCE ON IT

2.1 INTRODUCTION

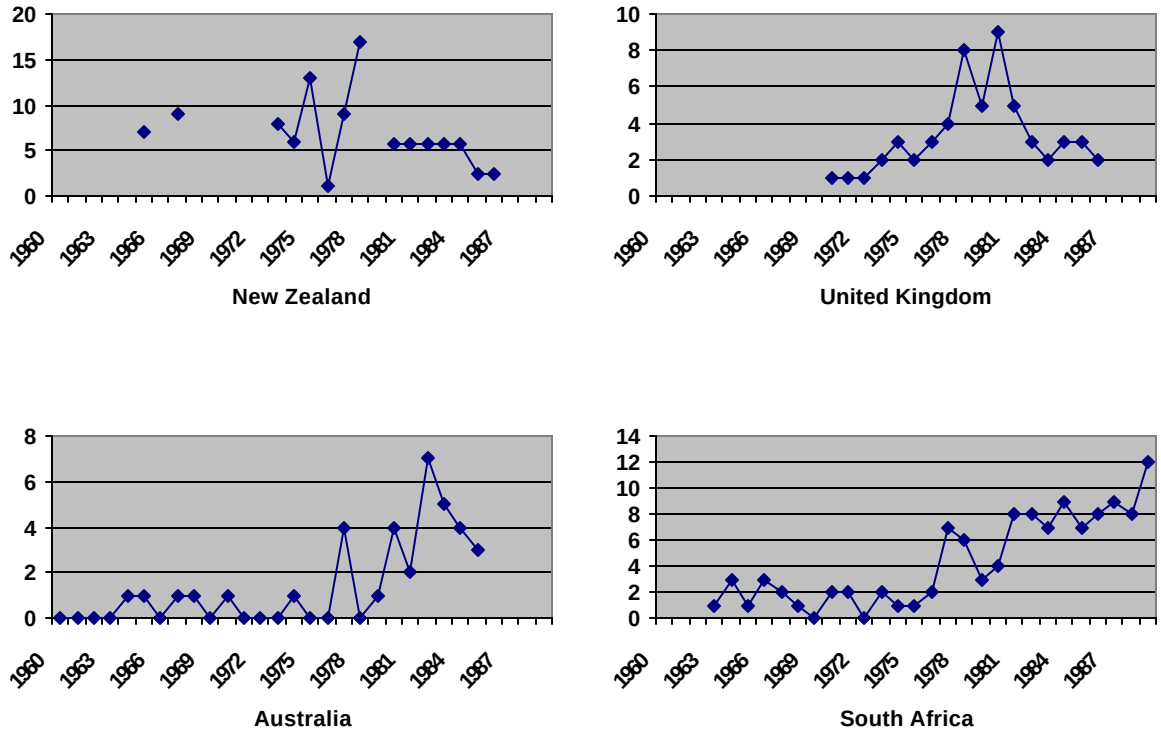
Numerous clinical and epidemiological studies on injuries have been undertaken with the underlying aim to make rugby a safer sport. These studies have been conducted using various ways of documentation such as team doctors completing injury reports (Holtzhausen, 2001; Targett, 1998; Bathgate, 2002), match doctors on duty at matches completing injury reports (Jakoet & Noakes, 1998), Linkmen using standard closed questionnaires (Garraway & McLeod, 1995), research nurses and physiotherapists completing questionnaires (Lee & Garraway, 2000), and recently , referees using referee replacement reports to document injuries (Sharp et al., 2001). Risk factors can be divided into two main categories (Miles, 1977). The first category comprises of the internal personal factors, the second the external environmental factors. Discussed below are a number of the external factors believed to have the greatest influence on injury rates in rugby union.

2.2 CHANGES OF THE LAWS

Injuries to the cervical spine are among the most serious injuries occurring as a result of participation in rugby. Outcomes from such injuries range from complete recovery to death, depending on the degree of spinal cord damage sustained (Quarrie et al., 2002). Figure 1 illustrates the number of rugby union players

admitted to spinal cord units in four of the world's largest rugby playing countries; New Zealand, the United Kingdom, Australia and South Africa. These figures do not represent all the spinal cord injuries sustained by rugby union players in these countries, but only players admitted to certain spinal units within the country (Burry & Gowland, 1981; Burry & Calcinai, 1988; Silver, 1984, 1988; Taylor & Coolican, 1987; Kew et al., 1991).

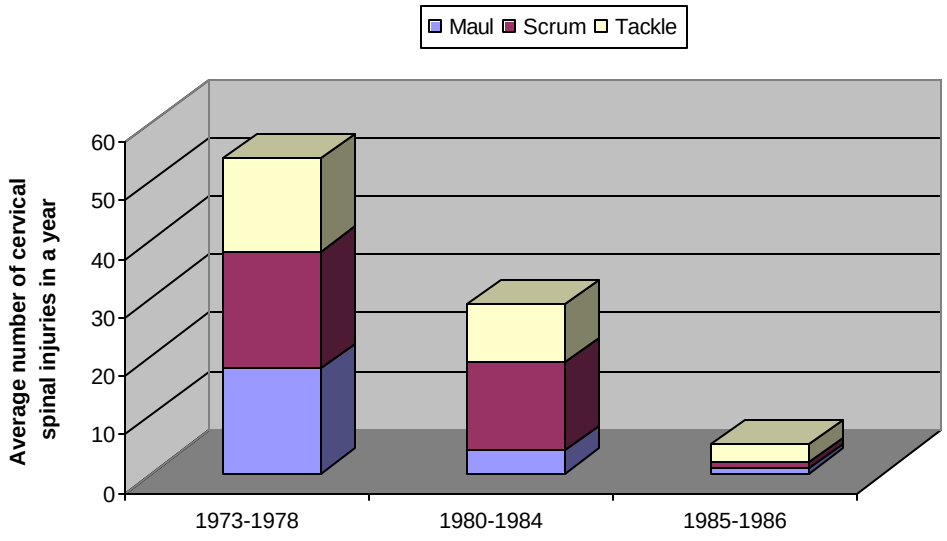
FIGURE 1: NUMBER OF RUGBY UNION PLAYERS ADMITTED TO SPINAL CORD UNITS IN NEW ZEALAND, THE UNITED KINGDOM, AUSTRALIA AND SOUTH AFRICA



Cervical spinal cord damage is a known hazard of rugby, and changes in the rules of the game have been accompanied by a dramatic fall in the number of such injuries in New Zealand. The risk is now estimated to be less than one in a million appearances in New Zealand (Burry & Calcinai, 1988).

Most cervical spinal cord injuries occur in scrums, mauls, or tackles (Burry & Gowland, 1981: Williams & McKibbin, 1987: Silver, 1984), and young players appear to be particularly vulnerable in scrums (Burry & Gowland, 1981). The unexpected finding that mauls after tackles were particularly hazardous caused a revision of the laws in 1980. In the late 70s, the maul was deemed to be particularly dangerous, and subsequently, local rule changes were introduced to control play after a player was tackled with the ball. As a result, the average annual number of cervical spinal injuries was reduced from an average of three per annum between 1973 and 1984, to one per annum in New Zealand rugby between 1980 and 1986 (Burry & Calcinai, 1988). The reduction in the number of spinal cord injuries after the law changes is shown in Figure 2.

FIGURE 2: AVERAGE ANNUAL NUMBER OF CERVICAL SPINAL INJURIES IN NEW ZEALAND BETWEEN 1973 AND 1986.



The next challenge was to reduce the risk of scrum collapsing. This was achieved by altering the players' binding method, in particular by preventing

crotch binding, by minimizing the duration of the scrum, by preventing the scrum from moving more than 1.5m or wheeling more than 90°, and by reducing the forces on the scrum engagement by controlling the speed of engagement (Burry & Calcinai, 1988).

Almost similar to New Zealand, in the United Kingdom, at the end of the 1970's, the Medical Officers of the Schools Association expressed their concern about an apparently rising incidence of rugby injuries in schoolboys. Subsequently they produced a memorandum containing a number of proposals (Medical Officers of the Schools Association, 1979), and mainly because of the opening statement, this document immediately became a source of controversy. It was feared that legal action could be taken should a schoolboy be injured subsequently to the start of the 1979-80 season in a school that had failed to take out adequate insurance against such an eventuality (Noakes & du Plessis, 1996).

In 1979 Hoskins reported five cases of cervical spinal cord injuries for the period between 1942 and 1968 (27 years). Of these two were fatal and three lead to permanent paralysis. However for the period 1973 to 1978 (5 years), 12 such injuries had occurred, two fatal and ten leading to permanent paralysis. Furthermore 16 injuries to the cervical spinal cord were reported from 1971 to 1978 (7 years), with no permanent neurological damage. This research showed that there had been a dramatic increase of cervical spinal cord injuries among English schoolboys in the 1970's, and as a result of these events, the Rugby

Football Union then issued ten recommendations in 1980 that suppressed the original document (Noakes & du Plessis, 1996). A strong reminder was also sent by the Rugby football association to all involved with the game stating that correct coaching of the tackle should be emphasized, no player should be allowed to play outside his age group or play out of position when not fit to do so, and that the correct spirit of the game should be stressed (Harrison et al., 1980).

As a result of schoolboy rugby injuries, especially at Rugby Schools, the committee concluded that the overall number of schoolboy rugby injuries had probably not increased during that time. However, the evidence suggested that the incidence of neck injuries had almost certainly increased during the same period. The committee then proposed that spinal cord injuries usually occurred when the head was flexed forward and locked on to the ground while undergoing a degree of rotation at the same time as pressure was being exerted from behind by other players falling on top of the downed player. They identified five major phases of play in which this dangerous situation could develop, and on the basis of these findings, the working committee recommended to the Schools Rugby Football Union that there should be a change in the interpretation of the laws to allow the following:

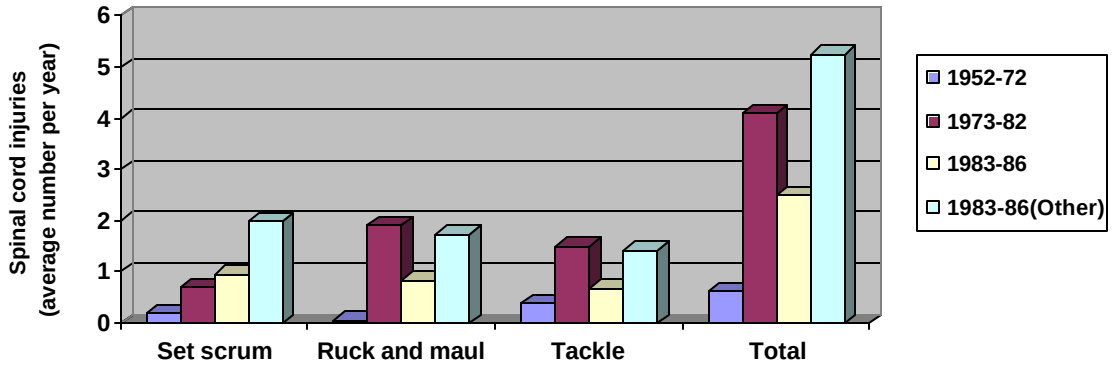
1. Any player in the scrum, ruck or maul should keep his shoulder joint above the level of his hip joint.
2. Players arriving at a breakdown and entering the ruck and maul should stay on their feet and not fall on to or over the ball.

3. Play should stop immediately if the scrum collapses.

The recommendations were subsequently accepted and the new law interpretations were enacted on 1 September 1983, while a further 10 guidelines to prevent injury were added in addition to those already described.

As a result of these rule changes, the incidence of spinal cord injuries in English rugby players admitted to Stoke Mandeville has shown a dramatic and sustained decrease since a peak incidence in 1980. The increase during that period was due to an increase in the number of spinal cord injuries in all phases of play, most especially those resulting during tackling (425% increase) and during the ruck and maul (4200% increase) as seen in Figure 3.

FIGURE 3: AVERAGE ANNUAL NUMBER OF SPINAL CORD INJURIES OCCURRING IN SCRUMS, RUCK AND MAUL, AND TACKLES IN RUGBY UNION PLAYERS ADMITTED TO THE NATIONAL SPINAL INJURIES CENTER IN STOKES MANDEVILLE (UK) BETWEEN 1951 AND 1987. ALSO INCLUDED ARE DATA FOR ADMISSION TO SEVEN OTHER SPINAL CORD INJURY UNITS IN THE UNITED KINGDOM BETWEEN 1983-1986.



While this reduction in the admissions to the Stoke Mandeville hospital has been interpreted to mean that the overall incidence of these injuries has decreased in the United Kingdom since 1980 (Silver, 1984; 1988), the data of Silver (1988) and Silver & Gill (1988) conflict with his conclusion. They show that whereas the number of admissions to the Stoke Mandeville has fallen substantially since 1980, there have been a large number of admissions to seven other spinal cord injury units in the United Kingdom. When these data are analyzed, the annual incidence of spinal cord injuries in British rugby players actually peaks after 1983. If these units have not been active prior to 1980, the reduction in the number of spinal cord injuries admitted to Stoke Mandeville could have resulted, not from any real reduction in the incidence of these injuries, but simply referral of injured players to other hospitals, perhaps situated close to their homes. If this is indeed the explanation, the possibility is raised that rule changes in the United Kingdom may have had a smaller effect on the incidence of these injuries than is currently believed (Noakes & du Plessis, 1996).

As a result of a negative public concern that was raised regarding the game, Dr Myles Coolican, a former provincial player and an active rugby union referee, was commissioned to establish the incidences and causes of spinal cord injuries in Australian football players in all codes.

By studying all injuries in football players admitted to the spinal cord injury units in the capital cities of all Australian states, Taylor and Coolican (1987) established that injuries occurred much more commonly in rugby union than in

the other codes, especially among schoolchildren. Furthermore all injuries to schoolboys playing rugby union had occurred since 1977. Not surprisingly 42% of injuries occurred at scrum engagement (Taylor & Coolican, 1987).

As a result from these findings, domestic rule changes were introduced into Australian schoolboy rugby for all ages up to under 19. These changes were called the Australian Rugby Football Union (ARFU) Under-19 law variations, and aimed at a number of safety features. In order to fulfill these aims, the laws were changed, and as a result of these changes the ARFU was able to announce in 1993 that, for the eight full rugby seasons (1985-1992) after their introduction there had not been one serious spinal cord injury in under-19 Australian schoolboy rugby played under these altered rules. This is clearly quite a remarkable record, which should be achievable by all countries if the same rule changes are adopted.

The ARFU also noticed that, besides improved safety, the other benefits were that the scrums had become generally safe and stable, with the ball emerging quickly and cleanly, and that coaches were encouraged to employ a positive attitude. The emphasis became one of winning the ball from the scrums rather than shoving, and on retaining continuity of possession from the rucks and mauls.

However certain negative consequences were also noticed. It was observed that coaches were teaching their players to “tie-up” the opponent’s ball, thereby

gaining the feed into the next scrum. This had led to “ball and all tackling” rather than low, round the legs defense.

In addition referees found difficulty moving between matches involving senior and under-19 laws. Players moving from under-19 to the senior laws also found difficulty in adapting to the need to drive into rucks and mauls.

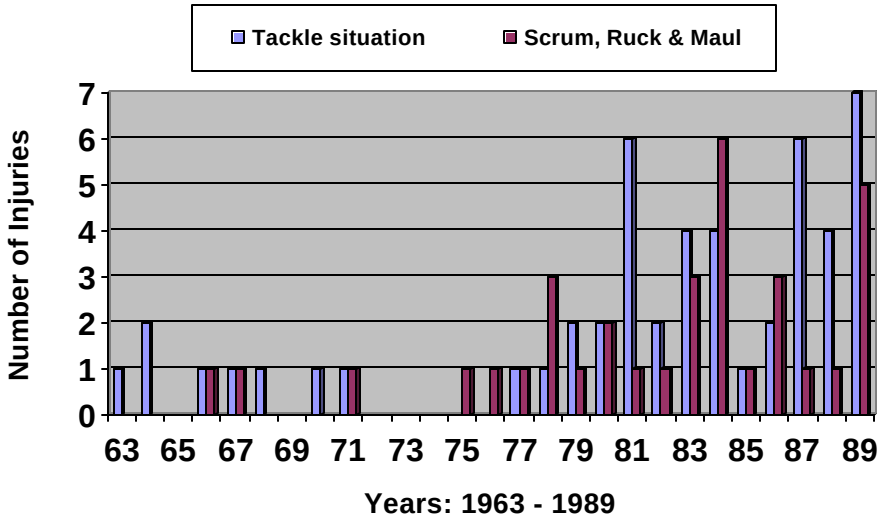
It was also noticed that Australian representative teams experienced difficulty in playing successfully in international and other matches against New Zealand teams, since the New Zealanders drove more effectively into the rucks and mauls because of the different interpretation of the scrum-feed criteria in their country (Noakes & du Plessis, 1996).

In March 1988 the International Rugby Board legislated to make some of the Australian and New Zealand domestic laws applicable to all rugby playing countries. This was motivated by the important findings by New Zealand, Australia and England. Apart from a law change to law 20 relating to scrummaging, the International Rugby Football Board issued a circular, which emphasized a number of safety precautions.

In contrast to the positive developments in Australia, and perhaps also in New Zealand and the United Kingdom, the number of serious spinal cord injuries admitted to the spinal cord injuries unit at Conradie Hospital in the Cape Province of South Africa continued until the 1990 playing season (Figure 1).

Further analysis of the Cape Province data showed that the higher number of spinal cord injuries between 1963 to 1971, and 1982 to 1989 resulted from a 333% annual increase in injuries occurring during the scrum and the ruck and maul, and a 1430% increase in injuries during the tackle phase of the game (Figure 4).

FIGURE 4: THE ANNUAL NUMBER OF SPINAL CORD INJURIES THAT OCCURRED IN THREE DIFFERENT PHASES OF PLAY IN SOUTH AFRICA



Thus no single mechanism could be blamed for the progressive increase in these injuries after 1971. Perhaps the only conclusion one could possibly draw from this finding was that the rule changes which had proved so effective in Australia, and perhaps also in England and New Zealand, could not have been introduced into South Africa.

