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Injuries at Johannesburg high school rugby festivals

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INJURIES AT JOHANNESBURG HIGH SCHOOL RUGBY FESTIVALS

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Declaration

I, Demitri Constantinou, declare that this research report is my own work. It is being submitted for the degree of Master of Science in Medicine in the field of Emergency Medicine at the University of the Witwatersrand, Johannesburg.

It has not been submitted before for any degree or examination at this or any other university.

Signed at Parktown on this 26^{h} day of May 2014.



Demitri Constantinou

Abstract

Aim.

The aim of the study was to analyse the prevalence and type of injuries over two years of a Johannesburg High School rugby festival by assessing the injuries (number, anatomical sites, types and severity), to compare the injuries between the two years and to compare the injuries between the three days of the festival.

Methods.

The study design was a retrospective, descriptive and observational study. The study population was the participating rugby players at the two rugby festivals in 2010 and 2011. Medical records of rugby related injuries in schoolboy participants were used for capturing injury data.

Results.

A total of 626 players participated (322 and 304 in 2010 and 2011 respectively) of which there were a total of 100 injury data sets analysed. The injury rate per player in year one was 16.8%, and 15.2% in year two. There was no statistical difference (P = 0.6526) in the injury numbers between the two years. The injury profiles between the respective days between the two years were not statistically different. Most injuries were to the head/face, with the majority being concussion related. The next commonest injuries were to the neck area. Most injured players had not had previous similar injuries.

Tackles were the commonest mechanism of injuries. Twenty four percent of injuries were deemed severe enough to stop the players from continuing play. Few required

referral for investigations or specialist physician care and most were managed with simple first aid at the primary care level.

Conclusion.

The nature and mechanisms were in keeping with numerous local and international studies of schoolboy rugby players, but with a lower injury frequency. Providing medical services at rugby events such as these festivals is a requirement and adequate standardised record keeping is recommended to increase knowledge and monitor trends as the dynamic nature of the game of schoolboy rugby continues to develop and change.

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Table of Contents

Declaration 2

Abstract 3

Acknowledgements 5

List of annexures 8

List of figures 9

List of tables 10

Key words 11

Definitions and abbreviations 11

Introduction 13

1. Literature review 18

1.1. Incidence 18

1.2. Types of injuries 23

1.3. Precipitating causes 28

1.3.1. Age 28

1.3.2 Setting 29

1.3.2 Plays and position 30

1.3.3 Mismatching 32

1.3.4 Temporal factors 32

1.3.5 Previous similar injury 33

1.4 Need for medical facilities at events 34

2. Methodology 38

2.1 Setting 38

2.2 Study design 38

3 Results 43

3.1 Injured body parts 43

3.2 Number of injuries 44

3.3 Injuries between the three days of the festivals 46

3.4 Mechanisms of injury 47

3.5 Injury severity 48

3.6 Injury management 48

3.7 Investigations and referral 50
3.8 Side of injury and age 51
4. Discussion 52
4.1 Number of injuries 53
4.2 Injured body areas 54
4.3 Side of injury 55
4.4 Previous similar injury 55
4.5 Mechanism of injury 55
4.6 Injury severity 56
4.7 Injury management 57
4.8 Investigations 58
4.9 Limitations 59
5. Conclusion 60
6. References 63
7. Annexures 74

List of annexures

1. Annexure A: Injury recording forms p74
2. Annexure B: Permission letter p75
3. Annexure C: Ethics approval p76-77

List of figures

1. Figure 1: Injuries over the two festivals p44
2. Figure 2: Injury types and frequencies in years one and two p45
3. Figure 3: Injury frequencies on different festival days over the two years P47
4. Figure 4: Mechanisms of injury p48
5. Figure 5: Management of injuries after assessment p49
6. Figure 6: Referral for investigation p50
7. Figure 7: Side of injury p51

List of tables

Table 1: Incidence of schoolboy rugby injuries p20

Table 2: Schoolboy rugby injury anatomical structures and sites p25

Table 3: Injury frequencies and anatomical sits on different festival days p46

Key words

Rugby, injuries, schoolboy.

Definitions and abbreviations

1. **Rugby**

This is the football sport of Rugby Union. First developed in the 1820s at Rugby School in England. Rugby Union became fully professional in 1995. The game is played by teams of 15 members each, using an inflated oval ball. The ball may be kicked, carried, or passed laterally or backward (but not forward). The object is to score goals (worth three points) by kicking the ball between the uprights of the opponent's goal, or tries (worth five points), by grounding the ball behind the opponent's goal line. A conversion kick (worth two points) is attempted after scoring a try. Rugby is most popular in the United Kingdom, South Africa, Australia, and New Zealand. (Brittanica, 2013).

2. **Injury**

"Any physical complaint sustained by a player that results from a football match or football training, irrespective of the need for medical attention or time loss from football activities. An injury that results in a player receiving medical attention is referred to as a ''medical attention'' injury, and an injury that results in a player being unable to take a full part in future football training or match play as a ''time

loss'' injury." (Fuller, et al., Consensus statement on injury definitions and the data collection procedures in studies of football (soccer) injuries, 2006). A further definition and specific to rugby union is "Any physical complaint, which was caused by a transfer of energy that exceeded the body's ability to maintain its structural and/or functional integrity, that was sustained by a player during a rugby match or rugby training, irrespective of the need for medical attention or time-loss from rugby activities. An injury that results in a player receiving medical attention is referred to as a 'medical-attention' injury and an injury that results in a player being unable to take a full part in future rugby training or match play as a 'time-loss' injury. In rugby union, non-fatal catastrophic injuries are of particular interest and therefore a third subgroup of reportable injuries was added:

A brain or spinal cord injury that results in permanent (>12 months) severe functional disability is referred to as a 'non-fatal catastrophic injury'." (Fuller, et al., 2007).

Injury risk is defined by Knowles et al as "the average probability of injury per athlete". (Knowles, Marshall, & Guskiewicz, 2006). Such risk may be related to various factors such as exposure, level of playing, match vs. training and others.

3. Rugby festival

Refers to rugby competitions that take place on three days over the Easter weekend at various schools around South Africa. There are three such festivals in Gauteng, and numerous schools participate. These three rugby festivals are

held at St Stithian's college, King Edward VII high school and St John's College. (Stoops, 2013).

4. **SARU (South African Rugby Union)** (Rugby, 2013)

The SARU is the national sports federation which administers rugby at al levels and is a member of the International Rugby Board. It is the umbrella brand for:

- The Springboks
- Vodacom Super Rugby
- Absa Currie Cup
- Vodacom Cup
- SA Under 20 (Junior Springboks)
- Springbok Sevens
- Springbok Women
- Springbok Women Sevens

Introduction

Rugby Union Football was primarily an amateur sport all around the world until the Rugby World Cup™, which was hosted in South Africa, in 1995. As its popularity and participation increases, it is also set to make an Olympic Games comeback in its Sevens rugby format in 2016, after an absence since 1923.

Rugby is played at various levels; amateur (as in schools, clubs and social leagues), semi-professional and professional. Professional rugby is played in various competitions, and South Africa national and international competitions include the Vodacom Cup, Vodacom Super Rugby, ABSA Currie Cup, Six Nations, the Rugby

Championship, Junior World Trophy and World Cups. There are also women's rugby competitions where South Africa participates, namely the Women's World Cup™.

Amateur rugby is played primarily at club and school level. School rugby falls under the joint jurisdiction of the National Department of Sport and Recreation, and the South African Rugby Union (SARU).

In South Africa there are numerous school level competitions, of which the Easter Rugby Festivals are very popular. These are competitions held on three days over the Easter weekend at a number of schools around the country. In Gauteng three schools host Easter Rugby Festivals, St John's College being one of them. The festivals are held over three non-consecutive days, on the Thursday before the Christian religious holiday of Easter Friday, two days later on the Saturday and then on the Monday after that.

The rugby festivals at St John's College started in 1996, and in 2010 and 2011 they hosted the 15th and 16th annual festivals respectively. The school describes the event as hugely successful as "a rugby festival and as a social family networking event in a safe environment". There are many spectators that attend on the match days, and the matches are televised on the Supersport channels of the pay network of Multichoice. Food stalls, a beer tent, motor vehicle displays, and other activities including those for children, provide entertainment in addition to the rugby matches.

Over 300 boys participate in the festivals from 22 schools, and visiting teams are accommodated at the host college residences / hostels for the duration of the tournament. There are an average of 35 matches played in any one weekend festival for an average 35 minutes each, and each participating player may play between

one and three matches in that time. The refereeing at the festival matches is done by certified referees of the Golden Lions Rugby Union.

Medical facilities are provided during the festival. A medical room and tent which are fully equipped for first aid and emergency medical management provide assistance where necessary, and are manned by at least one medical doctor, paramedics, first aiders, a nurse and physiotherapists. On the field side there are paramedics and first aiders, with first aid kits and spine immobilisation boards. An advanced life support ambulance is present and further paramedic and ambulance support available on call for despatch to the festival.

There is also an excellent system of referring, where an arrangement is in place with a local hospital, which has an advanced trauma unit, and where X-rays can be fast tracked when referred from the rugby festival. There is the availability of ambulance and normal vehicle transportation is available, and in addition to the medical support personnel, a teacher from the school is assigned for each of the days to accompany any injured boys to the hospital.

The boys that have injuries are often referred back to the school infirmary for follow up if it is deemed necessary during their stay at the school over the weekend, or even thereafter for the host school players. Here they also have access to physiotherapy services. Thus St John's College has medical service provision at their Easter Rugby Festival that appears adequately developed and managed relative to the statutory requirements, medical guidelines and outcomes of injury management (Government Gazette, 2010) (SARU, Boksmart, 2009). The provision of the medical facilities and services is done via sponsorship and subsidy as the players do not pay for pitchside assistance, but do incur expenses if referred to

hospital. Many of the participants have medical insurance, either private or through their schools.

Rugby Union is the most popular worldwide collision sport, yet concerns have been raised regarding the safety of the sport due to the physical, high impact nature and an increasing number of injuries (Nicol, Pollock, Kirkwood, Parekh, & Robson, 2010). In New Zealand (Quarrie, Cantu, & Chalmers, 2002) and almost certainly in South Africa as echoed on the side-lines at the festivals, parents of playing rugby players have concerns about school boy rugby safety and liability.

Injuries were noted to be more varied and more severe in rugby when compared to other sports such as athletics, basketball, squash, hockey and cricket, amongst others (Sparks, 1981). Thus it is recognised that an injury assesment and management service is required when this game is being played. Accurate triage is necessary to appropriately manage injuries (Laskowski, Najarian, Smith, Stuart, & Friend, 1995) and early appropriate management of neck injuries improves chances of full recovery and/or better outcomes (McCoy, Piggot, Macafee, & Adair, 1984).

The SARU has a number of policies that take into account International Rugby Board (IRB) regulations, local legislation such as the Safety at Sports and Recreational Events Act, 2010 (Government Gazette, 2010) and contextual information for hosting rugby matches. One such policy is the Participant Medical and Safety measures at SARU Tournaments: *Medical and Safety Minimum Standards Document of 2012.* (Readhead, 2012). Another document is the “Participation Requirements for SARU Youth Week Tournaments: Medical and Anti-Doping” (SARU, 2012).

Schoolboy rugby festival injury information has not previously been evaluated and there is a current lack of knowledge of schoolboy rugby injuries in South Africa, with previous studies having been published decades ago. For these reasons and for adequate preparation for such events, an analysis of injuries presenting at schoolboy rugby festivals was warranted.

1. Literature review

Rugby union is a football game in which play is continuous, usually without time-outs or substitutions, except for injury. Interference and forward passing are not permitted, and kicking, dribbling, lateral passing, and tackling are featured (Brittanica, 2013). These features make the sport a full contact and collision sport, and as such traumatic injuries are fairly common.

Any injury service for sport requires “a background of comprehensive medical cover”, as expressed by the physiotherapist that worked at the Crystal Palace National Sports Centre (Grisogono, 1981) and reiterated by an epidemiological study conducted in English youth community rugby union (Haseler, Carmont, & England, 2010). Further, the observation made was that there must be channels for the provision of general and specialist medical care for injured players.

This literature review will look at injuries on the rugby field – incidence, types of injuries, causes and the on-site need for medical care by focusing on research done in schoolboys.

1.1. Incidence

Rugby injuries in young players do occur, and may differ in their incidence and nature relative to adult players depending on the different levels of competitive play (table 1).

The incidence of injuries has been presented in different formats. These include:

- per-player hours
- per-player matches
- per-player training
- total number of injuries
- per-unit exposure
- per- season

Per player hours refers to the number of injuries as a ratio of the number of hours the player has played at this particular level or over a time period (e.g season); per-player matches or per-player training. These use the unit of sessions and not time in assessing injury incidence. This does not differentiate between relative time ratios; so whether a player plays for the full match or only ten minutes in a match it is assessed the same as for a player playing a full match of 80 minutes, thereby introducing a serious error into the equation. Total number of injuries incidence is more often seen in a competition or event as an overall incidence, or over a season, as is more relevant in the rugby festivals. In such circumstances it is difficult if not impossible to get accurate data on individual player exposure.