Publication of data resulted in the introduction of significant rule changes at schoolboy rugby level from the middle of the 1990 rugby season. These changes included the modification of the CTPE (crouch-touch-pause-engage) mechanism

with the sequential formation of the set scrum, with the front row forward of both teams engaging first, the locks binding next and the loose forward binding only when the five tight forwards of both sides had formed a stable scrum.

Fortunately as a result of the introduction of these effective rule changes, there was a predictable, though smaller than anticipated, reduction in the incidence of spinal cord injuries among schoolboys in the Cape Province.

In a study by Berge et al. (1999), it was established that 66% of senior rugby players were found to have osteosclerosis of the vertebral bodies. Protrusive discs were present in 48% of senior rugby players, and 29% had herniated discs. Close to 52% of the senior front line players had a narrow canal according to the Torg index measurement. Additionally it was established that hyperextension reduces the diameter of the cervical canal by approximately 30% (Berge et al., 1999, Davis et al., 1991, Goldberg et al., 1989). This places a further obligation on the rules of the game, and the strive to make rugby as safe as possible.

2.3 TIME OF THE SEASON

More injuries occur in the earlier part of the season, compared to the latter (Garraway & Macleod, 1995; Clark et al., 1990; Kew et al., 1991; Nathan et al., 1983). In 1993 Alsop et al. (2000) did a study on 356 rugby union players in Dunedin, New Zealand. These included male and female players, and both senior and junior players. The results showed that there was significant

reduction in the game injury rate for both males and females over the season, with peaks frequently occurring near the start of an individual's season (Alsop et al., 2000). This indicates that the incidence of injury is not solely dependent upon the amount of exposure.

2.4 PREPARATION – PRE-SEASON

In a study that was performed in the Border's Reivers District during the 1997-1998 season, it was found that injury risk is more likely to be related to rugby training than to overall rugby fitness. It showed an increased risk of rugby injury for professional players, those who attend preseason rugby training for a longer period, and for those who were injured or were carrying an injury at the end of the previous season (Lee et al., 2001). Various possible reasons exist why players who attend more pre-season training weeks may have a higher risk of subsequent injury.

- They will probably have had more practice in rugby related maneuvers such as tackling and scrummaging.
- This may boost a player's confidence to make more injury prone maneuvers, which less skilled players would not attempt.
- These players may also play more intensively.
- Players who attend training more frequently were more likely to undertake power activities, and players of a larger build have been found to have a higher risk of injury (Lee et al., 2001; 1997)

Lee et al. (2001) also noted that the number of hours of manual work, aerobic fitness, and power activities undertaken during the summer period, level of manual work, and fitness levels before the start of the season had little effect on subsequent injury. This suggests that injury risk is related far less to overall player fitness than to rugby training – type of activities undertaken in training, personalities, characteristics of players undertaking training more frequently (Lee et al., 2001). This statement is supported by another study that found that strength and flexibility did not exert a significant role in determining injuries in a study of elite young athletes (Maffulli et al., 1994).

More than half of injuries that occur in the tackle, occur within the tackled player's peripheral vision (19%) or from behind him (33%) (Garraway et al., 1999). Due to the fact that peripheral vision may be affected by fatigue (O'Connor & Crowe, 1999), this may also give cause to higher injury rates.

2.5 PREVIOUS INJURY

In a study on high-level contact sports players, one hundred and two players formed part of the two year study investigating the sports injuries related to flexibility, posture, acceleration, clinical defects and previous injury. During the first year, all injuries and time affected by injury were recorded. The subjects then underwent flexibility tests, an accurate photogrammic assessment of posture, measures of speed and acceleration, and a clinical assessment of anatomical and physiological factors thought to be associated with the risk of

sports injury. Time affected by injury was then recorded for a further 12-month period. The analysis revealed that the number of days of injury during the second twelve-month period could be predicted from (1) the days of injury during the first twelve-month period, (2) posture, acceleration over ten meters from a standing start, and (4) the number of musculo-skeletal clinical defects. Flexibility scores were not found to be significant predictors of injury (Watson, 2001).

Quarrie et al. (1999) found that players who were injured, or were carrying an injury at the end of the previous season had a higher risk of subsequent injury, and that previously injured players also had a higher risk of subsequent injury compared to those without previous injury. Injury prevention programmes should therefore concentrate on improving posture and the rehabilitation from previous injury rather than flexibility.

2.6 ENVIRONMENTAL FACTORS

It has previously been established that environmental conditions can significantly affect how athletes perform (Thein, 1995). Also can environmental factors affect how athletes perform (Powell, 1987; Messier & Pitalla, 1988; Bouter et al., 1989). During the 1993-1994 season, a study was undertaken in the Scottish Borders District on the weather and pitch conditions at 112 grounds for the season. Rugby was played in a variety of weather and pitch conditions, and the conditions only deteriorated as the season progressed. The survey observed a linear relationship between the state of the pitch and the injury rate, with more injuries

sustained on hard pitches. The linear regression however revealed that this could be explained by it's confounding with time. The reason being that hard pitches are more frequent in the early part of the rugby season when the injury rate is also at it's highest. Also may other factors have contributed to the high injury rate such as pre-season fitness? It was concluded that weather conditions may have been the confounding factor in the risk of injury, and not the state of the pitch (Lee & Garraway, 2000).

2.7 PROTECTIVE CLOTHING

Little is known about the psychological effect of wearing protective clothing in the game of rugby union (Quarrie & Chalmers, 2001). In a study in New Zealand, the most common reasons for wearing protective equipment given by participants were: to prevent injury (57%), because of previous injury (53%), and because of medical advice (21%) (Gerrard et al., 1994). In a study on Australian schoolboy rugby players, safety was also cited as the primary reason for using headgear and they reported that they played more confidently when wearing headgear (Finch et al., 2001). Garraway et al. (2000) reported a substantial increase in the incidence of injury during the survey of the 1997-1998 season compared to the 1993-1994 season. As part of their explanations for the findings they also concluded that the factor most likely to have contributed to the increased burden of injuries in competitive play, and that requires the most urgent attention, is the almost universal adoption of protective equipment in rugby union between the

1993-1994 season, and the 1997-1998 season (Garraway et al., 2000). In a study on under 15 rugby union players in Australia, results strongly indicated that current headgear does not provide significant protection against concussion in rugby union at junior level (McIntosh & McCrory, 2001). It was also found that 63% of players in a schoolboy study in 1999 reported that their head felt hotter from wearing headgear, and that 67% said that they played more confidently when they wore headgear (Finch et al., 2001).

During the 1999 Rugby World Cup, 41 games were played. A video cohort study on all 41 these games was made, whereby at least 2 observers viewed the games independently and recorded players, replacements, and playing time for each player, along with the use of protective clothing. The study revealed that wearing headgear was associated with substantial reductions in the point estimates of injury to the areas covered by the headgear (Jones et al., 2004).

2.8 PROFESSIONALISM

In a study on the Border Reivers District during the 1997-1998 season, a comparison was made between the injury rates for professional versus amateur rugby players. The results suggested a 180% relative increase in the risk of injury for professional players compared to amateurs (Lee et al, 2001. This statement is supported by the study on the 1995 Rugby World Cup (Jakoet &

Noakes, 1998) and other surveys reporting higher injury rates among those who play at a higher team level (Kew et al., 1991; Nathan et al., 1983; Myers, 1980)

2.9 PHYSIQUE

There is a great variety in players' physique by different playing positions, and the laws of the game encourage different playing requirements for forwards and backs. Forwards need to have more power and weight to provide a strong pushing force in the scrum and maul, and height to compete in the lineout. Backs on the other hand need to be fast and agile to clear the ball away from the scrum and advance it down the field. Several studies have highlighted these differences in physique between forwards and backs (Casagrande & Viviani, 1993; Quarrie et al., 1995; 1996; Maud, 1983; Bell, 1979; Carlson et al., 1994). In a study on the influence of player physique on rugby football injuries, a strong association between physique and age was found. Younger players were more ectomorphic, and older players were more often endomorphic. The study found that endomorphic players were more likely to be injured in a match than were ectomorphic players, after adjustment for age was done (Lee et al., 1997). In a previous study it was suggested that muscular players are cushioned in collisions, and that the muscle act as protection to the bone (Reilly & Hardiker, 1981). Also did one study suggest that injury might be associated with under development of muscles (Watson, 1981). These findings however are not

supported by the by the results found by Lee et al. (1997). Certain risk factors were not included in these studies, and may have influenced results such as particular personality traits for certain somatotyping groups, different levels of motor skills and different levels of physical fitness.

The study on the Scottish Borders also noted that for players that play out of their position, an increased risk of injury might occur (Lee et al., 1997).

DISCUSSIONS AND RECOMMENDATIONS

Cervical spine injuries are among the most dangerous injuries occurring as a result of participation in rugby. Outcomes from such injuries range from complete recovery to death, depending on the degree of spinal cord damage sustained (Quarrie et al., 2002). Changes in the laws of the game, of which New Zealand have been at the forefront, have had a dramatic influence on the outcomes of such injuries. Although changes in the laws of the game reflect positively on the injury rates, other aspect of the game, such as the fluency, is sometimes negatively influenced by such changes. Much more study is needed on injury, but more specifically, spinal injuries in professional rugby union. Both player and administrator to make the sport a safer one to participate in should also place more emphasis on the laws of the game, changes of the laws of the game, and interpretation of the laws of the game.

More injuries occur in the earlier part of the season compared to the latter (Garraway & Macleod, 1995; Clark et al., 1990; Kew et al., 1991; Nathan et al., 1983. A factor like poor fitness levels of the players at the beginning of the season may have an influence on this finding. As the season progresses and fitness levels improve, the amount of injuries then subsequently decrease towards the end of the season. Another factor that may have an influence on these statistics is the state of the pitch that is played upon. With the change of season, the state of the pitch will change according to the season that is entered.

The rainy season will cause softer heavier pitches; the dry season will cause harder firmer pitches.

Those who attend pre-season training for longer periods have an increased risk for rugby injury (Lee et al., 2001). The reasons for this are many and they vary from psychological to physical factors .

Previously injured players and players carrying an injury at the end of the previous season have a higher risk of subsequent injury than those without previous injury (Quarrie et al, 1999). The question may be raised whether these injuries are ever fully rehabilitated. Games missed means loss of income to the player, and this can only aggravate the situation.

Current headgear does not provide significant protection against concussion in rugby union at junior level (McIntosh & McCrory, 2001). This may also be true at the senior level, but no studies have been undertaken to prove this statement.

Younger players are more ectomorphic, compared to older players who are more endomorphic (Lee et al., 1997). Statements like; endomorphic players are more likely to be injured than ectomorphic players (Reilly & Hardiker, 1981), and; muscular players are cushioned in collision and the muscle act as protection to the bone (Watson, 1981, are not supported by other studies.

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CHAPTER 3

THE INCIDENCE AND NATURE OF INJURIES IN SOUTH-AFRICAN RUGBY TEAMS DURING THE 2002 CURRIE CUP COMPETITION

3.1 INTRODUCTION

A number of studies on injuries in rugby union have concluded that a higher level of play is associated with a higher incidence of injuries, and possible explanations for this include increased strength and body size of players, higher level of competitiveness, longer seasons, and the fact that the ball may in play for longer in higher levels of the game (Bird et al., 1998; Jakoet & Noakes, 1998; Targett, 1998; Bathgate et al., 2002).

The scientific data concerning etiology and incidence of injuries is essential for medical staff to provide appropriate advice to policy makers, team management, coaching staff and players, in order to prevent and manage injuries. This is the first study of its kind to investigate injury rates in the Currie Cup competition, the premier inter-provincial rugby competition in South Africa. The findings are compared with similar studies on other competitions.

The Currie Cup competition is held annually in South Africa and includes provincial teams from 14 regions in South Africa. During the 2002 competition, the 14 teams were divided into two groups of seven, which within each group played against each other in a round robin tournament. The top 4 teams from each group then played against the top 4 teams from the other group, and the 4 teams with the highest points then played in a knockout semi-final and final match. An almost equal number of “home” and “away” games were played. All

teams played virtually one match per week for the duration of the competition, but had one week during the competitions where there was no draw for them. This “off week” was at a different time during the competition for each team.

The aim of this study was to document the incidence and nature of injuries to players in Currie Cup teams participating in the 2002 Currie Cup competition. Data from two teams was used for statistical analysis.

3.2 METHODS

Medical staff of five South African Currie Cup teams was approached for participation in this cohort study for 2002. The research protocol was explained, and confidentiality assured. One team did not wish to participate in the project, and named confidentiality as the reason for that. A number of players from the remaining squads studied were replaced during the course of the competition due to various reasons. Due to the difficulty of the task and the total reliance on other officials, data collection on all players joining and leaving the squad proved to be impossible. A number of players were therefore included and excluded from the cohort during the course of the study. Medical reports were requested on a weekly basis, and with completion of the Currie Cup season, only 2 teams had acted on the requests and on a weekly basis handed in their reports. No medical reports were received from the other 2 teams for the

entire competition. The final cohort study then consisted of two squads of twenty-two players as stipulated by SARFU. Twenty-two players participated in each training session, and fifteen were on the field per game. The same problem defining the cohort was encountered in the other studies on injuries in the 1997 Super 12 (Targett 1998) and the 1999 Super 12 (Holtzhausen, 2001).

The survey started 1 week before the commencement of the first game for the 2002 Currie Cup competition. The teams were involved in 20 matches (12 round robin, 8 top eight round robin), which accounts for 400 hours of player game time. Training hours were calculated at 11 hours and 15 minutes per week, which included 10 training sessions. A total of 4950 player-training hours were thus included in the study. Injuries sustained during games were documented as injuries per 1000 player game hours, and injuries during training as injuries per 1000 player training hours. The sum of injuries sustained during games and training were documented as injuries per 1000 hours of exposure. Injuries that had not healed since the previous season were not included.

For the purposes of this study, an injury were defined as one which prevented a player from playing or participating in squad training, or one that required special medical treatment (medication, suturing, radiographs). All cases of concussion were recorded. Acute and chronic overuse injuries were included if these criteria were met. Severity of an injury was assessed by recording of the number of games and training sessions missed due to an injury. A player, who was unable

to participate for a week, was recorded to have missed three sessions (two training sessions and a game). Injuries were classified as minor if three or less sessions were missed, intermediate if four to nine sessions were missed, and serious if ten or more sessions were missed. This definition was chosen to allow comparison with five other studies on injuries. Firstly the study on injuries to first-grade players in the Australian Capital Territories Rugby Union (ACTRU) competition, as it allows recording of minor injuries, which they found to be the most prevalent (58.7%) group of injuries (Hughes & Fricker, 1994). This definition is similar to, but not exactly the same as the one used in the 1997 study on injuries in the Super 12 (Targett, 1998), and the study of the 1994 – 2000 Australian Wallaby players (Bathgate et al., 2002), and the study on the Scottish Borders Reivers district (Garraway et al., 2000), but exactly the same as the 1999 study on injuries in the Super 12 competition (Holtzhausen, 2001).

Information were collected on injury forms using the following: Date, player position, team, injured during match or practice session, anatomical site, type and mechanism of injury, first or recurrent injury to the same structure, and number of sessions missed as a result of the injury. The information was documented by the team doctor of each team, as requested by the researcher. The team doctors were contacted telephonically on a weekly basis during course of the competition to confirm that all injuries were being recorded. Completed injury forms were forwarded to the researcher.

Central tendency, variability, and other important characteristics of the questionnaire data were explored using frequency distributions, graphical tools, descriptive statistics and hypothesis testing. A 5% level of significance was used throughout the study. All conclusions and recommendations were based on aforementioned statistical tools.

Approval of the research protocol was obtained from the Ethics and Research Committee of the University of the Free State before commencement of the study.

3.3 RESULTS

INJURY RATES

Injury rates according to exposure are shown in Table 1. A total of 100 injuries were recorded in fifty-two players over a period of 10 weeks. Seventy-five of these injuries occurred during games, which represent 187.5 injuries per 1000 player game hours. Of these, twenty-five injuries (62.5 injuries per 1000 player game hours, 33% of game injuries, 25% of total injuries) were of intermediate or severe nature. Twenty-five injuries (5 injuries per 1000 player training hours) were recorded during training, which is significantly less than the 75 that occurred during games ($P<0.01$). Five of the injuries (1 per 1000 player training hours) sustained during training, representing 20% of training injuries and 5% of total injuries recorded, were of intermediate or severe nature.

The total injury rate for training and games was 18.7 injuries per 1000 hours of exposure. If the total number of injuries sustained during games and training is expressed as injuries per player game hours, as was done in previous studies of this nature (Seward et al, 1993), the overall injury rate is 250 injuries per 1000 player game hours. Seventy injuries (70%) were minor injuries, twenty-four injuries (24%) were of intermediate severity and 6 injuries (6%) were of severe nature. Injuries of intermediate severity and serious injuries were therefore responsible for 5.6 injuries per 1000 hours of total exposure, or 30% of injuries

recorded. Of the severe injuries recorded, 4 (4% of total injuries) caused players to miss the remainder of the rugby season. Of the total number of injuries recorded, 71 (71%) were first injuries and 29 (29%) were recurrent injuries to the same structure.