Injuries in rugby, at school level and senior club level have been reported in Great Britain, Australasia and South Africa. (Lee & Garraway, 1996) (Roux, Goedeke, Visser, van Zyl, & Noakes, 1987) (Nathan, Goedeke, & Noakes, 1983) (Davidson R. M., 1987) (Sugerman, 1983), but not in the last decade or two.

Averages of between 6.8 and 129.8 injuries per 1000 player hours of matches occur in schoolboys (Parekh, Hodges, Pollock, & Kirkwood, 2011) (Roux, Goedeke, Visser,

van Zyl, & Noakes, 1987). Between 1969 and 1986, data from matches played in Australia on a Saturday indicated that out of 1444 schoolboy rugby boys there was an overall injury rate of 176/10 000 player-hours or 0.12/100 player-games (Davidson R. M., 1987).

Table 1: Incidences of schoolboy rugby injuries

Study	Sport	Incidence	Injuries noted	Time frame
Nathan, Goedeke, & Noakes, 1983	Rugby (high school)	1/395 boy-hours* 1/119 boy-hours of *match* play	All	One season (1982)
McCoy, Piggot, Macafee, & Adair, 1984	Rugby (school boy)	7 over six seasons (6 years)	Spinal cord with neurological deficit	1977-1983
Roux, Goedeke, Visser, van Zyl, & Noakes, 1987	Rugby (schoolboy)	6.8 injuries per match	All, severe enough to miss a week of play	18 weeks
Davidson, 1987	Rugby (schoolboy)	176/10 000 player hours	All	18 years (1969-1986)
Lee & Garraway, 1996	Rugby (high school and club)	86.8/1000 player seasons (school boys) 367.0 / 1000 player hours (club)	all	One season (1993-1994)
Rotem, et al., 1998	Rugby	6.5/100 000 participants per year	Spinal cord with neurological deficit	
Raftery, Parker, Stacey, Peat, & Wang, 1999	Rugby (league)	9.9 / 1000 player hours		
Quarrie, Cantu, & Chalmers, 2002	Rugby	2.3 /100 000 participants per year	Spinal cord with neurological deficit, estimated in New Zealand	
Nicol, Pollock, Kirkwood, Parekh, & Robson, 2010	Rugby (school boy)	10.8 / 1000 player hours over one season	All	2008-2009
Scher, 1998	Rugby (all)	5.4 / year 8.7 / year (1987-1996)	Spinal cord with neurological deficit	1981-1987
Hughes, 2000	Rugby	28 / year	Spinal cord with neurological deficit	1979-1988
Maharaj & Cameron, 1998	Rugby	10/100 000 per year	Spinal cord with neurological deficit/death	
Palairet & Xiong, 2000	Rugby	2.8/100 000 players per year	Spinal cord with neurological deficit	
Parekh, Hodges, Pollock and Kirkwood (2011)	Rugby	7-129.8 / 1000 player hours	All	
Sparks (1981)	Rugby (schoolboy)	197.7 / 10 000 player hours	All	30 seasons (1950-1979)
Macintosh (2005)	Rugby (school boy)	7-18 / 1000 hours played		

*boy hours = 15 boys playing for 1 hour equals 15 boy-hours of rugby

In the United Kingdom rugby is a popular school-level sport. Despite this, there are limited data on the absolute number and sport injury incidence of children (Cunningham, 2002). According to the Scottish Rugby Union, about 14 players have been seriously injured since the early 1950s (Nicol, Pollock, Kirkwood, Parekh, & Robson, 2010).

In Scotland, a study revealed 37 out of 470 returned school survey forms indicated that of rugby injuries that had occurred 10.8 per 1000 player hours occurred during training (Nicol, Pollock, Kirkwood, Parekh, & Robson, 2010).

In school boarders in Britain between the ages of 13 and 18 years over 30 terms (1950-1979) (Sparks, 1981) the rugby injury incidence was 197.7 per 10 000 player hours out of a total of half a million player hours analysed. In this particular study an injury was recorded only if a player missed at least one week from participating in the game and therefore excludes a significant number of less severe injuries. Over an eight year period of 556 schoolboy rugby players sustaining injuries, half were considerd “trivial” (Davidson, Kennedy, & Vanderfield, 1978).

Macintosh (2005) reviewed paeditaric rugby injuries and found between 7 and 18 injuries per 1,000 hours played, with the rate of injuries resulting in loss of playing or training time measured at 6.5–10.6 per 1,000 hours played. Injury rates increased with age and level of qualification. Also reporting on South African schoolboy rugby, Nathan et al (1983) reported 70 injuries in 465 players who played 51 times (15 matches and 36 practices), over 18 weeks.

As compared to schoolboy rugby injuries, senior club match injury prevalence is higher at 367.0 (339.4 to 394.6) per 1000 player-seasons, compared to 86.8 (95% confidence interval 73.4 to 100.2) per 1000 player-seasons (Lee & Garraway, 1996).

One recent study assessed injuries in club rugby over two seasons, and found an incidence of 91 injuries/1000 player-hours. (Brooks, Fuller, Kemp, & Reddin, 2005)
In South African adults playing at club level, there were 114 injuries that occurred in 78 players in one season (Clark, Roux, & Noakes, 1990). Reporting can thus be made in terms of days of play, number of matches and number of participants.
The difficulty in comparing results and studies is evident due to the different measures used.

The risk of injury is has been defined as “the probability or likelihood that a hazard will have an impact on these people” (Fuller & Drawer, 2004). To be able to compare data and make constructive sense of data, injury definition should be consistent with studies for consistency, and the evaluators should be defining the injury consistently (Laskowski, Najarian, Smith, Stuart, & Friend, 1995).

Epidemiological reporting of schoolboy rugby injuries is often reported as an incidence of number of injuries per player-exposure. This has however been shown not to accurately support the risk of injury with respect to probability over a period of time, usually a rugby season (Parekh, Hodges, Pollock, & Kirkwood, 2011). Parekh et al in (2011) in fact have used Poisson distribution to evaluate probability of injury over a rugby season and suggest that this should be considered in epidemiological studies on schoolboy rugby injuries. Such measures would also not likely be of value in predicting injury risk for an annual rugby festival where the period of exposure is short (alternate days over a long weekend), but with high frequency (multiple matches), matches played close together, and there is a short time of recovery between play.

1.2. Types of injuries

Injuries can be reported with respect to site (e.g. head and neck, lower limb) or anatomical structure (e.g. ligament, bone). Injuries in a number of sports have overlapping types of injuries and have been reported in multi-code sports. The injuries reported are common in team sports and include thigh, foot, knee, lower leg and ankle (Laskowski, Najarian, Smith, Stuart, & Friend, 1995) (Kerr, Collins, Pommering, Fields, & Comstock, 2011) (Fuller, et al, 2006).