TABLE 1: INJURY RATES TO PROFESSIONAL RUGBY UNION PLAYERS DURING THE 2002 CURRIE CUP COMPETITION

		Mild injuries		Intermediate injuries		Severe injuries		Total injuries	
	Player hours exposure	Number of player injuries	Injuries per 1000 player hours	Number of player injuries	Injuries per 1000 player hours	Number of player injuries	Injuries per 1000 player hours	Number of player injuries	Injuries per 1000 player hours
Games	**400**	**50**	**125.0[1]**	**19**	**47.5[1]**	**6**	**15.0[1]**	**75**	**187.5[1]**
Training	**4950**	**20**	**4.0[2]**	**5**	**1.0[2]**	**0**	**0**	**25**	**5.0[2]**
Total Exposure	**5350**	**70**	**13.0[3]**	**24**	**4.5[3]**	**6**	**1.1[3]**	**100**	**18.7[3]**

[1] injuries per 1000 player game hours

[2] injuries per 1000 player training hours

[3] injuries per 1000 hours of exposure

POSITIONS INJURED

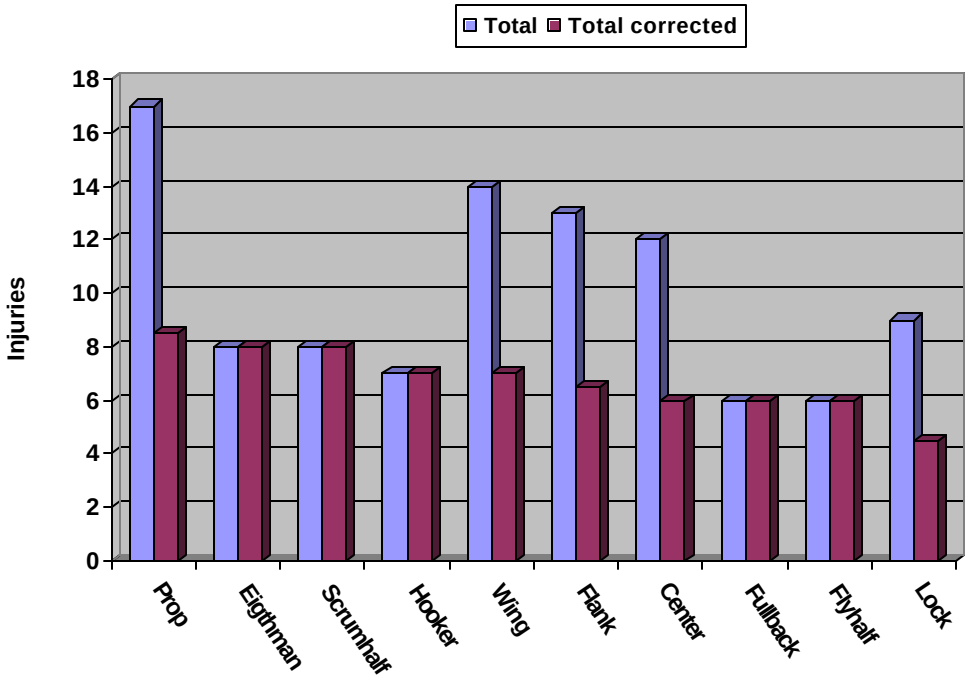
Amanda Lee has found in a study that players of a larger build has a higher risk of injury than the smaller players (Lee et al., 1997). The total number of injuries per player position and the severity is shown in Figure 1. Backs comprising of 47% of the team were responsible for 46% of the injuries, while the forwards comprising of 53% of the injuries were responsible for 54% of the injuries. This difference in injuries between forwards and backs was not proven to be significant (p=0.5). Of the 30 intermediate and serious injuries, 15 (50%) were from forwards and 15 (50%) were from backs. Props had the highest count of injuries with 17 injuries (17% of total injuries), wings second with 14 injuries (14% of total injuries), and then flankers and centers with 13 injuries (13% of total injuries) and 12 injuries (12% of total injuries) respectively. Locks recorded 9 injuries (9% of total injuries), eigthman and scrumhalves 8 injuries (8% of total injuries) respectively, and hookers 7 injuries (7% of total injuries). The lowest recording was by Fullbacks and flyhalves with 6 injuries (6% of total injuries) respectively. The highest total of severe injuries (2 injuries; 2% of total injuries) was recorded by hookers, while wings recorded the highest total of intermediate and severe injuries combined (6 injuries; 6% of total injuries).

TABLE 2: INJURIES TO PROFESSIONAL RUGBY UNION PLAYERS BY PLAYING POSITION FOR THE 2002 CURRIE CUP COMPETITION

PLAYING POSITION	MILD	INTERMEDIATE	SEVERE	TOTAL
Props	12 injuries	5 injuries	0	17 injuries
Wings	8 injuries	5 injuries	1 injury	14 injuries
Flankers	8 injuries	4 injuries	1 injury	13 injuries
Centers	7 injuries	5 injuries	0	12 injuries
Locks	7 injuries	1 injury	1 injury	9 injuries
Eigthman	7 injuries	1 injury	0	8 injuries
Scrumhalves	5 injuries	2 injuries	1 injury	8 injuries
Hookers	5 injuries	0	2 injuries	7 injuries
Fullbacks	5 injuries	1 injuries	0	6 injuries
Flyhalves	6 injuries	0	0	6 injuries
TOTAL	70 injuries	24 injuries	6 injuries	100 injuries

The total number of injuries per player position “corrected” is shown in Figure 1. The column for injuries “corrected” reflects the fact that two players in the team represent some player-positions, whereas others have only one player. The corrected figures indicate that props, scrumhalves and eigthmen were the most commonly injured positions with props 8.5% of injuries, and scrumhalves and eigthmen with 8% of injuries each. Hookers and wings had 7% of injuries each, and flankers 6.5% of injuries. Centers, flyhalves and fullbacks recorded 6% of injuries each, and locks the lowest recording of 4.5% of injuries. These results fail to indicate statistical significance between the incidence of injury and playing position (P>0.1)

FIGURE 1: INJURIES TO PROFESSIONAL RUGBY UNION PLAYERS BY PLAYING POSITION CORRECTED FOR THE 2002 CURRIE CUP COMPETITION



INJURY TYPE

Injury types are shown in Table 3. Contusions/haematomas (29%), ligament sprains (24%) and musculo-tendinous strains/tears (16%) accounted for 69% of the injuries recorded, which is significantly more than any other types of injury ($p<0.003$). Twenty-three of the contusions/ haematomas (79%; 57.5 injuries per 1000 player game hours) occurred during games and 6 (21%; 1.2 injuries per 1000 player training hours) occurred during training. Of the ligament sprains 20 (83%; 50 injuries per 1000 player game hours) occurred during games, and 4 (17%; 0.8 injuries per 1000 player training hours) occurred during training. Ten of the musculo-tendinous strains/tears (63%; 25 injuries per 1000 player game hours) occurred during games, and 6 (37%; 1.2 injuries per 1000 training hours) occurred during training. Of the other injuries, lacerations accounted for 7% of injuries. Chronic overuse injuries and dislocations/subluxations were responsible for 5% of injuries respectively. Fractures and concussions accounted for 3% of injuries each, and muscle cramping reported 2% of injuries.

The serious/intermediate injuries consisted of the following: the 9 thigh injuries consisted of 7 hamstring tears, 1 quadriceps tear and 1 quadriceps contusion. The six knee injuries consisted of 1 ACL rupture, 1 sprain, 2 meniscus tears, 1 capsular tear and 1 contusion. The three ankle injuries were all sprains. The

head, neck, arm/hand, trunk and lower leg all had 2 intermediate/serious injuries, while the shoulder and pelvis/hip had 1 intermediate/serious injury each.

The total amount of injuries during games amounted to 75 (75%; 187.5 injuries per 1000 player game hours), and the total amount of injuries during training was 25 (25%; 5 injuries per1000 training hours). There is a statistical significant difference between match and training injuries ($p=0.019$). Furthermore there exists a strong significant correlation between match injuries and training injuries ($r=0.687$). The coefficient of determination, r^2, which is an indication of the % variation in match injuries explained by training injuries was reported as $r^2=0.47$, thus nearly 50% of all training injuries re-occur in matches.

TABLE 3: TYPES OF INJURIES SUSTAINED TO PROFESSIONAL RUGBY UNION PLAYERS DURING THE 2002 CURRIE CUP COMPETITION

INJURY TYPE	TOTAL INJURIES		MATCH INJURIES		TRAINING INJURIES		% OF TOTAL INJURIES
	Number of injuries	Injuries per 1000 hours of exposure	Number of injuries	Injuries per 1000 player game hours	Number of injuries	Injuries per 1000 player training hours	
Contusion/haematomas	29	5.4	23	57.5	6	1.2	29%
Ligament sprains	24	4.5	20	50.0	4	0.8	24%
Muscle/tendon strain/tears	16	3.0	10	25.0	6	1.2	16%
Lacerations	7	1.3	7	17.5	0	-	7%
Chronic overuse injuries	5	0.9	1	2.5	4	0.8	5%
Dislocations/subluxations	5	0.9	3	7.5	2	0.4	5%
Fractures	3	0.6	3	7.5	0	-	3%
Concussions	3	0.6	3	7.5	0	-	3%
Muscle cramping	2	0.4	2	5.0	0	-	2%
Other	6	1.1	4	10.0	2	0.4	6%

INJURY SITE

The distribution of injuries according to anatomical site is shown in Table 4. The thigh was the most commonly injured site, accounting for 19 (19% of total injuries; 3.6 injuries per 1000 player hours of total exposure) injuries. The head was the second most commonly injury site with 13 injuries (13% of total injuries; 2.4 injuries per 1000 hours of total exposure). The next most commonly injured site was the arm/hand with 12 injuries (12% of total injuries; 2.2 injuries per 1000 hours of total exposure), followed by the trunk, knee and lower leg with 9 injuries (9% of total injuries; 1.7 injuries per 1000 hours of total exposure) respectively. The ankle accounted for 8 injuries (8% of total injuries; 1.5 injuries per 1000 hours of total exposure), the neck and shoulder for 6 injuries each (6% of total injuries; 1.1 injuries per 1000 hours of total exposure), and the back for 5 injuries (5% of total injuries; 0.9 injuries per 1000 hours of total exposure). Three injuries (3% of total injuries; 0.6 injuries per 1000 hours of total exposure) were recorded for the pelvis/hip, and 1 injury (1% of total injuries; 0.2 injuries per 1000 hours of total exposure) to the foot.

The upper body (head, neck, shoulder, arm/hand, trunk, back) was responsible for 51 injuries in total (51% of total injuries), and the lower body (pelvis/hip, thigh, knee, lower leg, ankle, foot) responsible for 49 injuries (49% of total injuries). The biggest number of upper body injuries was recorded in the head (13 injuries; 13%

of total injuries), and the largest number of lower body injuries was recorded in the thigh (19 injuries; 19% of total injuries).

TABLE 4: INJURIES TO PROFESSIONAL RUGBY UNION PLAYERS BY ANATOMICAL SITE AND SEVERITY FOR THE 2002 CURRIE CUP COMPETITION

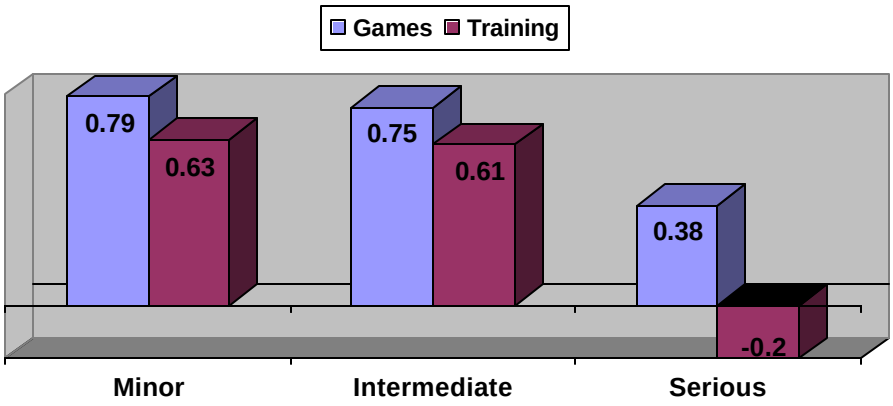
Region	Total no of injuries		Game injuries		Training injuries		Minor	Intermediate	Severe	% of total injuries
	Number of injuries	Injuries per 1000 hours of exposure	Number of injuries	Injuries per 1000 player game hours	Number of injuries	Injuries per 1000 training hours				
Thigh	19	3.6	14	35.0	5	1.0	10	8	1	19%
Head	13	2.4	12	30.0	1	0.2	11	2	-	13%
Arm/hand	12	2.2	8	20.0	4	0.8	10	2	-	12%
Trunk	9	1.7	7	17.5	2	0.4	7	1	1	9%
Knee	9	1.7	9	22.5	-	-	3	3	3	9%
Lower leg	9	1.7	5	12.5	4	0.8	7	2	-	9%
Ankle	8	1.5	4	10.0	4	0.8	5	3	-	8%
Neck	6	1.1	4	10.0	2	0.4	4	2	-	6%
Shoulder	6	1.1	4	10.0	2	0.4	5	-	1	6%
Back	5	0.9	4	10.0	1	0.2	5	-	-	5%
Pelvis/hip	3	0.6	3	7.5	-	-	2	1	-	3%
Foot	1	0.2	1	2.5	-	-	1	-	-	1%
Total	100	18.7	75	187.5	25	5.1	70	24	6	100%

SEVERITY OF INJURIES

All injuries to head but for one, all injuries to the knee and foot, and all injuries to the pelvis/hip occurred during games. All back and foot injuries were minor injuries. Most intermediate and serious injuries were recorded in the thigh (9 injuries), followed by the knee (6 injuries) and ankle (3 injuries).

There exists a strong coefficient correlation between game minor, game intermediate, and game serious injuries. There also exists a strong coefficient correlation between training minor, training intermediate, and training serious injuries.

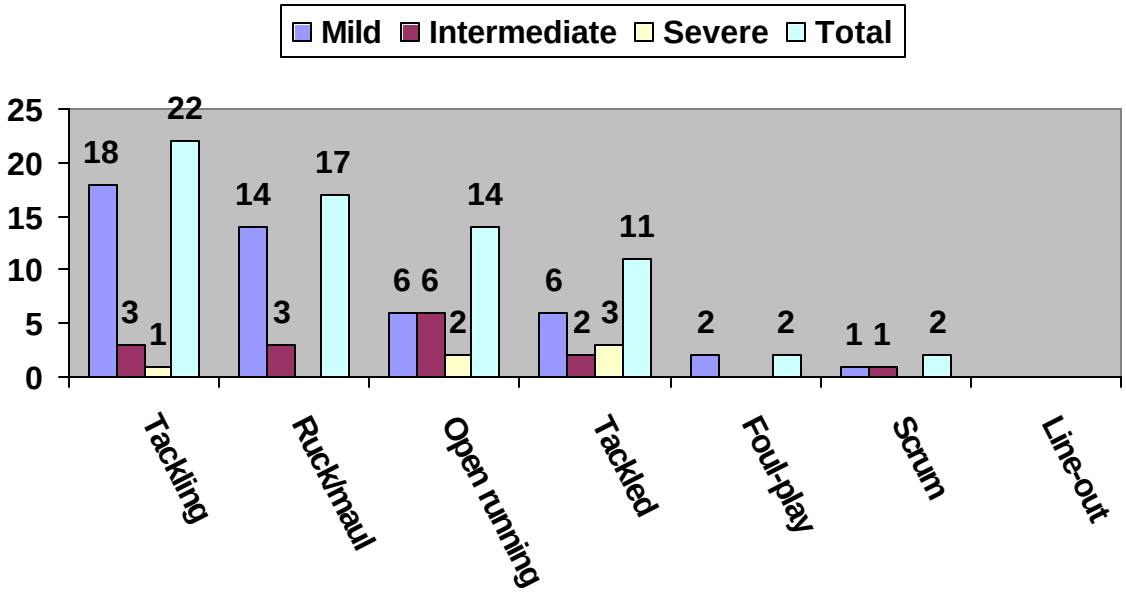
FIGURE 2: SEVERITY OF INJURIES TO PROFESSIONAL RUGBY UNION PLAYERS DURING GAMES AND TRAINING IN THE 2002 CURRIE CUP COMPETITION



MECHANISM OF INJURY.

Contact between players accounted for 68 injuries (68% of all injuries). Of these, 15 (15%) were intermediate or serious. The most dangerous phase of play during matches was tackling, which accounted for 22 injuries (29% of game injuries; 55 injuries per 1000 player game hours). The ruck/maul was responsible for 17 injuries (23% of game injuries, 42.5 injuries per 1000 game hours), and open running for 14 injuries (19% of game injuries, 35 injuries per 1000 game hours). These three injury mechanisms were responsible for 45 injuries, constituting 60% of all game injuries. Being tackled was responsible for 9 injuries (12% of game injuries, 22.5 injuries per 1000 game hours), and collisions for 7 injuries (9% of game injuries, 17.5 injuries per 1000 player game hours) during games. The tackle (tackling and being tackled) was therefore responsible for 26 injuries, 26% of total injuries recorded, representing 65 injuries per 1000 player game hours. The distribution of injuries during games by mechanism is shown in Figure 3.

FIGURE 3: MECHANISM OF INJURIES DURING GAMES TO PROFESSIONAL RUGBY UNION PLAYERS FOR THE 2002 CURRIE CUP COMPETITION



Twenty-five acute injuries were sustained during training, which represents 25% (5 Injuries per 1000 player training hours) of the total number of injuries recorded. The distribution of injuries during training is shown in Table 5. Sixteen of the total injuries sustained during training were caused by contact play, which represents 64% of training injuries, and 3.2 injuries per 1000 player training hours. Fourteen of these injuries were recorded to be mild, and two were of intermediate nature.