The most common anatomical structures injured in school boy rugby are ligaments and tendons. Literature reveals that these make up between 25 and 39% of injured structures (Clark, Roux, & Noakes, 1990) (Roux, Goedeke, Visser, van Zyl, & Noakes, 1987) (Lee & Garraway, 1996) (Palmer-Green, et al., 2013) (Nathan, Goedeke, & Noakes, 1983). The nature of collision injuries in rugby are such that these soft tissue structures are affected more than others. In the schoolboy age group the tendency is for injuries to such soft issues to occur more than bone, with soft tissue attachments and infrastructure being more vulnerable than the relatively stronger skeletal tissue. The soft tissues of muscle make up a broader range of 17 to 33% of injuries and are related to the mechanisms of tackling and direct trauma with contusions (Roux, Goedeke, Visser, van Zyl, & Noakes, 1987) (Clark, Roux, & Noakes, 1990) (Palmer-Green, et al., 2013) (Nathan, Goedeke, & Noakes, 1983). Bony trauma has an even wider range of 8 to 27% of injuries (Palmer-Green, et al., 2013) (Clark, Roux, & Noakes, 1990) (Roux, Goedeke, Visser, van Zyl, & Noakes, 1987) (Lee & Garraway, 1996) (Nathan, Goedeke, & Noakes, 1983).

A number of studies have consistently found that the most likely anatomical areas of injury in rugby players are the lower limb and the head and neck (Table 2).

Lower limb injuries account for over two thirds of all schoolboy rugby injures (Table 2). The collision and contact nature of the game leads to the tackling mechanism of injury being most common (Fuller, Brooks, Cancea, Hall, & Kemp, 2007). Bringing down an opponent in tackling will lead to the lower limb being targeted and therefore lead to more injuries in that area, and of the soft tissues as shown in table 2.

The head and neck make up around 20% of injuries (Table 2), with a trend in recent years of a lower incidence due to law changes. Again, the nature of the game with tackling, scrum collapses, head to head contact, head to ground contact and foul play (high tackles) are the causes of head and neck injuries.

The upper limb injuries and other areas make up the remainder and least incidence of areas injured.

Table 2: Schoolboy rugby injury anatomical structures and sites

Study	Anatomical structure			Head and neck (%)	Upper limb (%)	Lower limb (%)	Trunk (%)
	Muscle	Ligament /tendon	Bone				
Clark et al (1990)	33	32	15				
Lee and Garraway (2012		30.9	19.9	17.7	31.6	30.4	7.0
Nathan et al (1983)	21.5	28	15.2	38	29	26	7
Palmer-Green et al (2013)	24	39	8	9			
Roux et al (1987)	17	25	27	29	20	37	
Weightman and Brown (1974)*				30.6	22.1	35.7	11.6
Adams (1977) *				16.1	32.3	40.4	11.2
O'Connell (1954) *				23.8	31.2	33.8	11.2
Davies and Gibson (1978)				24.5	22.5	42.4	10.6
Davidson (1978)				37.9	28.3	27.3	6.5
Allernandou (1971)*				18.3	28.4	39.9	13.4
Sparks (1981)				18.9	25.9	46.1	11.1

A study in the USA of all sports injuries in high school between 2005 and 2007 reported 446 715 severe injuries (off training for at least one week)(Darrow, Collins, Yard, & Comstock, 2009) . The most commonly injured body sites were the knee (29.0%), ankle (12.3%), and shoulder (10.9%). The commonest types of injuries

were fractures (36.0%), grade three ligament sprains (15.3%) and incomplete ligament sprains (14.3%).

In addition to the common musculoskeletal sports injuries, other types that require adequate assessment and management do occur in schoolboy rugby, and include abdominal injuries (Kohler, Miller, Bonner, & Louw, 2002), dental and orofacial injuries (Jagger, Abbasbhai, Patel, Jagger, & Griffiths, 2010), brachial plexus injuries and kidney injuries. (Grinsell, Butz, Gurka, Gurka, & Norwood, 2012). Despite the use of mouthguards being reportedly used, fractured and avulsed teeth occurred in 15% of players. (Jagger, Abbasbhai, Patel, Jagger, & Griffiths, 2010).

In 2009 a leading Scottish spinal surgeon called for a “radical overhaul” of school rugby after a 14-year-old boy was paralysed during a match (Macaskill, 2009). The schoolboy was the sixth player in Scotland to have had a severe spinal injury while playing rugby since 2006. Macaskill’s comments echo those of Professor Allyson Pollock, the Director of Edinburgh University’s Centre for International Public Health Policy, who prompted the Scottish government to launch a national study of injuries among young rugby players (Nicol, Pollock, Kirkwood, Parekh, & Robson, 2010). Data on the international incidence on sports injuries in schoolchildren from around the world reveals a number of varying statistics. In a local study (Roux, Goedeke, Visser, van Zyl, & Noakes, 1987) reported 6.8 injuries per match over a season (18 weeks) in 26 schools in the Western Cape. This was reporting on injures that were severe enough for players to miss a week of participation.

Severe spinal injuries have been reported as 6.5/100 000 participants per year in the 1990’s (Australia) (Rotem, et al., 1998); with report in New Zealand of 2.3/100 000 (Quarrie, Cantu, & Chalmers, 2002); 5 players out of 2500 schoolboy rugby players with serious cervical spine injuries (McCoy, Piggot, Macafee, & Adair, 1984);

comprising 11% of all spinal injury admissions due to all sports injuries (Boran, Lenehan, McCormack, & Poynton, 2011); 1.45/10 000 athlete exposures in high school athletes; 9.9 injuries per 1000 player hours (rugby league). (Raftery, Parker, Stacey, Peat, & Wang, 1999). Some 110 rugby players in Britain as at 2010 have been paralysed during the course of the game with 36,000 injuries each year from rugby at school level (Nicol, Pollock, Kirkwood, Parekh, & Robson, 2010). The nature of the game has changed over the past two decades with increased competitiveness (MacQueen & Dexter, 2010), schoolboy physical characteristics (Yard & Comstock, 2011) (Nutton, et al., 2012) and rule changes, (MacQueen & Dexter, 2010) but the impact on schoolboy injuries has not been appraised. Indeed from evidentiary data there was an apparent reduction in the severity of spinal cord injuries in schoolboy rugby players following rugby rule law changes (Noakes, et al., 1999).

In addition to catastrophic neck injuries, other severe injuries which may occur and can be classified as cardiac (e.g. commotio cordis) or non-cardiac (e.g. vascular), and are responsible for more deaths in children and young adults than all diseases combined. (Hazinski, et al., 2004), but are still relatively rare.

Davidson et al (1978) reported that most schoolboy rugby injuries are trivial as assessed from data in a casualty service over 8 years. This was also found in injury surveillance data from a multi-event competition where 0.88% of participants received medical attention for injuries of which the majority were minor, and required basic PRICE (protection, rest, ice and elevation) attention (Laskowski, Najarian, Smith, Stuart, & Friend, 1995).