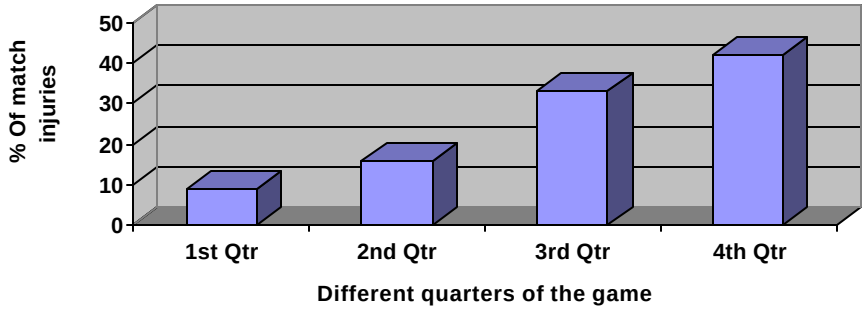
TABLE 5: MECHANISM OF ACUTE INJURIES SUSTAINED DURING TRAINING TO PROFESSIONAL RUGBY UNION PLAYERS IN THE 2002 CURRIE CUP COMPETITION

Training modality	Mild	Intermediate	Severe	Total	% of total injuries
Contact	14	2	-	16	64%
Speed	-	1	-	1	4%
Skills	3	2	-	5	20%
Other	3	-	-	3	12%
Total	20	5	-	25	25%

TIME OF INJURY

Of the 75 match injuries, seven (9%) occurred during the first 20 minutes of play, twelve (16%) during the second twenty minutes of play, twenty-five (33%) during the third twenty minutes of play, and thirty-one (42%) during the final twenty minutes of play as demonstrated in figure 4. When divided into two halves, a significant difference between the two halves can be observed (p=0.08).

FIGURE 4: PERCENTAGE OF TOTAL MATCH INJURIES FOR DIFFERENT QUARTERS OF THE GAME DURING THE 2002 CURRIE CUP COMPETITION



A total of 69 injuries took place during the first half of the competition, compared to 31 injuries taking place during the second half of the competition. Match injuries converted to injuries per 1000 playing hours equal 187.5/1000 player game hours.

3.4 DISCUSSION

A number of studies on injuries in rugby union have concluded that a higher level of play is associated with a higher incidence of injuries, and possible explanations for this include increased strength and body size of players, higher level of competitiveness, longer seasons, and the fact that the ball may in play for longer in higher levels of the game (Bird et al., 1998; Jakoet & Noakes, 1998; Targett, 1998; Bathgate et al., 2002). This study however contradicts the statement due to the higher injury rate reported (187.5 injuries per 1000 player game hours) for a lower level of play (inter provincial), unless underreporting of injuries took place in the other studies which is a common observation in studies of this nature (Sharp et al., 2001). The possibility of lack of interest also exists. Should lack of interest be a factor, this will then lead to poor compliance of team doctors in completion of injury reports, or even in participation in studies.

Methodology

As found with previous studies, lack of a uniformed method of reporting of injuries is probably the biggest difficulty encountered, when attempting to compare one study with another (Holtzhausen, 2001; Orchard & Seward, 2002). The following recommendations are made: In order to obtain a uniformed method of reporting, but to prevent the limitation of studies on this subject, the following ways of reporting should be used: ***Injuries per 1000 hours of exposure*** should

be determined by the total amount of injuries sustained (game and training), expressed as a figure of the total game and training time recorded. This definition needs game and training injuries, as well as game and training time to be recorded. If this can be obtained, comparisons with the following methods of reporting can also be made. ***Injuries per 1000 player game hours*** should be determined by the total amount of injuries sustained (game and training), expressed as a figure of the total game time played. This can be the method of choice in studies where determination of training time is not possible. ***Game injuries per 1000 player game hours*** should be determined by the amount of game injuries sustained, expressed as a figure of the total game time. This can be utilized in studies where neither the training time nor training injuries can be recorded. ***Training injuries per 1000 player training hours*** should be determined by the amount of injuries sustained during training, expressed as a figure of total training time. This can then only be utilized in studies where the actual training injuries and training time can be obtained. Training time in itself presents problems due to the difficulty in determining it accurately. Training sessions are often divided into skills training, conditioning, cardiovascular training and others, where each member of the team do not spend the same amount of time on these categories. Also do all members of the team not train all sessions together? Many times it is found that a member does extra strength training sessions, which the team does not perform. Should studies then succeed in acquiring game and training time, as well as game and training injuries, these studies will then be able to make comparisons with other studies that used the

one or more of the above mentioned definitions. Re-injury should be clearly defined and reported. The definition of an injury incident should be standardized for acute and chronic injuries. Player position should be standardized for purposes of reporting injury rates per player position, and correction should be made for positions of which there are two per team. Description of the pathological type of injury needs clear description, as terms such as sprain and strain have been used in different context in different studies. The international Rugby Board (IRB) is the international governing body of rugby union, and is in an ideal position to recommend standardized research methods in rugby union. Studies should be undertaken with the entire set of teams in a season, rather than a single team doctor over a number of seasons. This will help to counter the bias of an individual, and present statistically more reliable results from a larger sample population.

Injury Rates

A total of 100 injuries were recorded in fifty-two players over a period of 10 weeks. Seventy-five of these injuries occurred during games, which represent 187.5 injuries per 1000 player game hours. Of these, twenty-five injuries (62.5 per 1000 player game hours, 33% of game injuries, 25% of total injuries) were of intermediate or severe nature, and twenty-five injuries (5/1000 player training hours) were recorded during training. Five of the injuries (1 per 1000 player training hours) sustained during training, representing 20% of

training injuries and 5% of total injuries recorded, were of intermediate or severe nature.

The total injury rate for training and games was 18.7 injuries per 1000 hours of exposure. If the total number of injuries sustained during games and training is expressed as injuries per player game hours, as was done in previous studies of this nature (Seward et al, 1993), the overall injury rate is 250 injuries per 1000 player game hours.

When compared to other studies, this study of Currie Cup players reported an injury rate of 250 injuries per 1000 player game hours, when compared to a study of similar level of play, which reported a significantly lower injury rate of 67.8 injuries per 1000 playing hours for the Scottish Borders Reivers District (Garraway et al., 2000). Two studies of Super 12 level of play reported 150 injuries per 1000 player game hours, and 84 injuries per 1000 player game hours respectively (Targett, 1998; Holtzhausen, 2001). A fifth study on Australian Wallaby international players reported an injury rate of 78.6 injuries per 1000 player game hours (Bathgate et al., 2002).

The reason why the incidence of injury in this study presents high compared to other studies might be that minor injuries was recorded much more accurately compared to other studies. When the intermediate and severe injury rates are compared to other studies, a much smaller difference is found in the variation of

rates. As found with other studies, mild injuries certainly occur most frequently in rugby union players.

Positions Injured

Amanda Lee has found in a study that players of a larger build, usually comprising of forward players, has a higher risk of injury than the smaller players, usually comprising of back line players (Lee et al., 1997). This statement could not be supported in this study due to the results failing to indicate statistical significance between the incidence of injury between forward players and back line players ($p=0.5$).

Backs comprising of 47% of the team were responsible for 46% of the injuries, while the forwards comprising of 53% of the injuries were responsible for 54% of the injuries. Of the 30 intermediate and serious injuries, 15 (50%) were from forwards and 15 (50%) were from backs. Props had the highest count of injuries with 17 injuries (17% of total injuries), wings second with 14 injuries (14% of total injuries), and then flankers and centers with 13 injuries (13% of total injuries) and 12 injuries (12% of total injuries) respectively. Locks recorded 9 injuries (9% of total injuries), eigthman and scrumhalves 8 injuries (8% of total injuries) respectively, and hookers 7 injuries (7% of total injuries). The lowest recording was by Fullbacks and flyhalves with 6 injuries (6% of total injuries) each. The highest total of severe injuries (2 injuries; 2% of total injuries) was recorded by

hookers, while wings recorded the highest total of intermediate and severe injuries combined (6 injuries; 6% of total injuries).

When the figures of injury count were corrected for the fact that some player positions are represented by two players in the team, the following figures was reported. The corrected figures indicate that props, scrumhalves and eigthmen were the most commonly injured positions with props 8.5% of injuries, and scrumhalves and eigthmen with 8% of injuries each. Hookers and wings had 7% of injuries each, and flankers 6.5% of injuries. Centers, flyhalves and fullbacks recorded 6% of injuries each, and locks the lowest recording of 4.5% of injuries. A possible reason for props having the highest injury count could be that they are the biggest members on the field, and carrying around these massive weights can result in muscle fatigue, and therefore be cause to injury. This suggestion is however immediately proved wrong when taking into account that scrumhalves are the second most injured position, but they are usually the smallest members on the field of play. A further possible reason for the high injury count among props could be the fact that props do a lot of cleaning around the scrum after the first phase. Injury count during the tackle is high and this could give cause to the high count.

Injury Type

Contusions/haematomas (29%), ligament sprains (24%) and musculo-tendinous strains/tears accounted for 69% of the injuries recorded.

Twenty-three of the contusions/ haematomas (79%; 57.5 injuries per1000 player game hours) occurred during games and 6 (21%; 1.2 injuries per 1000 player training hours) occurred during training. Of the ligament sprains 20 (83%; 50 injuries per 1000 player game hours) occurred during games, and 4 (17%; 0.8 injuries per 1000 player training hours) occurred during training. Ten of the musculo-tendinous strains/tears (63%; 25 injuries per 1000 player game hours) occurred during games, and 6 (37%; 1.2 injuries per 1000 training hours) occurred during training. Of the other injuries, lacerations accounted for 7% of injuries. Chronic overuse injuries and dislocations/subluxations were responsible for 5% of injuries respectively. Fractures and concussions accounted for 3% of injuries each, and muscle cramping reported 2% of injuries.

The total amount of injuries during games amounted to 75 (75%; 187.5 injuries per 1000 player game hours), and the total amount of injuries during training was 25 (25%; 5 injuries per1000 training hours). There is a statistical significant difference between match and training injuries ($p=0.019$). Furthermore there exists a strong significant correlation between match injuries and training injuries ($r=0.687$). The coefficient of determination, r^2, which is an indication of the % variation in match injuries explained by training injuries was reported as $r^2=0.47$, thus nearly 50% of all training injuries re-occur in matches. This is the first time this important finding has been reported. The question may be raised whether these injuries were ever fully rehabilitated? Also was it found that players that are injured at the end of the previous season are at an increased risk of re-injury for

the new season (Lee et al., 2001). The most significant indication for hamstring injury would be that the risk factor for hamstring strain would be highest in individuals with previous hamstring injury.

Injury Site

The thigh was the most commonly injured site, accounting for 19 (19% of total injuries; 3.6 injuries per 1000 player hours of total exposure) injuries. The head was the second most commonly injury site with 13 injuries (13% of total injuries; 2.4 injuries per 1000 hours of total exposure). Of these 13 injuries 3 were concussions, 7 lacerations and 1 contusion. The next most commonly injured site was the arm/hand with 12 injuries (12% of total injuries; 2.2 injuries per 1000 hours of total exposure), followed by the trunk, knee and lower leg with 9 injuries (9% of total injuries; 1.7 injuries per 1000 hours of total exposure) respectively. The ankle accounted for 8 injuries (8% of total injuries; 1.5 injuries per 1000 hours of total exposure), the neck and shoulder for 6 injuries each (6% of total injuries; 1.1 injuries per 1000 hours of total exposure), and the back for 5 injuries (5% of total injuries; 0.9 injuries per 1000 hours of total exposure). Three injuries (3% of total injuries; 0.6 injuries per 1000 hours of total exposure) were recorded for the pelvis/hip, and 1 injury (1% of total injuries; 0.2 injuries per 1000 hours of total exposure) to the foot.

The upper body (head, neck, shoulder, arm/hand, trunk, back) was responsible for 51 injuries in total (51% of total injuries), and the lower body (pelvis/hip, thigh,

knee, lower leg, ankle, foot) responsible for 49 injuries (49% of total injuries). The greatest number of upper body injuries were recorded in the head (13 injuries; 13% of total injuries), and the largest amount of lower body injuries were recorded in the thigh (19 injuries; 19% of total injuries).

Severity Of Injuries

All injuries to head but for one, all injuries to the knee and foot, and all injuries to the pelvis/hip occurred during games. All back and foot injuries were minor injuries. Most intermediate and serious injuries were caused by the thigh (9 injuries), followed by the knee (6 injuries) and ankle (3 injuries). The serious/intermediate injuries consisted of the following: the 9 thigh injuries consisted of 7 hamstring tears, 1 quadriceps tear and 1 quadriceps contusion. The six knee injuries consisted of 1 ACL rupture, 1 sprain, 2 meniscus tears, 1 capsular tear and 1 contusion. The three ankle injuries were all sprains. The head, neck, arm/hand, trunk and lower leg all had 2 intermediate/serious injuries, while the shoulder and pelvis/hip had 1 intermediate/serious injury each.

Mechanism Of Injury

Contact between players accounted for 68 injuries (68% of all injuries). Of these, 15 were intermediate or serious. The most dangerous phase of play during matches was tackling, which accounted for 22 injuries (29% of game

injuries; 55 injuries per 1000 player game hours). In a study by Wilson et al (1999), it was determined that approximately 70% of tackle injuries occur when the player is running or going to ground. This places an obligation on coaching staff to learn their players to fall correctly and protect themselves in the tackle situation. The ruck/maul was responsible for 17 injuries (23% of game injuries, 42.5 injuries per 1000 game hours), and open running for 14 injuries (19% of game injuries, 35 injuries per 1000 game hours). These three injury mechanisms were responsible for 45 injuries, constituting 60% of all game injuries. Being tackled was responsible for 9 injuries (12% of game injuries, 22.5 injuries per 1000 game hours), and collisions for 7 injuries (9% of game injuries, 17.5 injuries per 1000 player game hours) during games. The tackle (tackling and being tackled) was therefore responsible for 26 injuries, 26% of total injuries recorded, representing 65 injuries per 1000 player game hours.

Twenty-five acute injuries were sustained during training, which represents 25% (5 Injuries per 1000 player training hours) of the total number of injuries recorded. This figure compares well to injury rates reported in rugby league, which reports a training injury rate of 45.3 injuries per 1000 player training hours (Gabbett, 2003). Sixteen of the total injuries sustained during training were caused by contact play, which represents 64% of training injuries, and 3.2 injuries per 1000 player training hours. Fourteen of these injuries were recorded to be mild, and two were of intermediate nature.

Time Of Injury

Of the 75 match injuries, seven (9%) occurred during the first 20 minutes of play, twelve (16%) during the second twenty minutes of play, twenty-five (33%) during the third twenty minutes of play, and thirty-one (42%) during the final twenty minutes of play. A total of 69 injuries took place during the first half of the competition, compared to 31 injuries taking place during the second half of the competition. Match injuries converted to injuries per 1000 playing hours results in 187.5 injuries per 1000 player game hours.

3.5 CONCLUSIONS

Terminology in epidemiological studies recording injury rates seems to be a stumbling block in determining injury rates over a wider spectrum of studies than just the one involved. Standardized methodology should be put forward by a governing body such as the national unions or the International Rugby Board (IRB). The following observations could be made regarding the epidemiology of rugby injuries:

- The high incidence of injuries in rugby union has been confirmed in this study. Ways have to be found to minimize the injury rates, and thereby make it a safer sport to participate in.
- The tackle is the most dangerous phase of play. This should be regarded as an integral part of training with much emphasis on tackling technique and physical conditioning for this phase of play, posing the threat that it does.
- Without rule changes, the existing rules about tackling should be enforced to the letter of the rule.
- Props are the most frequently injured player position in this study, but no significant correlation could be found to support the finding.
- The thigh was the most frequent site of injury in this study, but also no significant correlation could be found to support this finding.

- The type of injury that occurs most frequently during game play is contusions/haematomas, and during training contact play causes most injuries.
- The fourth quarter of play caused the greatest amount of injuries, indicating fatigue a possible cause. This assumption was also found in previous studies of this nature.
- Further research needs to be done on these aspects to clarify assumptions that cannot be supported by other studies.

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CHAPTER 4

THE EPIDEMIOLOGY OF INJURIES IN PROFESSIONAL RUGBY UNION

4.1 INTRODUCTION

In 1983 the estimated cost of rugby injuries in New Zealand was conservatively predicted to be NZ $6.13 million (Burry,1986) and NZ $19.3 million in 1990 (Dixon, 1993). Not only is the monetary effects of great concern, but in recent years more concern has existed about the long-term effects of rugby injuries to players in the rugby countries of the world such as the United Kingdom (Silver, 1979; 1984), Australia (Taylor & Coolican, 1987), New Zealand (Burry & Gowland, 1981; Burry & Calcinai, 1988), and South-Africa (Kew et al., 1991; Scher, 1977; 1980; 1981; 1982). In contrast, many believe rugby to be inherently safe, and that the problem lies with players who have become soft (Noakes & du Plessis, 1996).

Since 1990 thirteen epidemiological studies have been conducted on injuries in senior level rugby union. Of these, five were prospective cohort studies including injury rates of professional rugby players (Targett, 1998; Garraway et al., 2000; Holtzhausen, 2001; Bathgate et al., 2002; le Roux, Unpublished data). Of the remaining studies, one is a survey of all injuries sustained in Argentina over one weekend per year over seven years (Bottini et al., 2000), five are prospective cohort studies conducted over one season, including senior club and regional teams (Bird et al., 1998; Seward et al., 1993; Hughes & Fricker, 1994; Lee & Garraway, 1996; Babic et al., 2001), and two are prospective cohort studies, reporting injuries sustained by all players competing in a single tournament

(Jakoet & Noakes, 1998; Wekesa et al., 1996). Of the five studies that include injury rates in professional rugby, the two Super twelve studies and the Currie Cup study were similar, making comparison of results possible. The fourth study, which included professional rugby players playing club rugby in the Border Reivers district in Scotland, and the fifth study, which included Australian Wallaby rugby union players used a different definition of injury and method of reporting incidence, type, and anatomical site of injury. A summary of similarities and differences between the five studies is given in Table 1. Injuries sustained during training were included as a total of match injuries in three studies, and in the other two (Holtzhausen et al., Unpublished data; le Roux, Unpublished data) differentiated between match and practice injuries. Figures that are compared in this review are incidence of all incidents of injury sustained during matches and practice sessions, per 1000 player match hours. In the study conducted in Scotland, the incidence of all new injuries was reported. The Australian Wallaby study reported all injuries that forced the player to leave the field, or miss a subsequent game. The Currie Cup and two Super 12 studies, however, recorded all incidents that prevented a player from participating in a training session or match as an injury, including re-injury. Therefore the incidence of injuries in the two Super 12 and the Currie Cup studies, is comparable to the period prevalence of injuries reported in the Scottish study and Australian Wallaby study.

The second important difference in study design is the method of data collection. Data was collected by the team doctors in the Currie Cup, Australian Wallaby and two Super 12 studies who were in daily contact with the squad and examined

all injuries, whereas with the Scottish study linkmen with questionnaires were used to collect data.

Incidence of injuries in the studies on amateur rugby are not directly comparable with one another or with the studies on professional rugby because of lack of uniformity in study design, including study population, definition of injury, method of data collection, and format of expressing results. Trends in anatomical distribution, type and severity of injuries, and player position of injured players can, however be compared in terms of percentage of total number of injuries recorded in each study. A recent study on amateur rugby players revealed an injury rate of 47.5 injuries per 1000 player game hours (Junge et al., 2004).

TABLE 1: SUMMARY OF STUDY DESIGN OF PROSPECTIVE COHORT STUDIES ON INJURY RATES IN PROFESSIONAL RUGBY UNION

Study	Targett, 1998 (1 Super 12 squad)	Holtzhausen, 2001 (3 Super 12 squads)	Garraway et al, 2000 (Professional rugby players competing in the Borders Reivers club competition in Scotland)	Bathgate et al, 2002 (Australian Wallaby rugby union players from 1994 to 2000)	Le Roux (3 Currie Cup squads)
Type of study	Prospective cohort study	Prospective cohort study	Prospective cohort study	Prospective cohort study	Prospective cohort study
Study population	1 Super 12 rugby squad	3 Super 12 rugby squads	All rugby players registered with Scottish rugby union affiliated senior clubs in the Border Reivers District, including all 30 adult professionals contracted to the SRU or Border Reivers District	Australian Wallaby Rugby Union players, playing from 1994 to 2000)	2 Currie cup squads
Duration of study	1 Super 12 competition (4 months)	1 Super 12 competition (4 months)	One season (1997-1998)	1994 – 2000	One Currie Cup competition (2002)
Method of data collection	Team doctor	Team doctors	Linkmen, completing standard closed questionnaires	Team Doctors	Team doctors
Definition of injury	That which prevented a player from taking full part in two training sessions, from playing the next week, or one that required special medical treatment (such as suturing or special investigation) • Minor: miss less than 1 week • Moderate: miss 1 to 3 weeks • Severe: miss more than 3 weeks Re-injury was included as a new incident of injury, and included in incidence of injury events.	That which prevented a player from playing or participating in squad training, or that required special medical treatment (such as suturing or special investigation). Severity was calculated in number of sessions missed. A session is a match or training session. One match and two training sessions (3 sessions) took place per week. • Mild: missed 1-3 sessions (less than 1 week) • Moderate: missed 4-9 session (1-3 weeks) • Severe: missed 10 and more sessions (> 3 weeks) Re-injury was included as a new incident of injury, and included in incidence of injury events.	That which was sustained on the field during a competitive match, during a practice game, or during training activity directly associated with rugby football, which prevented the player from training or playing rugby football from the time of the injury or the end of the match or practice in which the injury was sustained. Rugby injuries sustained during training were those sustained during practice scrums or maneuvers involving a rugby ball (not circuit training or activities undertaken to achieve fitness). • Transient: missed less than 7 days • Mild: missed 7-28 days • Moderate: missed 29-84 days • Severe: missed more than 84 days Only new injuries were included in incidence, and recurrent injuries were included in period prevalence.	An event that forced the player to either leave the field or miss a subsequent game. • Mild: miss less than 1 week • Moderate: miss 1 to 3 weeks • Severe: miss more than 3 weeks Re-injury was included as a new incident of injury, and included in incidence of injury events.	That which prevented a player from playing or participating in squad training, or that required special medical treatment (such as suturing or special investigation). Severity was calculated in number of sessions missed. A session is a match or training session. One match and two training sessions (3 sessions) took place per week. • Mild: missed 1-3 sessions (less than 1 week) • Moderate: missed 4-9 session (1-3 weeks) • Severe: missed 10 and more sessions (> 3 weeks) Re-injury was included as a new incident of injury, and included in incidence of injury events.
Expression of injury rates	• Injury rate expressed as number of injuries per hours of game time and injuries per player per game • Total game hours can be calculated • Total training time not presented • Incidence of injuries per anatomical site, injury type, and severity not differentiated between game and training injuries	• Incidence of injuries expressed in number of injuries per 1000 game hours and number of injuries per 1000 training hours • Game and training injuries reported separately (Sum of game and training injuries per 1000 player game hours used for comparison with other studies)	• Total game hours recorded • Training injuries expressed as a percentage of total injuries, but training hours not quoted • Site and nature of injuries presented for injuries sustained in games only • Site and nature of injuries not differentiated in age groups, but presented as total of all players included in the study • Injury episodes expressed in episode rate per 1000 playing hours, quoting incidence of new injuries, and period prevalence	• Total game hours recorded • Training injuries and game injuries expressed separately, but training hours not quoted	• Incidence of injuries expressed in number of injuries per 1000 game hours and number of injuries per 1000 training hours • Game and training injuries reported separately (Sum of game and training injuries per 1000 player game hours used for comparison with other studies)

4.2 THE INCIDENCE OF RUGBY INJURIES

The incidence of injuries in professional rugby union is summarized in Table 2 where incidence is expressed as number of injury incidents per 1000 player game hours. Available studies in the literature do not allow for seasonal or annual incidence to be compared, and represent a very small fraction of professional rugby played since 1995. These studies therefore may not reflect the true incidence or trends of injury patterns in professional rugby union. The average incidence/period prevalence of injuries recorded in professional rugby union is 98.4 injuries per 1000 player game hours, and ranges between 67.8 and 250 injuries per 1000 player game hours.

The incidence of injuries in one squad of 25 Super 12 players during the 1997 Super 12 competition was 150 injuries per 1000 player game hours (Targett, 1998). The Australian Wallaby players from 1994 to 2000 had an incidence of 78.6 injuries per 1000 player game hours. The incidence of injuries for the 3 Currie Cup squads during the 2002 Currie Cup competition was 250 injuries per 1000 player game hours. The three Super 12 squads suffered 84 injuries per 1000 player game hours during the 1999 Super 12 competition (Holtzhausen, 2001), and the period prevalence of injuries among 30 professional rugby players in the Scottish Borders Reivers club competition was 67,8 injuries per 1000 player game hours. The incidence of new injuries in this group was 29,9 injuries per 1000 player game hours (Garraway et al., 2000).

A wide range of injury rates in senior amateur rugby union has been reported by previous studies. Hughes and Fricker recorded an injury rate of 48.8 injuries per 1000 player hours in a prospective survey of injuries to first class rugby union players in the Australian Capital Territories (ACT) during the 1992 ACTRU competition (1994). In 1995 a period prevalence of 14.8 injuries per 1000 player hours was reported among Scottish clubs during the 1993-1994 season (Garraway et al., 2000; Garraway & Macleod, 1995; Lee & Garraway, 1996). The study of Seward et al. (1993) compared injuries in three codes of football at the elite level in Australia, and reported an overall injury rate of 62 injuries per 1000 player hours among first grade players. During a single season in Dunedin, New Zealand, a survey of incidence, nature and circumstances of injuries revealed injury rates of 14 injuries per 100 player games in the senior male A-league 10.7 injuries per 100 player games in the senior male B-league (Bird et al., 1998). In 2001 Quarrie et al. (2001) reported the injury rate at 2.5 injuries per 1000 player hours (game and training hours) for the senior male A league, and 1.85 injuries per 1000 player hours (game and training hours) for the male senior B league (Quarrie et al., 2001).

Garraway et al. (2000) compared injury rates between amateur and professional rugby players in the Scottish Reivers club competition for the 1997-1998 competition. A period prevalence of 67.8 injuries per 1000 player game hours were recorded among professional players, while the senior amateur club players had 22.6 injuries per 1000 player game hours. Period prevalence of injuries in

senior club players in the same competition during the 1993-1994 season was 14.8 injuries per 1000 player game hours. The overall population of players who were injured increased from 27% in 1993-1994 to 47% in 1997-1998, indicating an increase in injury rates. Ninety percent of professional players were injured during the 1997-1998 season in only 15% more hours of competitive play than amateurs (Garraway et al., 2000).

TABLE 2: THE INCIDENCE OF INJURIES RECORDED IN PROFESSIONAL RUGBY UNION

	Targett, 1998 (1 Super 12 squad)	Holtzhausen, 2001 (3 Super 12 squads)	Garraway et al, 2000 (Players of the Borders Reivers District)	Bathgate et al, 2002 (Australian Wallaby players 1994-2000)	Le Roux (2 Currie Cup squads)	Total
Game injuries	39 game injuries	41 game injuries	68 game injuries	143 game injuries	75 game injuries	366 injuries
Total injuries	49 injuries	62 injuries	68 injuries*	143 injuries*	100 injuries	422 injuries
Hours of game play	327 hours	740 hours	1003 hours	1820.3 hours	400 hours	4290.3 hours
Game injuries per 1000 player game hours	119.3 game injuries per 1000 player game hours	55.4 game injuries per 1000 player game hours	67.8 game injuries per 1000 player game hours	78.6 game injuries per 1000 player game hours	187.5 game injuries per 1000 player game hours	85.3 game injuries per 1000 player game hours
Injuries per 1000 player game hours	150/1000 player game hours	84/1000 player game hours	67.8/1000 player game hours*	78.6/1000 player game hours*	250/1000 player game hours	98.4/1000 player game hours

*Only injuries during matches were included in the study

The incidence of injuries in professional rugby union sustained during training has not been well described. True incidence could only be determined in two studies, the 1999 Super 12 and 2002 Currie Cup competition, where actual training time was reported (Holtzhausen, 2001; le Roux, Unpublished data). A comparison between the two studies can be seen in Table 3. During the 1999 Super 12 competition, three squads reported twenty-one injuries in 4900 player training hours, or 4.3 training injuries per 1000 player training hours. This represents 34% of all injuries reported in the study (Holtzhausen, 2001). In the 2002 Currie Cup competition two teams reported 25 injuries in 4950 training hours, which is equal to 5 training injuries per 1000 player training hours. This calculated to 4.7 training injuries per 1000 player training hours.

To make further comparison of the above-mentioned studies with other studies possible, the training injuries were expressed as training injuries per 1000 player game hours. The 2002 Currie Cup competition reported 62.5 training injuries per 1000 player game hours (le Roux). The 1999 Super 12 competition reported 28 training injuries per 1000 player game hours (Holtzhausen, 2001), and the 1997 Super 12 competition one squad reported 30 training injuries per 1000 player game hours, representing 20% of injuries reported (Targett, 1998). The Australian Wallaby players (Bathgate et al., 2002) reported an injury rate of 9.3 training injuries per 1000 player game hours. A comparison between the training injuries for the four studies can be seen in Table 3. The average injuries sustained, expressed as training injuries per 1000 player game hours (32.7 training injuries per 1000 player game hours) is significantly higher than the figure

expressed as training injuries per 1000 training hours (4.7 training injuries per 1000 player training hours), thus signifying the importance of reporting actual training time.

TABLE 3: TRAINING INJURIES SUSTAINED DURING TRAINING IN PROFESSIONAL RUGBY UNION

STUDIES COMPARED	TRAINING HOURS	TRAINING INJURIES PER 1000 PLAYER TRAINING HOURS	TRAINING INJURIES PER 1000 PLAYER GAME HOURS
Targett, 1998 (1 Super 12 squad) [1]	-	-	30.6 training injuries/1000 player game hours [1]
Bathgate et al, 2002 (Australian Wallaby players) [2]	-	-	9.3 training injuries/1000 player game hours [2]
Holtzhausen, 2001 (3 Super 12 squads) [3]	4900 hours	4.3 training injuries/1000 player training hours	28.4 training injuries/1000 player game hours [3]
Le Roux (2 Currie Cup squads) [4]	4950 hours	5 training injuries/1000 player training hours	62.5 training injuries/1000 player game hours [4]
AVERAGE:	4925 hours	4.7 injuries/1000 player training hours	32.7 training injuries/1000 player game hours [5]

[1] 327 Player game hours recorded; 10 training injuries recorded
[2] 1820.3 Player game hours recorded; 17 training injuries recorded
[3] 740 Player game hours recorded; 21 training injuries recorded
[4] 400 Player game hours recorded; 25 training injuries recorded
[5] Combined total of 3287.3 player game hours recorded

4.3 NATURE AND SITE OF INJURY

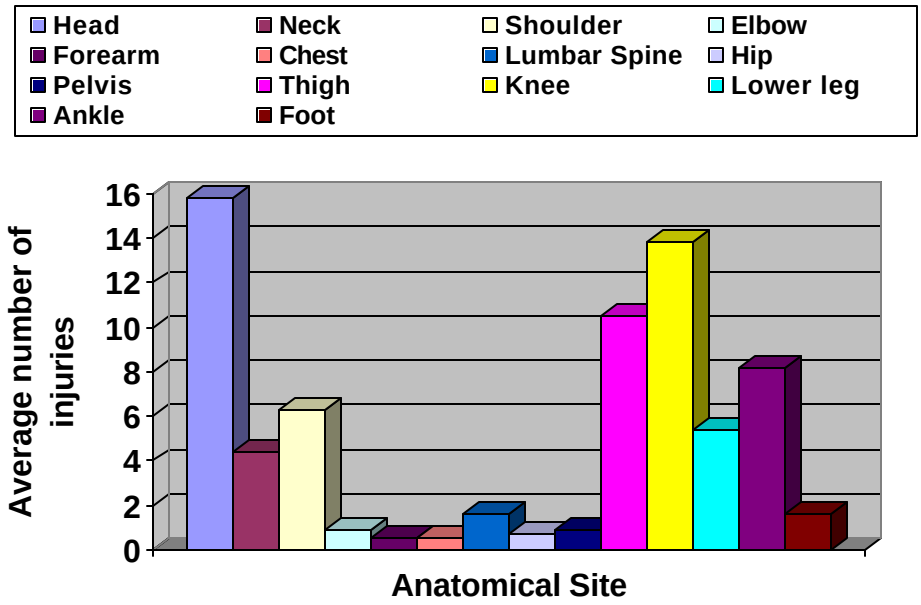
The regional distribution of injuries in professional rugby is shown in table 4. The highest injury rates were recorded in the lower limb, where the knee, thigh and ankle were the most commonly injured structures. The 1997 Super 12 squad reported head injuries (11 injuries, 34 injuries per 1000 player game hours) as the most common site of injury, knee injuries (6 injuries, 18 injuries per 1000 player game hours) as the second most common site of injury, and ankle injuries (5 injuries, 15 injuries per 1000 player game hours) as the third most common site of injury (Targett, 1998). The three Super 12 squads of 1999 reported the pelvis and hip as the most common site of injury (12 injuries; 16.2 injuries per 1000 player game hours) and the head and knee respectively (8% of injuries; 10.8 injuries per 1000 player game hours) as the second most common sites of injury (Holtzhausen, 2001). For professional rugby players the Border Reivers study reported 16 knee injuries as their most common site of injury (16 injuries per 1000 player game hours), with 10 hip and thigh injuries (10 injuries per 1000 player game hours) as the second most common site of injury, and 9 ankle and foot injuries (9 injuries per 1000 player game hours) as the third most common site of injury (Garraway et al., 2000). The two Currie Cup squads of 2002 reported thigh injuries as the most common site of injury (19% of injuries; 47.5 injuries per 1000 player game hours), with head injuries (16% of injuries; 32.5 injuries per 1000 player game hours) as the second most common site of injury (le Roux, Unpublished data). The Australian Wallaby players reported the

head as the most common injured structure (25.1% of injuries; 19.8 injuries per 1000 player game hours), followed by the knee (14% of injuries; 10.9 injuries per 1000 player game hours) and the thigh (13.6% of injuries; 10.4 injuries per 1000 player game hours) as the third most common site of injury (Bathgate et al., 2002).

Should a comparison be made between the five mentioned studies, and the injury rates and percentages be converted to injuries per 1000 player game hours, the following figures will result as the averages of the injuries in professional rugby as can be viewed in Figure 1.

The head injury is the most commonly injured body part with an average of 15.8 injuries per 1000 player game hours. The second most commonly injured structure is the knee with 13.8 injuries per 1000 player game hours, followed by the thigh with 10.5 injuries per 1000 player game hours, and the foot with 8.2 injuries per 1000 player game hours. The ankle reported an average injury rate of 8.2 injuries per 1000 player game hours, the shoulder an average of 6.3 injuries per 1000 player game hours, lower leg injuries an average of 5.4 injuries per 1000 player game hours, and neck injuries an average of 4.4 injuries per 1000 player game hours. The average for all lower limb injuries combined was 50.6 injuries per 1000 player game hours, the average for all upper limb injuries combined 14.7 injuries per 1000 player game hours, and the average for all trunk injuries combined 6.8 injuries per 1000 player game hours.

Figure 1: Average number of injuries per anatomical site recorded in professional rugby union



Evaluating the nature and site of injury for amateur rugby, it was found that the highest injury rates were reported for the lower limb, the head and face and the shoulder. Injuries to the head and face were mostly minor injuries, with facial lacerations making up the largest portion. Musculo-tendinous muscle strains and ligament sprains were the most common types of injury (Jakoet & Noakes, 1998; Bird et al., 1998; Hughes & Fricker, 1994).

In professional rugby a low incidence of chronic overuse type injuries were reported. Three studies discussed chronic overuse type injuries. During the 1999 Super 12 competition, the cohort of three squads reported six chronic overuse injuries that fit the definition of an injury used in that study (Holtzhausen, 2001).

These injuries could not be expressed in terms of injury per 1000 hours of exposure, because of the chronic nature of these conditions. Most of these were carried over from the previous season.