1.3. Precipitating causes

1.3.1. Age

Club rugby players have a higher rate of match injury than schoolboys for all injury types (Lee & Garraway, 1996). However school boy rugby players appear to be at a greater risk of cervical spine injury than older players (Silver J, 1979) (Hoskins, 1978) (Carvell, Fuller, Duthie, & Cockin, 1983) (Quarrie, Cantu, & Chalmers, 2002).

Interestingly in a study of elite schoolboy footballers (soccer players) aged 9 – 16 years, Johnson et al (2009) showed that after adjusting for training and playing time, stature and player position, there was no significant difference for maturity.

The frequency of rugby injuries increases with age between the ranges of 6 and 18 years (Raftery, Parker, Stacey, Peat, & Wang, 1999) (Davidson, Kennedy, & Vanderfield, 1978) (Davidson R. M., 1987) (Nathan, Goedeke, & Noakes, 1983). It was also noted that the lowest incidence was in pre-pubescent boys (Raftery, Parker, Stacey, Peat, & Wang, 1999) (Johnson, Doherty, & Freemont, 2009) (Lee & Garraway, 1996). Interestingly Raftery et al(1999) showed a significant increase in injury rate in schoolboys playing rugby league between the ages of 11 and 12 years, probably related to increased participation as this age plays more structured rugby, exposure to more formal matches and playing more often. Further, schoolboy injuries tend to be less severe than those seen in senior club rugby, and have better injury outcomes both in South Africa and elsewhere (Lee & Garraway, 1996) (Holtzhausen, Schwellnus, Jakoet, & Pretorius, 2006).

As schoolboys develop through puberty there are morphological changes, with changes in lean mass, bone growth and overall size. With differences in the rate of change amongst similar ages, at any given time there may be players with different

mass and sizes. In adolescent rugby players all boys who want to participate are accommodated. After puberty increased size and skill will determine player participation. Rugby players tend to be larger than other athletes, attracted to the game by its physicality (Watson, 1988). Body mass index has been assessed as having an influence on injury patterns amongst high school children, with an increased incidence amongst overweight and obese children (Yard & Comstock, 2011).

1.3.2 Setting

The setting refers to the environment in which the study was conducted. This could be training, matches, longer competitions such as festivals with multiple matches over short periods of time.

Competitions present a higher risk for injury relative to training (Johnson, Doherty, & Freemont, 2009) (Roux, Goedeke, Visser, van Zyl, & Noakes, 1987) (Lee & Garraway, 1996). In one study training presented with a frequency of 14.4 injuries per 10 000 hours compared to 105 injuries per 10 000 hours in matches. (Johnson, Doherty, & Freemont, 2009). Kew et al (1991) showed that as many as 98% of injuries occurred in matches. In Lee and Garraway's paper (1996) 80% of injuries in Scottish schoolboys occurred during matches, and 70% did in the South African study by Roux et al (1987), versus 20% and 30% respectively at other times. In professional rugby similarly there are more injuries during matches (554 injuries per 10 000 player game hours) than during training (43 injuries per 10 000 player training hours) (Holtzhausen, Schwellnus, Jakoet, & Pretorius, 2006). Matches are an environment where the competitive nature makes for more intense play, more effort, higher expectations for results and may be factors for the increased risk and

incidence for injury relative to injuries in training. In addition training is not always sport-specific full play and therefore less exposure to tackling and contact.

It is therefore a reasonable assumption that school boy rugby festivals are potentially at a higher risk of a player being injured in a very competitive environment; where exposure of matches is high in a concentrated space of time. Also high inherent driven spirits are further fuelled by the competitive environment at these festivals. There is also little time for recovery between matches played which may play a role in injury risk (Dupont, et al., 2010).

Previous researchers have asked for well-designed epidemiological studies in order to provide more accurate information about potential risk factors for injury such as age, position and gender (Quarrie, Cantu, & Chalmers, 2002). That injuries need targeted prevention is echoed by Kerr et al (2011).

It has been shown that there are numerous potential causes that have been evaluated in contributing to rugby injures on the field.

1.3.2 Plays and position

1.3.2.1. Tackles are by far the leading cause of injury amongst rugby players, for both the player tackling and the player being tackled. More than half (55%) of all rugby injuries are caused by this manoeuvre in South Africa (Roux, Goedeke, Visser, van Zyl, & Noakes, 1987). The player doing the tackling may be more at risk than the player being tackled (40% whilst tackling and 24% of injuries occurring whilst being tackled) (Lee & Garraway, 1996).

The nature of the clashing of rugby players involved in tackling or being tackled is the collision that occurs that creates the forces leading to the high risk of injury occurring with these manoeuvres.

1.3.2.2. The **playing position** and with that the type of collision sustained, will be a greater influence over contact injury risk than the number of physical collisions performed (Gabbett, Jenkins, & Abernethy, 2011).

Playing position at all levels of play, from schoolboys to adult international competition, affects injury risk (Quarrie, Cantu, & Chalmers, 2002) (Noakes, Jakoet, & Baalbergen, 1999) (Holtzhausen, Schwellnus, Jakoet, & Pretorius, 2006). Tackling is considered to be the highest risk manoeuvre with deliberate physical interaction by one player on another to stop them in their tracks. Therefore certain playing positions are more likely to be involved in tackling and have a higher risk of injury, such as the eighth man being the position most at risk, followed by the flank, hooker and lock (Hattingh, 2003). In efforts to reduce such risks, recent law changes have been effected to enforce safer tackling and in schoolboy rugby altering the scrum “hit and shove” manoeuvres. (Int Rugby Board, 2010)

Numerous studies have shown that for cervical spine injuries, the nature of the scrum and forced neck flexion particularly with collapsing of the scrum, means that the front row players who participate in the scrum are particularly at high risk for cervical spine injuries (Scher, 1998) (Kew, et al., 1991) (Noakes, Jakoet, & Baalbergen, 1999) (McCoy, Piggot, Macafee, & Adair, 1984) (Quarrie, Cantu, & Chalmers, 2002) (Clark, Roux, & Noakes, 1990) (Roux, Goedeke, Visser, van Zyl, & Noakes, 1987) (Jakoet & Noakes, 1998) (Davidson R. M., 1987) (Nathan, Goedeke, & Noakes, 1983).