The 2002 Currie Cup competition reported 5 chronic overuse injuries for the two teams during the ten-week competition. These injuries could also not be expressed in terms of injury per 1000 hours of exposure, because most of them were carried over from the previous season.

The 1997 Super 12 squad reported two chronic overuse injuries, that did not prevent training, therefore not qualifying as “injuries” in the study design. Both required surgery after the Super 12 competition (Targett, 1998), emphasizing the serious nature of these injuries. Underreporting of this type of injury may have taken place because of the definitions of “injury” used in most rugby injury surveys, which are more suited in describing acute injuries.

During the 1999 Super 12 competition, three squads reported 11 recurrent injuries per 1000 player game hours (13% of injuries) (Holtzhausen, 2001). In the Scottish Border Reivers competition, 56% of all injury episodes for professional players in 1997-1998 were recurrent, compared with 29% for amateurs in 1997-1998 and 18% for all players in 1993-1994 (Garraway et al., 2000; Garraway & Macleod, 1995; Lee & Garraway, 1996). The 2002 Currie Cup competition reported 65 recurrent injuries per 1000 player game hours, which

represents 26% of all injuries (le Roux, Unpublished data). In the study on Australian Wallaby players, 90% of all injuries were acute, with the remainder being either chronic or a recurrent.

TABLE 4: THE SITE OF INJURIES RECORDED IN PROFESSIONAL RUGBY UNION (FIGURES IN BRACKETS INDICATE INJURIES PER 1000 PLAYER GAME HOURS)

Main	Acute general	Acute seasonal	Targett, 1998 (1 Super 12 squad)	Holtzhausen, 2001 (3 Super 12 squads)	Garraway et al, 2000 (Players of the Borders Reivers District)*	Bathgate et al, 2002 (Australian Wallaby players 1994-2000)*	Le Roux (2 Currie Cup squads)	Total no of injuries	Incidence per 1000 player game hours
Overall			49 (150)	62 (84)	68 (67,8)	143 (78.6)	100 (250)	441	102.8
Regional (anatomical)	Head	All	11 (34)	8 (11)	-	36 (19.8)	13 (32.5)	68	15.8
	Neck	All	3 (9)	3 (4)	2 (1,99) [7]	5 (2.8)	6 (15)	19	4.4
	Upper limb	All	10 (30)	7 (10)	6 (5,98) [7]	22 (12.1)	18 (45)	63	14.7
		Shoulder	4 (12)	4 (5)	4 (3,99) [7]	9 (4.9)	6 (15)	27	6.3
		Elbow	3 (9)	- [3]	-	1 (0.5)	- [3]	4	0.9
		Forearm	-	- [3]	-	2 (1.1)	- [3]	2	0.5
		Wrist	- [2]	- [3]	-	- [8]	- [3]	-	-
		Hand	- [2]	- [3]	-	- [8]	- [3]	-	-
	Trunk	Total	3 (9)	5 (7)	1 [7]	6 (3.3)	14 (35)	29	6.8
		Chest	-	- [4]	-	2 (1.1)	- [4]	2	0.5
		Thoracic spine	-	- [4]	-	-	- [4]	-	-
		Lumbar spine	3 (9)	- [4]	-	4 (2.2)	- [4]	7	1.6
		Abdominal	-	- [4]	-	-	- [4]	-	-
	Lower Limb	Total	20 (60)	39 (53)	35 (34,86) [7]	74 (40.7) [5]	49 (122.5)	217	50.6
		Hip	- [5]	- [5]	- [5]	3 (1.7)	- [5]	3	0.7
		Pelvis	4 (12)	- [5]	- [5]	-	- [5]	4	0.9
		Thigh	- [5]	7 (10)	- [5]	19 (10.4)	19 (47.5)	45	10.5
		Knee	6 (18)	8 (11)	16 (15,96)	20 (10.9)	9 (22.5)	59	13.8
		Lower leg	2 (16)	4 (5)	-	8 (4.4)	9 (22.5)	23	5.4
		Ankle	5 (15)	7 (10)	- [6]	15 (8.2)	8 (20)	35	8.2
		Foot	-	1 (1,5)	- [6]	5 (2.7)	1 (2.5)	7	1.6

*Only injuries during games were included in this study
[1]Total number of playing hours: 4291.3 (Garraway – 1004 playing hours; Holtzhausen – 740 playing hours; Targett – 327 playing hours; Bathgate – 1820.3 playing hours; le Roux – 400 playing hours)
[2]Targett: Hand/wrist injuries: 2 (6/1000 playing hours); Upper arm injuries: 1 (3/1000 playing hours)
[3]Holtzhausen: Arm/hand injuries: 3 (4/1000 playing hours)
le Roux: Arm/hand injuries: 12 (20/1000 playing hours)
[4]Holtzhausen: Trunk injuries: 3 (4/1000 playing hours); Back injuries: 2 (3/1000 playing hours)
le Roux: Trunk injuries: 9 (22.5/1000 playing hours); Back injuries:5 (12.5/1000 playing hours)
[5]Targett: Groin injuries: 4 (12/1000 playing hours); Thigh/hip injuries: 3 (9/1000 playing hours)
Holtzhausen: Pelvis/hip injuries: 12 (16/1000 playing hours)
Garraway: Hip/Thigh injuries: 10 (3.99/1000 playing hours)
Bathgate: Groin injuries: 4 (2.2/1000 playing hours)
Le Roux: Pelvis/hip injuries: 3 (7.5/1000 playing hours)
[6]Garraway: Ankle and foot injuries: 9 (3.99/1000 playing hours)
[7]Only dislocations, sprains and strains reported
[8]Bathgate: Hand/wrist injuries: 8 (4.4/1000 playing hours); Upper arm injuries: 2 (1.1/1000 playing hours)

The nature of injuries in professional rugby is shown in table 5. The 1997 Super 12 study reported musculo-tendinous sprains and strains as the most common type of injury (29% of injuries; 43 injuries per 1000 player game hours), and contusions as the second most common (22% of injuries; 34 injuries per 1000 player game hours) (Targett, 1998). The three Super 12 squads of 1999 reported ligament sprains (26% of injuries; 22 injuries per 1000 player game hours) and musculo-tendinous tears (24% of injuries; 20 injuries per 1000 player game hours) as the most common type of injury (Holtzhausen, 2001). In the study on the Currie Cup players of 2002, contusions/haematomas formed the greatest part of injuries (29% of injuries; 72.5 injuries per 1000 player game hours), with ligament sprains second (24% of injuries; 60 injuries per 1000 player game hours), and muscle/tendon strain/tears (16% of injuries; 40 injuries per 1000 player game hours) as the third most common (le Roux, Unpublished data). The study on elite Australian Wallaby players reported that ligament sprain/tears (26% of injuries) were most common, followed by lacerations (23% of injuries), and muscle/tendon sprain/tear (20% of injuries) as the thirdly most common injured (Bathgate et al., 2002).

In order to make comparison possible, the four available studies that reported on the nature of injuries were all expressed as injuries per 1000 player game hours. The average was then calculated based on the result for each individual study, and expressed as injuries per 1000 player game hours as seen in Table 2.

Figure 2: Average number of injuries according to nature recorded in professional rugby union

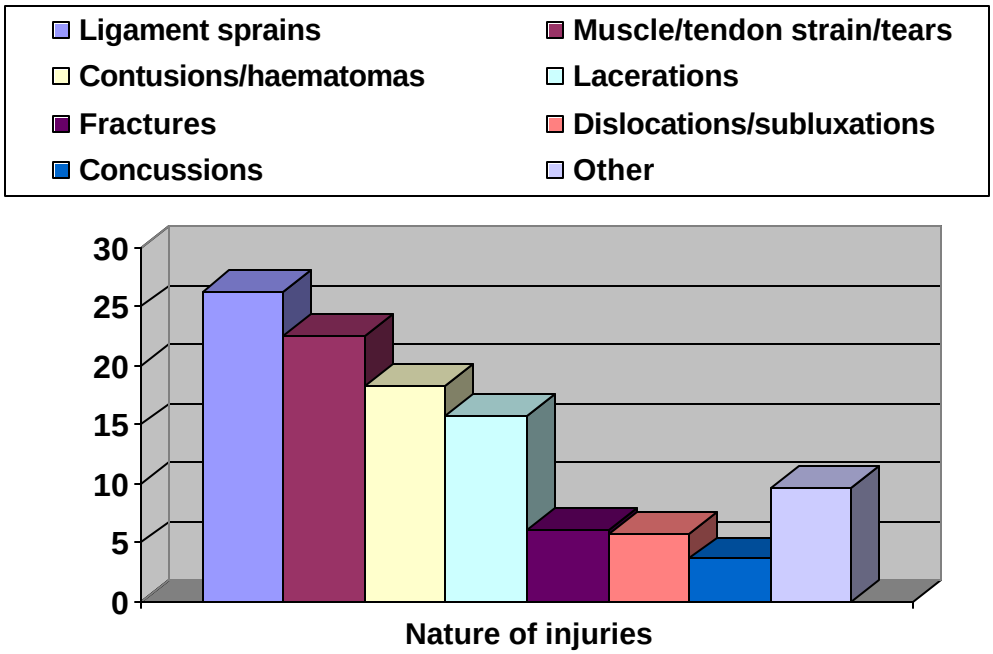


Table 5 shows the comparison between the four available studies. From the comparison it is evident that ligament sprains is significantly the most common type of injury (p=0.07) with an average of 26.2 injuries per 1000 player game hours. The second most common type of injury is muscle/tendon strains/tears with 22.5 injuries per 1000 player game hours, and thirdly contusions/haematomas with 18.3 injuries per 1000 player game hours. Lacerations reported an average injury rate of 15.8 injuries per 1000 player game hours, fractures an average injury rate of 6.1 injuries per 1000 player game hours, and dislocations/subluxations an average injury rate of 5.8 injuries per 1000 player game hours. Concussions reported an injury rate of 3.7 injuries per

1000 player game hours, and all the other injuries with minor injury rates reported were combined to form an average of 9.7 injuries per 1000 player game hours.

TABLE 5: THE NATURE OF INJURIES RECORDED IN PROFESSIONAL RUGBY UNION (FIGURES IN BRACKETS INDICATE INJURIES PER 1000 PLAYER GAME HOURS)

Injury Type	Targett, 1998 (1 Super 12 squad)[1]	Holtzhausen, 2001 (3 Super 12 squads)[2]	Bathgate et al, 2002 (Australian Wallaby players 1994-2000)*[3]	Le Roux (2 Currie Cup squads)[4]	Total Injuries[5]
Ligament sprains	9 (27.5)	16 (21.6)	37 (20.3)	24 (60.0)	86 (26.2)
Muscle/tendon strain/tears	14 (42.8)	15 (20.3)	29 (15.9)	16 (40.0)	74 (22.5)
Contusion/haematomas	11 (33.6)	6 (8.1)	14 (7.7)	29 (72.5)	60 (18.3)
Lacerations	6 (18.3)	6 (8.1)	33 (18.1)	7 (17.5)	52 (15.8)
Fractures	1 (3.0)	5 (6.8)	11 (6.0)	3 (7.5)	20 (6.1)
Dislocations/subluxations	1 (3.0)	4 (5.4)	9 (4.9)	5 (12.5)	19 (5.8)
Concussions	0	1 (1.4)	7 (3.8)	3 (7.5)	12 (3.7)
Other	7 (21.4)	9 (12.2)	3 (1.6)	13 (32.5)	32 (9.7)

* Only injuries during games were included in this study
[1] Targett – 327 playing hours
[2] Holtzhausen – 740 playing hours
[3] Bathgate – 1820.3 playing hours
[4] le Roux – 400 playing hours
[5] Total number of playing hours: 3287.3

4.4 SEVERITY OF INJURIES

During the 2002 Currie Cup competition, two squads recorded 70% minor injuries (175 injuries per 1000 player game hours), 24% intermediate injuries (60 injuries per 1000 player game hours), and 6 serious injuries (15 injuries per 1000 player game hours) (le Roux, Unpublished data).

During the 1999 Super 12 competition, three squads recorded 39% minor injuries (32/1000 player game hours), 27% intermediate injuries (23/1000 player game hours), and 33% severe injuries (28/1000 player game hours)(Holtzhausen, 2001). During the 1996 Super 12 competition, one squad recorded 70% minor injuries (110/1000 player game hours), 20% intermediate injuries (28/1000 player game hours), and 11% serious injuries (18/1000 player game hours)(Targett, 1998). The 1994 to 2000 Australian Wallaby squads reported an average of 64% minor injuries (50 injuries per 1000 player game hours), 14% moderate injuries (11 injuries per 1000 player game hours), and 22% serious injuries (18 injuries per 1000 player game hours) (Bathgate et al, 2002). The study on the Scottish Borders Reivers district reported an average of 59% minor injuries (40 injuries per 1000 player game hours), 28% moderate injuries (19 injuries per 1000 player game hours), and 13% severe injuries (9 injuries per 1000 player game hours)(Garraway et al., 2000). A comparison between the severity of injuries in the four studies is shown in Table 6. The numbers of severe injuries in the five studies have a strong correlation, while for moderate injuries, the 2002 Currie Cup competition reported a significantly higher injury rate. The other four studies

show significant correlation for moderate injuries. The injury rate for mild injuries is reported to be significantly higher for the Currie Cup than the 1997 Super 12, significantly higher for the 1997 Super 12 compared to the Australian Wallaby study, and significantly higher for the Australian Wallaby study compared to the other three studies. When the totals of injuries in the different severity categories are compared to each other, mild injuries are significantly higher than moderate injuries ($p=0.009$), and significantly higher than severe injuries ($p=0.005$). There is no significant difference between moderate and severe injuries ($p=0.7$).

TABLE 6: SEVERITY OF INJURIES IN PLAYERS IN PROFESSIONAL RUGBY UNION

STUDIES COMPARED	SEVERITY OF INJURIES		
	MILD **Number of Injuries** **(Injuries per 1000 player game hours in brackets)**	**MODERATE** **Number of Injuries** **(Injuries per 1000 player game hours in brackets)**	**SEVERE** **Number of Injuries** **(Injuries per 1000 player game hours in brackets)**
Targett, 1998 (1 Super 12 squad)[1]	36 (110/1000 player game hours)[1]	9 (28/1000 player game hours)[1]	6 (18/1000 player game hours)[1]
Holtzhausen, 2001 (3 Super 12 squads)[2]	24 (32/1000 player game hours)[2]	17 (23/1000 player game hours)[2]	21 (28/1000 player game hours)[2]
Le Roux et al (2 Currie Cup squads)[3]	70 (175/1000 player game hours)[3]	24 (60/1000 player game hours)[3]	6 (15/1000 player game hours)[3]
Bathgate et al, 2002 (1994–2000 Australian Wallaby players)[4]	91 (50/1000 player game hours)[4]	20 (11/1000 player game hours)[4]	32 (18/1000 player game hours)[4]
Garraway et al, 2000 (Scottish Borders Reivers district)[5]	40 (40/1000 player game hours)[5]	19 (19/1000 player game hours)[5]	9 (9/1000 player game hours)[5]
TOTAL:	261 (61/1000 player game hours)[6]	89 (21/1000 player game hours)[6]	74 (17/1000 player game hours)[6]

[1] 327 Player game hours recorded
[2] 740 Player game hours recorded
[3] 400 Player game hours recorded
[4] 1820.3 Player game hours recorded
[5] 1004 Player game hours recorded
[6] Combined total of 4291.3 player game hours recorded

4.5 MECHANISM OF INJURY

The Currie Cup study and the two Super 12 studies reported the tackle as the most frequent cause of injury, while the two Super 12 studies also found it to be the most frequent cause of severe injuries in professional rugby union. A comparison between the three studies can be seen in Table 7. In these three studies, a total 47 injuries per 1000 player game hours were sustained in the tackle, of which 21.8 injuries per 1000 player game hours were of moderate or serious nature. The ruck and maul phases were responsible for the second most injuries in all three studies, totaling 23.8 injuries per 1000 player game hours, of which 5.5 injuries per 1000 hours were of moderate or severe nature. In all three studies the scrum were responsible for the third most injuries, totaling 4.8 injuries per 1000 player game hours, with 2 injuries per 1000 player game hours being of moderate or severe nature. The lineout caused 2.7 injuries per 1000 player game hours, and 0.7 injuries per 1000 player game hours were of moderate or severe nature. The reason for the low injury rates in the set phases of play might be as a result of the law changes that have been implemented over the years to improve the safety of the game.

Since 1990 there have been a number of studies reporting on the mechanism of injury. All of these reported the tackle to be the phase of play where most injuries were sustained (Jakoet & Noakes, 1998; Bird et al., 1998; Targett, 1998; Garraway et al., 2000; Holtzhausen et al., 2001; Hughes & Fricker, 1994; Lee &

Garraway, 1996; Garraway & Macleod, 1995; le Roux, Unpublished data). During the 1995 Rugby World Cup the tackle was responsible for 56% of injuries, of which being tackled caused 29%, and 27% by tackling. The loose scrum was the second most dangerous phase of play in the competition, causing 23% of injuries. The scrums and lineouts with 1% and 0% of injuries respectively, were the safest phases of play (Jakoet & Noakes, 1998). In the study on amateur and professional rugby players in the Border Reivers competition, the highest proportion of injury occurred in the tackle, namely 48%. Higher percentage professional players were injured while being tackled (37%) than amateurs (26%). Of all scrumhalves 70% of players in this position were injured while tackling (Garraway et al., 2000). Bird et al. (1998) reported in their survey on the incidence, nature and circumstances of injuries during the 1993 season in Dunedin, New Zealand, that the tackle was responsible for 40%, which is the most injuries in all age groups, while rucks and mauls were responsible for 29%, which are the second most injuries. Scrums were relatively safe, causing only 7% of injuries (Bird et al., 1998). Hughes & Fricker (1994) did a study involving 8 amateur clubs competing in the Australian Capital Territories First League during the 1992 season. In this study tackling was responsible for 50% of all injuries, while injuries caused by rucks and mauls were second most common with 23% of injuries. Set phases were relatively safe with 5% of injuries sustained in scrums and 2% of injuries sustained in lineouts (Hughes & Fricker, 1994). There is a definite significant difference between the four mechanisms of injuries for the three studies ($p=0.0002$).