1.3.3 Mismatching

Mismatching of play and teams is another possible background reason attributing to injury. This can be accounted for by age in schoolboy rugby, where age groups are put to play against each other, rather than physical maturity or size. Schools, coaches and rugby authorities often involve children in the game without imposing adequate common training and refereeing standards (Macaskill, 2009) (Nathan, Goedeke, & Noakes, 1983). As a result, mismatched teams can play against each other, putting children at risk (Macaskill, 2009). Such mismatches occur in strength and technique with tackles, scrummages and other game actions. These mismatches are seen at a number of points through the whole game and in a number of parameters, and include age, weight, experience, inconsistent and poor refereeing and coaching standards. Different maturity rates amongst boys means that two boys of the same age play against each other, but may have largely different physiques. Upton et al (1996) reported after studying 25 high schools that schoolboy rugby players are at risk for injury based on coaching errors. Recent rugby law changes have addressed this. (SA Rugby Union, 2014)

1.3.4 Temporal factors

Certain **temporal changes** may also influence injuries; namely pre-season and early season training, exposure (number of matches played) and skills

attained (Gabbett, Jenkins, & Abernethy, 2011) (Macaskill, 2009) (Nathan, Goedeke, & Noakes, 1983).

Based on the data available, injuries in school boy rugby players occur more in matches than in training, the front row, or the scrum, are more at risk for neck injuries, and factors such as age, level of play, playing position, tacking manoeuvres, coaching and refereeing all play a role in injury risk. All matches at the St John's Easter rugby festival have referees sanctioned by the professional Golden Lions Rugby Union, and although there is always debate amongst players, coaches and parents, they are certified and knowledgeable such that they should be applying the rules and exercising oversight on the field. In competitions at schools where there are not always certified and experienced referees, the lack of applying rules appropriately may increase the risk of injury (Noakes, Jakoet, & Baalbergen, 1999), which may be from more illegal tackles, collisions and foul play.

1.3.5 Previous similar injury

In chronic and / or overuse injuries having had a similar previous injury is a known risk for another similar injury (Hagglund, Walden, & Ekstrand, 2006) (Dvorak, Junge, & Chomiak, 2000). This risk trend is also found in young players (Emery, Meeuwise, & Hartmann, 2005) (Kucera, Marshall, Kirkendall, Marchak, & Garrett, 2005).

1.4 Need for medical facilities at events

At rugby matches the risk of injuries in schoolboy rugby players is higher than in training, and this would be true for the Easter Rugby Festivals. It is prudent that there should be a medical service facility at the venues. Based on the literature there are also a wide range of injuries likely to occur.

These may be simple soft tissue injuries, and may require little intervention in the form of first aid. On the other end of the scale for acute potentially limb and life-threatening injuries, which are seen in rugby, there is an urgency and need for adequate pre-hospital treatment and management as well as rapid referral to an appropriate healthcare facility.

In addition, from a legal point of view, the recent "Safety at Sports and Recreational Events" Bill of 2010 (Government Gazette, 2010), applies to events including sporting events, hosted at a stadium, venue or along a route as defined by the Act. A venue is defined as a facility that can accomodate (seating or standing spectators) of at least 2000 persons. The requirements refer to the *capacity*, and does not relate to the actual number of people that are participating or attending an event. Thus some school events, such as the very popular Easter Rugby Festivals, fall within the ambit of this Bill.

The Bill covers aspects of ensuring responsibility and measures in place for safety and security at events, and general provisions. The Bill is not guaranteed to be evidence-based, but may be assumed to be so; taking into consideration that the people and bodies consulted would have applied best practice and evidence-based information. These included judges, 18 national departments, provincial departments of sport and recreation, statutory bodies (e.g. secretariat for safety and security),

national sports and recreation federations, sports macrobodies, national and provincial disaster management, city metropolitan councils, emergency services, sports sponsors, stadium security services, stadium managers and a number of representatives in various areas of expertise (Government Gazette, 2010). The ultimate responsibilty of complying lies with the controlling body, organiser or owner of the venue – therefore the school hosting a rugby festival that can accomodate more than 2000 people as well, must comply.

Research in the South African context is lacking, but internationally research would infer that many schools do not comply. In Northern Ireland and the Republic of Ireland a questionnaire based analysis was used to establish the school readiness and preparedness for the immediate care of sports injuries (Abernethy, MacAuley, McNally, & McCann, 2003). The results showed that between 35% and 81% out of 333 assessed schools were ready to deal with all sports injuries, and that would include rugby, based on operational plans and safety and medical equipment in place. The assessments were analysed using four different scenarios which were presented to assess the appropriate responses to the scenarios. What were deemed appropriate outcomes from the scenarios were evident in 65-90%. The study concluded that overall there still were deficiencies in sport injury care at school level, which should not be the case in high risk rugby matches and tournaments.

In 1993 a survey was undertaken by the then South African Rugby Football Union (SARFU) in the South African fourteen Provincial Unions to determine the prevalence of primary field-side medical care at club and schools around South Africa (SARU, Boksmart, 2009) . They found that there was a significant lack of such services. They further noted that the primary cause of this lack was:

- “The exorbitant costs involved in providing this emergency medical services
- The number of trained personnel to provide such emergency medical services countrywide was lacking “.

In addition SARU has a ‘Serious Injury Protocol’ through its Boksmart programme (SARU, 2009), in attempts to provide the best possible medical care for rugby players at all levels. Thus minimum medical requirements relating to the medical personnel and equipment must be present at SARU sanctioned events, including schoolboy rugby.

The impact of injury and the burden of sports injuries, and in particular at school level is unknown. Injury does carry a financial burden, which must be borne by medical insurers, sponsors, parents, schools or others, where medical costs need to be covered. There is also absence from school (and often time off work for parents/guardians) (Rechel, Collins, & Comstock, 2011) and reduces participation in physical activity (Orchard & Finch, 2002).

Macintosh (2005) concluded in a review of paediatric rugby injuries that “Research is required to understand better injury risks and to reduce the incidence of shoulder, knee and ankle joint injuries, concussion and spinal injury.” Further, legal aspects for events that should comply with the “Safety at Sports and Recreational Events” (South Africa, 2010), can be difficult if the range of injuries likely to occur is unknown. In the context of a rugby festival where there is fierce competition, multiple matches within a short period of time, a potential for mismatching of teams and players, injuries are likely to occur. No research has been done on these events and it is unknown whether the festivals, popular as they are, are leading to injuries that could

end the rugby playing careers of the schoolboys or affect their wellbeing. In order to address such questions this study was performed.

Study objectives

The aim of the study was to analyse the prevalence and type of injuries over two years of a Johannesburg High School rugby festival.

Objectives:

a. to describe the injuries (number, anatomical sites, types and severity) that occurred at Easter Rugby festival matches at a Johannesburg high school over two years
b. to compare the injuries between the two years
c. to compare the injuries between the three days of the festivals

2. Methodology

2.1 Setting

The site of the study was the St John's College Easter rugby festivals, Houghton, Johannesburg, South Africa; a private all-boys school.

The festival has three full days of play over the Easter weekend period, usually on the Thursday before Good Friday, the Saturday and the Monday after Easter Sunday. In each festival there were 12 high schools and 10 preparatory schools that participated. In the rugby festival there are different times of exposure per match, where matches are variably played over 30 minutes, 35 minutes or 40 minutes. (Stoops, 2013). There are an average of 35 matches played in any one weekend festival and each participating player may play between one and four matches in that time. The refereeing at the festival matches is done by certified referees of the Golden Lions Rugby Union.

2.2 Study design

The study design was a retrospective, descriptive and analytical non-experimental (observational) study.

The *study population* were the participating rugby players at the rugby festivals in both 2010 and 2011.

2.3 Medical facilities

At the St John's Easter rugby festival the medical service provision is adequately manned and conforms to the guidelines of the South African Rugby Union (SARU, 2009). The personnel on site include the school nursing sister (who is a professional nurse and is operating theatre trained), a volunteer sports medicine doctor, paramedics and first aiders trained in first aid and spinal immobilisation. The researcher was the volunteer medical doctor at both festivals and thus either completed the forms himself or checked and oversaw the completion, making standardisation and interpretation of injuries more accurate and consistently recorded. Further as the researcher also managed the injuries the injury detail was accurate.

Adjacent to the main rugby field there is a tent and surrounding area clearly demarcated as the medical facility. Equipment consisted of basic first aid supplies and consumables, and advanced life support equipment. Medication for acute use was available and the school sister had a dispensing license for stocking medication and should there be a need for dispensing medication. There were no restrictions to access the medical facility.

Funding for the facility is provided for by a budget from the proceeds and profits of the previous annual festival, and on some occasions from sponsorships.

2.4 Inclusion criteria

- All rugby related injuries in schoolboy rugby participants at the festival seen at the medical tent
- All completed medical records that had adequate information

2.5 Exclusion criteria – nil

2.6 Measuring tools

The injury recording form based on the Injury International Consensus (Fuller, et al., 2006) was used for capturing injury data (Annexure A). Spread sheets with relevant data headings were used for data capture. Once injuries were assessed, a decision as to whether any further investigation to guide management was made. These would be if there was the clinical suspicion of a fracture (X-rays) or significant tendon or ligament rupture where surgical intervention may have been required (magnetic resonance imaging [MRI]). The researcher was the only person making these decisions.

2.7 Procedure and data collection

The written records from the 2010 and 2011 Easter Rugby festivals were obtained and analysed on a spread sheet with: team, injury type, anatomical site and injury severity (according to Fuller et al, 2006) Further information recorded included mechanism of injury, whether the injured players were referred for specialist medical care (e.g. neurosurgeon), to hospital, were withdrawn from play at the time of injury and / or if sent for any investigations. All information was obtained by asking the injured player and where possible verified by the first aiders or paramedics, coach, parent/s and / or peers.

2.8 Severity of injury

The prevalence of injury severity was assessed by whether the injury was severe enough for the player to stop / be withdrawn from playing in the match in which they

sustained the injury. The decision to stop / withdraw from play was made by the medical personnel and verified by the researcher in his capacity as medical director; and not the coaches.

2.9 Ethical considerations

Permission for the use of the medical records for research was granted by the school (Annexure B).

Ethics permission was granted by the University's Human Research Ethics Committee (medical) for Human Subjects (clearance certificate number M120229, Annexure C).

All participating schools and players signed indemnities and allowed for injury records to be kept during the rugby festivals. All data selected and used did not identify individual players in the analysis.

2.10 Data analysis

Data analysis from the three days of festival matches included injury details with number of injuries, types of injuries and mechanisms of injury.

As most of the data was categorical, descriptive statistics looked at frequencies and percentages. Comparative statistics for non- parametric data between the two years was done with unpaired t-tests and between the different days of the festival was done using non-repeated measures ANOVA tests. Comparisons of categorical data was done with Fisher's exact tests.

The data was analysed using a computerized software programme (Microsoft Excel 2010, Graphpad software [http://www.graphpad.com/quickcalcs/ttest1.cfm]) and Statistica V12. A level of significance of $p<0.05$ was used.

3. Results

The results will be presented in the following formats and sequence:

1. Total data for all variables
2. Year 1 and year 2 results split only by year
3. Different days of the festivals compared to each other

A total of 626 players participated (322 and 304 in each year respectively).

3.1 Injured body parts

The various body parts injured are depicted in figure 1, showing most injuries being to the head/face, and in fact were mostly concussion (figure 1). The next commonest injury was to the neck area, followed by the knee and hand / fingers / thumb. There was no significant difference between anatomical sites of injury between the two years of the rugby festivals ($p = 0.6387$, Fishers exact test).

Assessing whether previous similar injuries had occurred as those at the festival showed that the majority (84.5% in year 1 and 78.2% in year 2) had not previously had similar injuries. In those that did report similar previous injuries, as expected, most were dislocations and repeat ligament strains.

Most injuries (figure 1) occurred to the upper body, namely head & face, neck, fingers (year one: 22%, 7.5% and 7% respectively and year two: 40%, 17% and 0% respectively), of which most were soft tissues (figure 2) (year one: ligaments & muscles, 28%; year two: 26%) followed by abrasions & contusions (year one:24% and 24% in year two). Following the upper body the next frequency of site was the

lower limb (figure 1) (year one: 35%; year two: 20%) which also followed the same injury type pattern (figure 2).