TABLE 7: MECHANISM (PHASE OF PLAY) AND SEVERITY OF INJURIES IN PLAYERS IN THREE PROSPECTIVE COHORT STUDIES (2 SUPER 12 SQUADS & 1 CURRIE CUP SQUAD).

SQUADS EVALUATED	SEVERITY OF INJURIES	PHASE OF PLAY			
		TACKLE Number of injuries (Injuries per 1000 player game hours in brackets)	**RUCK/MAUL** Number of injuries (Injuries per 1000 player game hours in brackets)	**SCRUM** Number of injuries (Injuries per 1000 player game hours in brackets)	**LINEOUT** Number of injuries (Injuries per 1000 player game hours in brackets)
Targett, 1998 (1 Super 12 squad)[1]	Mild	11 (34/1000 player hours)	13 (40/1000 player hours)	1 (3/1000 player hours)	1 (3/1000 player hours)
	Intermediate	2 (6/1000 player hours)	1 (3/1000 player hours)	2 (6/1000 player hours)	0
	Severe	5 (15/1000 player hours)	0	0	1 (3/1000 player hours)
Holtzhausen, 2001 (3 Super 12 squads)[2]	Mild	9 (12/1000 player hours)	2 (3/1000 player hours)	2 (3/1000 player hours)	2 (3/1000 player hours)
	Intermediate	6 (8/1000 player hours)	2 (3/1000 player hours)	0	0
	Severe	10 (14/1000 player hours)	3 (4/1000 player hours)	0	0
Le Roux (2 Currie Cup squads)[3]	Mild	17(42.5/1000 player hours)	12 (30/1000 player hours)	1 (2.5/1000 player hours)	0
	Intermediate	5 (12.5/1000 player hours)	2 (5/1000 player hours)	1 (2.5/1000 player hours)	0
	Severe	4 (10/1000 player hours)	0	0	0
TOTAL OF MODERATE AND SEVERE INJURIES PER PHASE OF PLAY[4]		32 (21.8/1000 player hours)	8 (5.5/1000 player hours)	3 (2/1000 player hours)	1 (0.7/1000 player hours)
TOTAL INJURIES PER PHASE OF PLAY[4]		69 (47/1000 player hours)	35 (23.8/1000 player hours)	7 (4.8/1000 player hours)	4 (2.7/1000 player hours)

[1] 327 Player game hours recorded
[2] 740 Player game hours recorded
[3] 400 Player game hours recorded
[4] Combined total of 1467 player game hours

4.6 PLAYER POSITION

Previous studies have not been able to significantly determine trends in the proportion of injury episodes through literature for professional and amateur rugby union. Firstly comparison has not been possible due to the fact that not all positions were reported individually and secondly due to the lack of training time being reported. In order to make comparison possible and to overcome this problem, the average percentage for a group of positions were allocated to each position respectively. The injury rates were also then calculated as injuries per 1000 player game hours. In the 1995 Rugby World Cup, loose forwards (2.7 injuries per 1000 player game hours) were most commonly injured, followed by scrumhalves and flyhalves (2.5 injuries per 1000 player game hours), and hookers and locks (2.3 injuries per 1000 player game hours) as the third most commonly injured position (Jakoet & Noakes, 1998). The 1992 Australian Capital Territories club league revealed the eigthman (6.6 injuries per 1000 player game hours) as most commonly injured position, followed by the center (4 injuries per 1000 player game hours) and flanker (3.9 injuries per 1000 player game hours) (Hughes & Fricker, 1994). In the 1997 Super 12 Study, the eigthman (24 injuries per 1000 player game hours) was the most commonly injured position, followed by the prop (18 injuries per 1000 player game hours) and thirdly the fullback (15 injuries per 1000 player game hours) (Targett, 1998). The 1999 Super 12 study documented the fullback and the center (8 injuries per 1000 player game hours) as the most commonly injured position, followed by the hooker (7 injuries per

1000 player game hours) (Holtzhausen, 2001). The 2002 Currie Cup study found the prop (21.3 injuries per 1000 player game hours) to be the most commonly injured position, followed by the eigthman and scrumhalf (20 injuries per 1000 player game hours) (le Roux, Unpublished data). In the 1994 to 2000 Australian Wallaby study, the lock (7.4 injuries per 1000 player game hours) was the most commonly injured position, followed by the eigthman (6.6 injuries per 1000 player game hours) and thirdly the flyhalf (6 injuries per 1000 player game hours) (Bathgate et al., 2002).

Table 8 illustrates the combined average rates of injury per playing position for five studies. According to the averages the eigthman was the most commonly injured position with 11.3 injuries per 1000 player game hours. The prop was the second most commonly injured position with 9.1 injuries per 1000 player game hours, and the fullback the third most commonly injured position with 8.4 injuries per 1000 player game hours (the average injury rate for all playing positions is 7.4 injuries per 1000 player game hours).

TABLE 8: COMBINED AVERAGE RATES OF INJURY FOR PROFESSIONAL RUGBY UNION

Playing Position	Hughes et al, 1994 (First grade players) Injuries per 1000 playing hours	Jakoet et al, 1997 (1995 Rugby World cup) Injuries per 1000 playing hours	Targett, 1998 (1 Super 12 squad) Injuries per 1000 playing hours	Holtzhausen, 2001 (3 Super 12 squads) Injuries per 1000 playing hours	Le Roux (2 Currie Cup Squads) Injuries per 1000 playing hours	Bathgate et al, 2002 (1994 -2000 Australian Wallaby Players) Injuries per 1000 playing hours	Average Injuries per 1000 playing hours
Eigthman	6.6	2.7	24	3	20.0	6.6	10.5
Prop	2.4	0.9	18	3	21.3	5.2	8.5
Fullback	2.9	0.9	15	8	15.0	4.9	7.8
Hooker	2.6	2.3	9	7	17.5	5.5	7.3
Center	4.0	1.6	9	8	15.0	5.5	7.2
Lock	2.6	2.3	14	5	11.3	7.4	7.1
Flanker	3.9	2.7	9	5	16.3	4.7	6.9
Wing	2.4	1.6	8	6	17.5	3.9	6.6
Scrumhalf	2.6	2.5	6	5	20.0	2.2	6.4
Flyhalf	3.6	2.5	3	5	15.0	6	5.9
Average	3.4	2.0	11.5	5.5	16.9	5.2	7.4

4.7 DISCUSSION

Methodology

This chapter attempted to present the epidemiology of injuries in professional rugby union. The professional era started in 1995, and therefore all studies used contained data from 1994 onwards. Certain difficulties were encountered during the course of the study, from which the following discussion points are made.

The method of reporting injuries was the most prohibiting factor encountered. A uniformed method of reporting should certainly be made available to future researchers. These adjustments will then enable researchers in the field to make more significant deductions and determine trends in the field of sports medicine, and at the end of the day reach our goal of making the sport a safer one to participate in.

Re-injury should be clearly defined and reported as such. Player positions should be standardized for purposes of reporting injury rates per player position, and corrections should be made for player positions of which there are two per team. Description of the pathological type of injury needs clear description, as terms such as sprains and strains have been used in different context in different studies.

Definition of an injury should be standardized for acute and chronic overuse injury, and whether they are game, training, or general injuries. General injuries, such as falling down stairs, should not be included in the study figures, due to

these injuries not forming part of the game and training environment. Although it may not be possible to standardize a protocol for all future studies, they should at least strive to standardize the definition of an injury, and the definition of injury rates.

The International Rugby Board (IRB) is the international governing body of rugby union, and is in an ideal position to recommend standardized research methods in rugby union. All the inputs from the various authors who have made recommendations on this subject should be taken into consideration, and then be published by the IRB as the recommended research method for future studies.

Injury Rates

A high incidence of injuries exists in rugby union. To make comparison between the different studies possible, the total amount of injuries were expressed as injuries per 1000 player game hours. The average injury rate for professional rugby union determined by five studies is 98.4 injuries per 1000 player game hours. The lowest injury rate reported (Garraway et al., 2000) was 67.8 injuries per 1000 player game hours, and highest injury rate reported was this study with 250 injuries per 1000 player game hours. The large difference in report of injury rates might be that the injury report forms for some of the studies are completed by the team doctors who have a direct involvement with the game, whereas with other studies third parties are used to complete the injury report forms. If the total amount of game injuries is expressed by game hours, a total of 85.3 game

injuries per 1000 player game hours is found. One study made a comparison between re-injury rates between amateur and professional rugby, and described an alarmingly high re-injury rate in professional rugby players. Training injuries were then expressed in different ways to enable comparison. An average of 4.7 training injuries per 1000 player training hours were found, and an average of 32.7 training injuries per 1000 player game hours were calculated. Injury rates during training are much lower than injury rates for matches. Injury rates in professional rugby union do not increase as the level of participation increases.

Nature and site of injury

A comparison between five studies was made, and the injury rates and percentages were converted to injuries per 1000 player game hours. The following figures resulted as the averages of the injuries in professional rugby:
The head injury is the most commonly injured body part with an average of 15.8 injuries per 1000 player game hours. h a study on elite Australian rugby union players, Bathgate et al (2002) determined 19.4% of all injuries sustained to the head were concussions. Taking into consideration the seriousness of the injury, this is cause for great concern. The second most commonly injured structure is the knee with 13.8 injuries per 1000 player game hours, followed by the thigh with 10.5 injuries per 1000 player game hours, and the foot with 8.2 injuries per 1000 player game hours. The ankle reported an average injury rate of 8.2 injuries per 1000 player game hours, the shoulder an average of 6.3 injuries per

1000 player game hours, lower leg injuries an average of 5.4 injuries per 1000 player game hours, and neck injuries an average of 4.4 injuries per 1000 player game hours. The average for all lower limb injuries combined was 50.6 injuries per 1000 player game hours, the average for all upper limb injuries combined 14.7 injuries per 1000 player game hours, and the average for all trunk injuries combined 6.8 injuries per 1000 player game hours.

In professional rugby a low incidence of chronic overuse type injuries were reported. Three studies discussed chronic overuse type injuries. During the 1999 Super 12 competition, the cohort of three squads reported six chronic overuse injuries that fit the definition of an injury used in that study (Holtzhausen, 2001). These injuries could not be expressed in terms of injury per 1000 hours of exposure, because of the chronic nature of these conditions. Most of these were carried over from the previous season. The 2002 Currie Cup competition reported 5 chronic overuse injuries for the two teams during the ten-week competition. These injuries could also not be expressed in terms of injury per 1000 hours of exposure, because most of them were carried over from the previous season. The 1997 Super 12 squad reported two chronic overuse injuries, that did not prevent training, therefore not qualifying as “injuries” in the study design. Both required surgery after the Super 12 competition (Targett, 1998), emphasizing the serious nature of these injuries. Underreporting of this type of injury may have taken place because of the definitions of “injury” used in most rugby injury surveys, which are more suited in describing acute injuries.

During the 1999 Super 12 competition, three squads reported 11 recurrent injuries per 1000 player game hours (13% of injuries) (Holtzhausen, 2001). In the Scottish Border Reivers competition, 56% of all injury episodes for professional players in 1997-1998 were recurrent, compared with 29% for amateurs in 1997-1998 and 18% for all players in 1993-1994 (Garraway et al., 2000; Garraway & Macleod, 1995; Lee & Garraway, 1996). The 2002 Currie Cup competition reported 65 recurrent injuries per 1000 player game hours, which forms 26% of all injuries (le Roux, Unpublished data). In the study on Australian Wallaby players, 90% of all injuries were acute, with the remainder being either chronic or a recurrence.

In order to make comparison possible, the four available studies that reported on the nature of injuries were all expressed as injuries per 1000 player game hours. The average was then calculated based on the result for each individual study, and expressed as injuries per 1000 player game hours.

The 1997 Super 12 study reported musculo-tendinous sprains and strains as the most common type of injury (29% of injuries; 43 injuries per 1000 player game hours), and contusions as the second most common (22% of injuries; 34 injuries per 1000 player game hours) (Targett, 1998). The three Super 12 squads of 1999 reported ligament sprains (26% of injuries; 22 injuries per 1000 player game hours) and musculo-tendinous tears (24% of injuries; 20 injuries per 1000 player game hours) as the most common type of injury (Holtzhausen, 2001). In

the study on the Currie Cup players of 2002, contusions/haematomas formed the greatest part of injuries (29% of injuries; 72.5 injuries per 1000 player game hours), with ligament sprains second (24% of injuries; 60 injuries per 1000 player game hours), and muscle/tendon strain/tears (16% of injuries; 40 injuries per 1000 player game hours) as the third most common (le Roux). The study on elite Australian Wallaby players reported that ligament sprain/tears (26% of injuries) were most common, followed by lacerations (23% of injuries), and muscle/tendon sprain/tear (20% of injuries) as the thirdly most common injured (Bathgate et al, 2002).

A comparison between the five studies revealed that ligament sprains are the most common type of injury with an average of 26.2 injuries per 1000 player game hours. The second most common type of injury is muscle/tendon strains/tears with 22.5 injuries per 1000 player game hours, and thirdly contusions/haematomas with 18.3 injuries per 1000 player game hours. Lacerations reported an average injury rate of 15.8 injuries per 1000 player game hours, fractures an average injury rate of 6.1 injuries per 1000 player game hours, and dislocations/subluxations an average injury rate of 5.8 injuries per 1000 player game hours. Concussions reported an injury rate of 3.7 injuries per 1000 player game hours, and all the other injuries with minor injury rates reported were combined to form an average of 9.7 injuries per 1000 player game hours.

Severity Of Injuries

During the 2002 Currie Cup competition, two squads recorded 70% minor injuries (175 injuries per 1000 player game hours), 24% intermediate injuries (60 injuries per 1000 player game hours), and 6 serious injuries (15 injuries per 1000 player game hours) (le Roux, Unpublished data).

During the 1999 Super 12 competition, three squads recorded 39% minor injuries (32/1000 player game hours), 27% intermediate injuries (23/1000 player game hours), and 33% severe injuries (28/1000 player game hours)(Holtzhausen, 2001). During the 1996 Super 12 competition, one squad recorded 70% minor injuries (110/1000 player game hours), 20% intermediate injuries (28/1000 player game hours), and 11% serious injuries (18/1000 player game hours)(Targett, 1998). The 1994 to 2000 Australian Wallaby squads reported an average of 64% minor injuries (50 injuries per 1000 player game hours), 14% moderate injuries (11 injuries per 1000 player game hours), and 22% serious injuries (18 injuries per 1000 player game hours) (Bathgate et al., 2002). The study on the Scottish Borders Reivers district reported an average of 59% minor injuries (40 injuries per 1000 player game hours), 28% moderate injuries (19 injuries per 1000 player game hours), and 13% severe injuries (9 injuries per 1000 player game hours)(Garraway et al., 2000). When comparing the five studies with each other, the following deductions can be made: The numbers of severe injuries in the five studies have a strong correlation, while for moderate injuries, the 2002 Currie Cup competition reported a significantly higher injury rate. The other four studies

show significant correlation for moderate injuries. The injury rate for mild injuries is reported to be significantly higher for the Currie Cup than the 1997 Super 12, significantly higher for the 1997 Super 12 compared to the Australian Wallaby study, and significantly higher for the Australian Wallaby study compared to the other three studies.

Every epidemiological surveillance system has it's individual advantages and disadvantages, with under-reporting a consistent feature (Sharp et al., 2001), therefore minor injuries may have been underreported in the other studies, and may explain the large difference in incidence of injuries reported in the three studies. The biggest differences in injury rates is found at the mild injuries, and this coincides with the suggestion that underreporting may have taken place.

A second possible explanation is the fact that all the games from the Currie Cup competition was played on South African soil, which is generally perceived to be harder than that of Australia and New Zealand. Also do teams including the smaller unions play this competition, and smaller unions generally lack to the larger unions in terms of preparations of their playing fields, and might this be a cause to the fact that more games are played on the harder surfaces. This might then contribute to the higher injury rates than for the other competitions. Further study and analysis need to be done in this aspect to determine the firmness and comprehension of the different playing fields across the country, and possibly the

world. A detailed analysis of the type of injury and the playing surface will then reveal the influence of the playing field.

Mechanism Of Injury

The Currie Cup study and the two Super 12 studies reported the tackle as the most frequent cause of injury, while the two Super 12 studies also found it to be the most frequent cause of severe injuries in professional rugby union. In these three studies, a total 47 injuries per 1000 player game hours were sustained in the tackle, of which 21.8 injuries per 1000 player game hours were moderate or serious injuries. The ruck and maul phases were responsible for the second most injuries in all three studies, totaling 23.8 injuries per 1000 player game hours, of which 5.5 injuries per 1000 hours were of moderate or severe nature. In all three studies the scrum were responsible for the third most injuries, totaling 4.8 injuries per 1000 player game hours, with 2 injuries per 1000 player game hours being of moderate or severe nature. The lineout caused 2.7 injuries per 1000 player game hours, and 0.7 injuries per 1000 player game hours were of moderate or severe nature. The reason for the low injury rates in the set phases of play might be as a result of the law changes that have been implemented over the years to improve the safety of the game.

Since 1990 there have been a number of studies reporting on the mechanism of injury. All of these reported the tackle to be the phase of play where most injuries

were sustained (Jakoet & Noakes, 1998; Bird et al., 1998; Targett, 1998; Garraway et al., 2000; Holtzhausen, 2001; Hughes & Fricker, 1994; Lee & Garraway, 1996; Garraway & Macleod, 1995; le Roux, Unpublished data). During the 1995 Rugby World Cup the tackle was responsible for 56% of injuries, of which being tackled caused 29%, and 27% by tackling. The loose scrum was the second most dangerous phase of play in the competition, causing 23% of injuries. The scrums and lineouts with 1% and 0% of injuries respectively, were the safest phases of play (Jakoet & Noakes, 1998). In the study on amateur and professional rugby players in the Border Reivers competition, the highest proportion of injury occurred in the tackle, namely 48%. Higher percentage professional players were injured while being tackled (37%) than amateurs (26%). Of all scrumhalves 70% of players in this position were injured while tackling (Garraway et al., 2000). Hughes & Fricker (1994) reported in their survey on the incidence, nature and circumstances of injuries during the 1993 season in Dunedin, New Zealand, that the tackle was responsible for 40%, which is the most injuries in all age groups, while rucks and mauls were responsible for 29%, which are the second most injuries. Scrums were relatively safe, causing only 7% of injuries (Bird et al., 1998). Hughes & Fricker (1994) did a study involving 8 amateur clubs competing in the Australian Capital Territories First League during the 1992 season. In this study tackling was responsible for 50% of all injuries, while injuries caused by rucks and mauls were second most common with 23% of injuries. Set phases were relatively safe with 5% of injuries

sustained in scrums and 2% of injuries sustained in lineouts (Hughes & Fricker, 1994).

Coaching and training staff should therefore teach players proper technique for tackling other players, and absorbing pressure when being tackled.

Player Position

Previous studies have not been able to significantly determine trends in the proportion of injury episodes through literature for professional and amateur rugby union. Firstly comparison has not been possible due to the fact that not all positions were reported individually, and secondly due to the lack of training time being reported. In order to make comparison possible and to overcome this problem, the average for a group of positions were allocated to each position respectively. The injury rates were also then calculated as injuries per 1000 player game hours. In the 1995 Rugby World Cup, loose forwards (2.7 injuries per 1000 player game hours) were most commonly injured, followed by scrumhalves and flyhalves (2.5 injuries per 1000 player game hours), and hookers and locks (2.3 injuries per 1000 player game hours) as the third most commonly injured position (Jakoet & Noakes, 1998). The 1992 Australian Capital Territories club league revealed the eigthman (6.6 injuries per 1000 player game hours) as most commonly injured, followed by the center (4 injuries per 1000 player game hours) and flanker (3.9 injuries per 1000 player game hours) (Hughes et al, 1994). In the 1997 Super 12 Study, the eigthman (24 injuries per

1000 player game hours) was the most commonly injured position, followed by the prop (18 injuries per 1000 player game hours) and thirdly the fullback (15 injuries per 1000 player game hours) (Targett, 1998). The 1999 Super 12 study documented the fullback and the center (8 injuries per 1000 player game hours) as the most commonly injured position, followed by the hooker (7 injuries per 1000 player game hours) (Holtzhausen, 2001). The 2002 Currie Cup study found the prop (21.3 injuries per 1000 player game hours) to be the most commonly injured position, followed by the eigthman and scrumhalf (20 injuries per 1000 player game hours). In the 1994 to 2000 Australian Wallaby study, the lock (7.4 injuries per 1000 player game hours) was the most commonly injured position, followed by the eigthman (6.6 injuries per 1000 player game hours) and thirdly the flyhalf (6 injuries per 1000 player game hours) (Bathgate et al., 2002).

According to the averages when six studies are compared with each other, the eigthman is the most commonly injured position with 11.3 injuries per 1000 player game hours. The prop the second most commonly injured position with 9.1 injuries per 1000 player game hours, and the fullback the third most commonly injured position with 8.4 injuries per 1000 player game hours. The average injury rate for all playing positions is 7.4 injuries per 1000 player game hours. The number eight position seems to be the player with the highest injury rate, although this is not a consistent finding through all studies revised.

4.8 RECOMMENDATIONS

The following recommendations are made in terms of the study and the International Rugby Board (IRB), being the international governing body of rugby union, is in an ideal position to recommend or implement them into rugby union.

A suggested uniformed method of reporting should certainly be made available to future researchers. Re-injury should be clearly defined and reported as such. Description of the pathological type of injury needs clear description. Definition of an injury should be standardized for acute and chronic overuse injury, and whether they are game, training, or general injuries.

The following terminology for definition of an injury is suggested: ***Injuries per 1000 player game hours*** should be determined by the total amount of injuries sustained (game and training), expressed as a figure of the total game time played. This of course can be utilized in studies where determination of training time is not possible. ***Game injuries per 1000 player game hours*** should be determined by the amount of game injuries sustained, expressed as a figure of the total game time. This can be utilized in studies where neither the training time nor training injuries can be recorded. ***Training injuries per 1000 player training hours*** should be determined by the amount of injuries sustained during training, expressed as a figure of total training time. This can then only be utilized in studies where the actual training injuries and training time can be obtained. Should studies then succeed in acquiring game and training time, as well as

game and training injuries, these studies will then be able to make comparisons with other studies that used one or more of the above mentioned definitions. The total injuries sustained for games and training can then be defined as ***injuries per 1000 hours of exposure***, and should be determined by the total injuries (game and training), expressed as a figure of the total time played (game and training).

Further study is needed with regards to playing fields around the globe, and the influence that they might have on rugby injury. If possible these studies should then be converted to a uniformed combined study that will produce a manual at the end of the day. This manual should then have all relevant information about the different playing fields around the globe such as firmness of the pitches, type of covering and state of the pitches during different seasons of the year to name but a few examples.

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CHAPTER 5

SUMMARY AND CONCLUSION

This study was conducted in three parts namely:

- Rugby injuries and external factors that have an influence on it.
- The incidence and nature of injuries in South African rugby teams during the 2002 Currie Cup Competition.
- The epidemiology of injuries in Rugby union.

In the review of the data the following main conclusions were reached:

RUGBY INJURIES AND EXTERNAL FACTORS THAT HAVE AN INFLUENCE ON IT

- ✓ Rugby injuries are many and the causes vary of which cervical spine injuries are among the most dangerous occurring as a result of participation in rugby union. Although changes in the laws of the game have reflected positively on the cervical spinal injury rates, other aspects of rugby union are sometimes influenced negatively by such changes. Although much work has been done to prevent cervical spinal injuries, a huge task is still at hand to make the game as safe as possible.

- ✓ More injuries occur in the earlier part of the season compared to the latter. Reasons for this could not be established, but could vary from fitness levels to field condition. Much study is still needed in this area.

- ✓ Those who attend pre-season training for longer periods are at an increased risk for rugby injury. The possible reasons for this are many and they vary from psychological to physical factors.

- ✓ Previously injured players and players carrying an injury at the end of the previous season have a higher risk of subsequent injury than those without previous injury. The question may be raised whether these injuries

are ever fully rehabilitated. Games missed means loss of income to the player, and this can only aggravate the situation and cause the player to hide any symptoms of injury that he may still have.

- ✓ Current headgear does not provide significant protection against concussion in rugby union at junior level. This may also be true at the senior level, but no studies have been undertaken to prove this statement.

- ✓ Younger players are more ectomorphic, compared to older players who are more endomorphic. Statements like; endomorphic players are more likely to be injured than ectomorphic players, and; muscular players are cushioned in collision and the muscle act as protection to the bone, are not supported by other studies.

THE INCIDENCE AND NATURE OF INJURIES IN SOUTH AFRICAN RUGBY TEAMS DURING THE 2002 CURRIE CUP COMPETITION

- ✓ The high incidence of injuries in rugby union has been confirmed in this study. Ways have to be found to minimize the injury rates, and thereby make it a safer sport to participate in.
- ✓ The tackle was found to be the most dangerous phase of play. This should be regarded as an integral part of training with much emphasis on tackling technique and physical conditioning for this phase of play, posing the threat that it does.

- ✓ Without rule changes, the existing rules about tackling should be enforced to the letter of the rule.
- ✓ Props are the most frequently injured player position in this study, but no significant correlation could be found to support the finding.
- ✓ The thigh was the most frequent site of injury in this study, but also no significant correlation could be found to support this finding.
- ✓ The type of injury that occurs most frequently during game play is contusions/haematomas, and during training contact play causes most injuries.
- ✓ The fourth quarter of play caused the greatest amount of injuries, indicating fatigue a possible cause. This assumption was also found in previous studies of this nature.

THE EPIDEMIOLOGY OF INJURIES IN RUGBY UNION

- ✓ A uniformed method of reporting and definition should be made available to future researchers. These adjustments will then enable researchers in the field to make more significant deductions and determine trends in the field of sports medicine.

- ✓ The average injury rate for professional rugby union determined by five studies is 98.4 injuries per 1000 player game hours. The lowest injury rate reported (Garraway et al, 2000) was 67.8 injuries per 1000 player game hours, and highest injury rate reported was this study with 250 injuries per

1000 player game hours. An average of 4.7 training injuries per 1000 player training hours were found, and an average of 32.7 training injuries per 1000 player game hours were calculated. Injury rates during training are much lower than injury rates for matches. Injury rates in professional rugby union do not increase as the level of participation increases.

- ✓ A comparison between five studies was made, and the injury rates and percentages were converted to injuries per 1000 player game hours. The head injury was found to be the most commonly injured body part with an average of 15.8 injuries per 1000 player game hours. In a study on elite Australian rugby union players, Bathgate et al (2002) determined 19.4% of all injuries sustained to the head were concussions. Taking into consideration the seriousness of the injury, this is cause for great concern.

- ✓ In professional rugby a low incidence of chronic overuse type injuries were reported. Most of these were carried over from the previous season.

- ✓ A comparison between the five studies revealed that ligament sprains is the most common type of injury with an average of 26.2 injuries per 1000 player game hours.

- ✓ When comparing the severity of injury of five studies with each other, the following deductions can be made: The numbers of severe injuries in the

five studies have a strong correlation, while for moderate injuries, the 2002 Currie Cup competition reported a significantly higher injury rate. The other four studies show significant correlation for moderate injuries.

- ✓ Every epidemiological surveillance system has it's individual advantages and disadvantages, with under-reporting a consistent feature, therefore minor injuries may have been underreported in the other studies, and may explain the large difference in incidence of injuries reported in the three studies. The biggest differences in injury rates are found at the mild injuries, and this coincides with the suggestion that underreporting may have taken place. A second possible explanation is the fact that all the games from the Currie Cup competition was played on South African soil, which is generally perceived to be harder than that of Australia and New Zealand. Also do teams including the smaller unions play this competition, and smaller unions generally lack to the larger unions in terms of preparations of their playing fields, and might this be a cause to the fact that more games are played on the harder surfaces. This might then contribute to the higher injury rates than for the other competitions. Further study and analysis need to be done in this aspect to determine the firmness and comprehension of the different playing fields across the country, and possibly the world. A detailed analysis of the type of injury and the playing surface will then reveal the influence of the playing field.

- ✓ The Currie Cup study and the two Super 12 studies reported the tackle as the most frequent cause of injury, while the two Super 12 studies also found it to be the most frequent cause of severe injuries in professional rugby union.

- ✓ Since 1990 there has been a number of studies reporting on the mechanism of injury. All of these reported the tackle to be the phase of play where most injuries were sustained. In this study tackling was responsible for 50% of all injuries. Coaching and training staff should therefore teach players proper technique for tackling other players, and absorbing pressure when being tackled.

- ✓ Previous studies have not been able to significantly determine trends in the proportion of injury episodes through literature for professional and amateur rugby union. Firstly comparison has not been possible due to the fact that not all positions were reported individually, and secondly due to the lack of training time being reported. In order to make comparison possible and to overcome this problem, the average for a group of positions were allocated to each position respectively. According to the averages when six studies are compared with each other, the eigthman is the most commonly injured position with 11.3 injuries per 1000 player game hours. The number eight position seems to be the player with the

highest injury rate, although this is not a consistent finding through all studies revised.

APPENDIX A

CURRIE CUP RUGBY 2002

INJURY REPORT

1. PLAYER INFORMATION

NAME:	
TEAM:	
DATE:	
DATE OF INJURY:	
POSITION WHEN INJURED:	

2. ACTIVITY

Match or Practice (tick)	Match		Practice	
If injury during match	Own team:		Opponents:	
If injury during practice (tick)	Contact session		Endurance training	
	Power training		Skills training	
	Speed training		Gym	
	Other (describe):			
Is the injury (tick):	Recurrent		First episode	
Was the player able to (tick):	Continue		Discontinue	
If discontinued, was it (tick):	Forced	Precautionary		Blood

3. PHASE OF PLAY

Scrum	Line-out	Ruck	Maul
Open play	Cannot recall	Conditioning	Non game related

4. CONDITIONS

Weather (tick)	Hot	Mild	Cold	
	Dry	Raining		
	Day	Night		
Surface	Wet	Dry		
	Soft	Firm		
Studs	Short	Medium	Long	
Time	1st 20 min	2nd 20 min	3rd 20 min	4th 20 min

5. SITE OF INJURY

Head and Neck (tick)			
Face	Nose	Eye	Ear
Neck	Head	Mouth	Jaw
Upper limbs (tick)			
Shoulder	Elbow	Wrist	Fingers
Upper arm	Forearm	Hand	Collarbone
Lower limbs (tick)			
Pelvis	Hip	Knee	Foot
Thigh (front)	Thigh (back)	Calf	Ankle
Trunk (tick)			
Ribs	Sternum	Internal Injury	Upper back
Lower back	Groin	Buttock	Abdomen
Other			
If any other, please state:			

6. TYPE OF INJURY / CLASSIFICATION

Traumatic (tick)			
Fracture	Periosteal contusion	Dislocation	Subluxation
Muscle contusion	Traumatic bursitis	Neuropraxia	Laceration
Abrasion	Concussion	Sprain	Strain
Acute compartment syndrome		Osteochondral/chondral fracture	
Rupture	Other (please state):		
EXTRINSIC MECHANISM (tick):			
Tackled	Tackling	Collision	Kneed
Collapsed scrum/maul	Rucked	Cleaned	Cleaning
Kicked	Elbowed	Punched	Gouged
Bitten	Head	Butt	Other:
If other, please state:			
INTRINSIC MECHANISM (tick)			
Twist	Slip	Accelerated	Decelerated
Side-stepping	Lunge	Sudden overload	Other:
If other, please state:			
Overuse (tick)			
Stress fracture	Bone strain	Oteitis	Apophysitis
Chondropathy	Synovitis	OA	Blister
DOMS	Fibrosis	Tendonopathy	Bursitis
Increased neural dynamics		Chronic Compartment syndrome	
Nerve entrapment	Non-specific	Other (please state):	
EXTRINSIC MECHANISM (tick)			
Training error	Surface	Shoes/boots	Equipment
Environment condition	Psycological factors	Inadequate nutrition	Other
If other, please state:			
INTRINSIC MECHANISM (tick)			
Malalignment	LLD	Muscle imbalance	Muscle weakness
Lack of flexibility	Other		
If other, please state:			

7. SEVERITY

Transient (return within 7 days)	Moderate (return within 29 – 84 days)
Mild (return within 7 – 28 days)	Severe (return after 84 days)

8. MANAGEMENT

Medical	Surgical	Physiotherapy	Rehabilitation
If other, please specify:			

9. PROTECTION AT TIME OF INJURY

Head gear	Gum guard	Shoulder pads	Shin pads
Strapping (specify)			

10. PROVISIONAL DIAGNOSIS

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Summary

The aim of this study was to review the available literature on the epidemiology of injuries in professional rugby, and then to collect data on previous injuries and the influence of external factors on rugby injuries. Secondly, the incidence, nature and circumstances surrounding injuries in a cohort of professional South African provincial rugby players were documented. The data collected was compared with available data in order to determine trends of injuries that, if taken into consideration, could possibly lead to the prevention of injuries to future rugby players.

No study has been done on injury rate and frequency in the Currie Cup competition. Being the cornerstone of providing players for competitions like the Super 12 and Tri-nations, it is certainly appropriate to record the incidence and nature of injuries in the Currie Cup competition. This study attempted to identify factors associated with injury, to direct further analytical research and suggest measures to reduce injury rate. It also drew a comparison between results obtained through this study, and results obtained by other relevant studies in other competitions.

The epidemiological data used in this study were collected from two professional rugby teams that competed in the 2002 Currie Cup Rugby Competition. This competition is held annually in South Africa and includes provincial teams from 14 regions in South Africa.

Opsomming

Die studie het ten doel om beskikbare inligting met betrekking tot die epidemiologie van beserings wat by professionele rugbyspelers voorkom, te bestudeer, data oor vorige beserings in te win, asook die invloed van eksterne faktore op rugbybeserings te identifiseer.

Twedens word die voorkoms, aard en omstandighede rakende beserings in ‘n groep professionele Suid-Afrikaanse provinsiale rugbyspelers gedokumenteer. Hierdie data word met beskikbare data vergelyk om tendense in beserings vas te stel. Die resultate van hierdie studie kan gebruik word om in die toekoms sekere tipe beserings wat by rugbyspelers voorkom, te verminder.

Geen studie is tot dusver gedoen om die aantal en frekwensie van beserings in die Curriebekerkompetisie te bepaal nie. Aangesien hierdie kompetisie die voedingsbron van spellers vir kompetisies soos die Super 12 en die Drienasies vorm, is die inwinning van hierdie inligting uiters belangrik vir die toekomstige kompeteringsvermoë van Suid-Afrikaanse rugbyspelers. Hierdie studie poog eerstens om faktore wat met die beserings verband hou te identifiseer, en tweedens om aanbevelings te doen oor faktore wat hierdie tipe beserings kan beperk. Resultate soos uit hierdie studie verkry, behoort die rigting vir toekomstige navorsing aan te dui. Hierdie studie tref dan ook ‘n vergelyking tussen nuwe data en resultate uit ander relevante studies.

Die epidemiologiese data wat in hierdie studie gebruik word, is verkry van twee professionele rugbyspanne wat in 2002 aan die Curriebekerkompetisie deelgeneem het. Hierdie kompetisie word jaarliks tussen 14 streekspanne in Suid-Afrika gehou.

Keywords

Rugby union, professional, injury rates, epidemiology, incidence, distribution