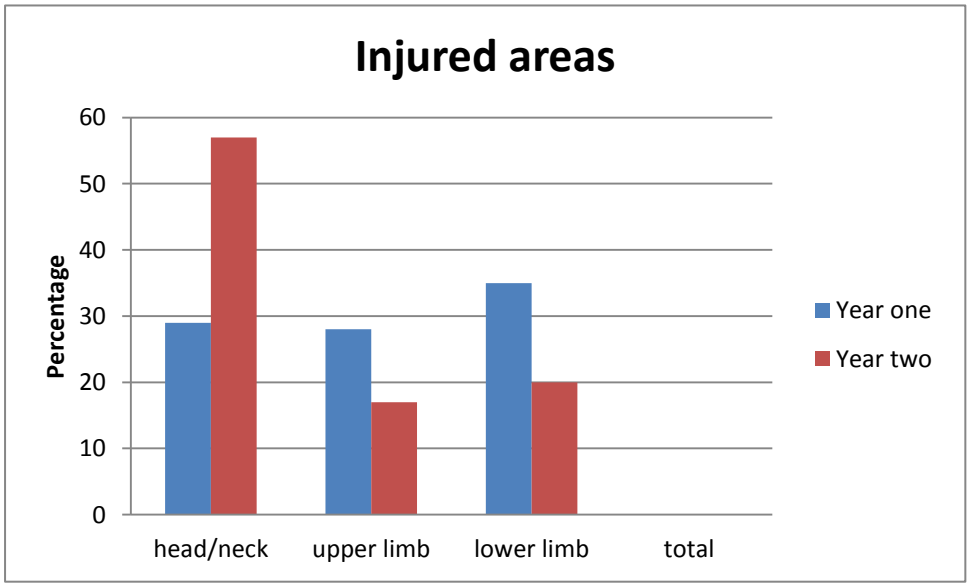


Figure 1. Injuries over the two festivals

3.2 Number of injuries

A total of 100 injury data sets were complete enough to analyse over the two annual rugby festivals. Incomplete data sets were not included, of which there were 5 and 6 in each year respectively. Considering the number of injuries and matches played, the injury rate was 408 per 10 000 match hours. The injury rate per player in year one was 16.8%, and 15.2% in the second year. The injury rate of 1.5 injuries per match was evident in the first year's festival and 1.4 in the second festival. Comparing the two years, it was found that there was no statistical difference in the injury rates between the two years (Chi squared 0.203, P = 0.6526).

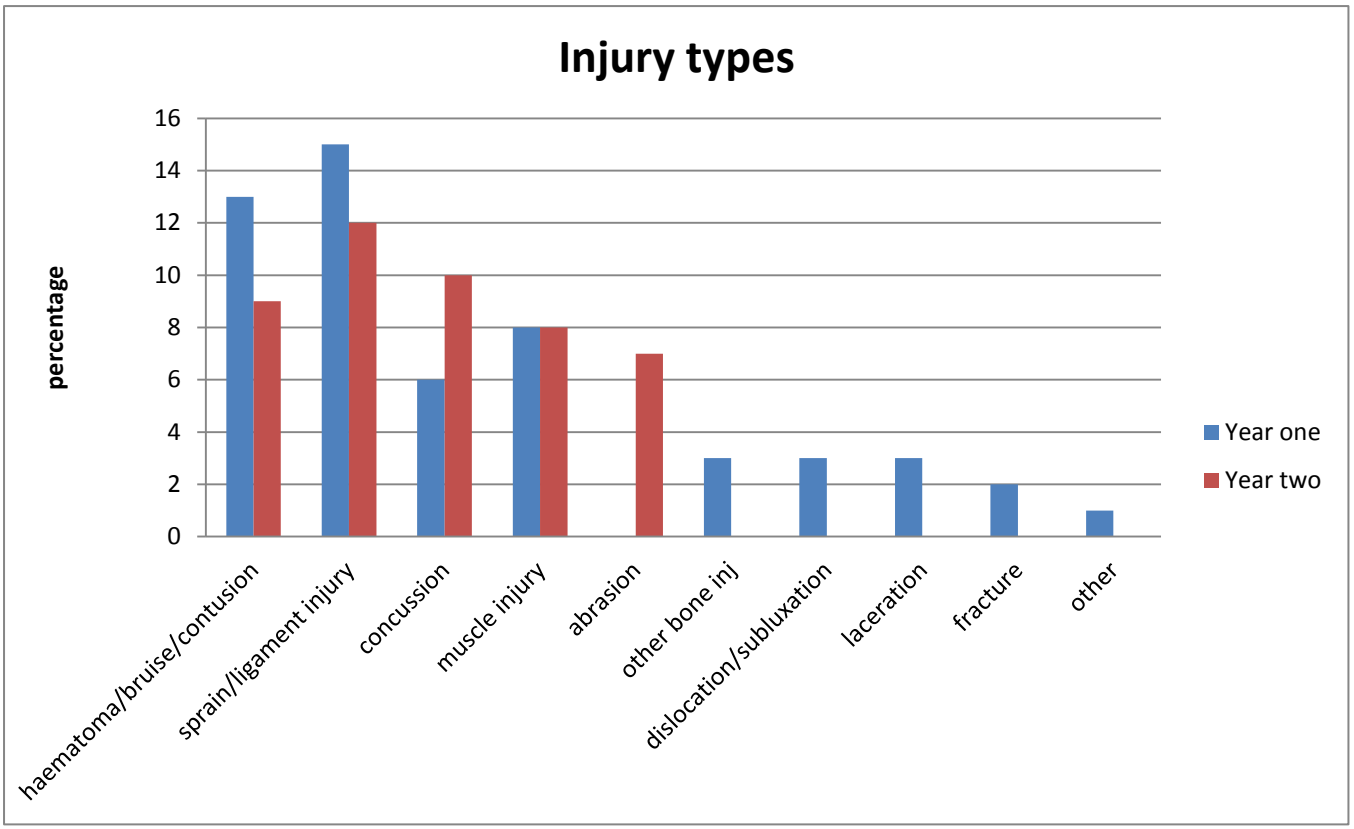


Figure 2. Injury types and frequencies in years one and two.

It was found that there were significant differences in the frequency of injury types between the years (p=0.0230) (figure 2), noting that the top 4 injury types, haematomas / bruises and contusions; ligament sprains, concussion and muscle injuries, were similar between the two years. There were incidences of dislocations, lacerations and fractures in year one, but not in year two. None of the fractures involved the cervical spine. Injuries not specified and referred to as “other” included abdominal, neural or a site which did not fit in with the standardised format of data collection.

3.3 Injuries between the three days of the festivals

The numerical data of types of injuries between the different days of the festival were analysed (Table 3).

The injuries between day one of year one compared to day one of year two using ANOVA did not show any statistical difference (p= 0.54) (figure 3). Comparing day two of year one and day two of year two also did not show any statistical difference in types of injuries. (p = 0.27; 95% confidence interval -0.43 to 1.43)

The difference of types of injuries comparing day three of the two years did not show any statistical difference. (p = 0.55; 95% confidence interval -0.46 to 0.84).

Table 3: Injury frequencies and anatomical sites on different festival days

	head/face	neck/cervical spine	sternum/ribs/upper back	lower back/sacrum/pelvis	Shoulder /clavicle	upper arm	elbow	forearm	wrist	hand/finger/thumb	thigh	knee	lower leg/Achilles tendon	ankle	foot/toe	**Total (by day)**	**Total by fetival**
first festival day –year 1	6			1						1		1		1		**10**	**Year one n=54**
second festival day –year 1	2	3	3	1	2		1			4	2	1	2	2	1	**24**	
third festival day year 1	4	1			2					3	1	6		1	2	**20**	
first festival day – year 2	8	2				1	1	2				2				**16**	**Year two n=46**
second festival day – year 2	5	4	1					2	1		1	1				**15**	
third festival day –year 2	5	2	1			1	1				1	4				**15**	
Total (by anatomical site)	**30**	**12**	**5**	**2**	**4**	**2**	**3**	**4**	**1**	**8**	**5**	**15**	**2**	**4**	**3**		**100**

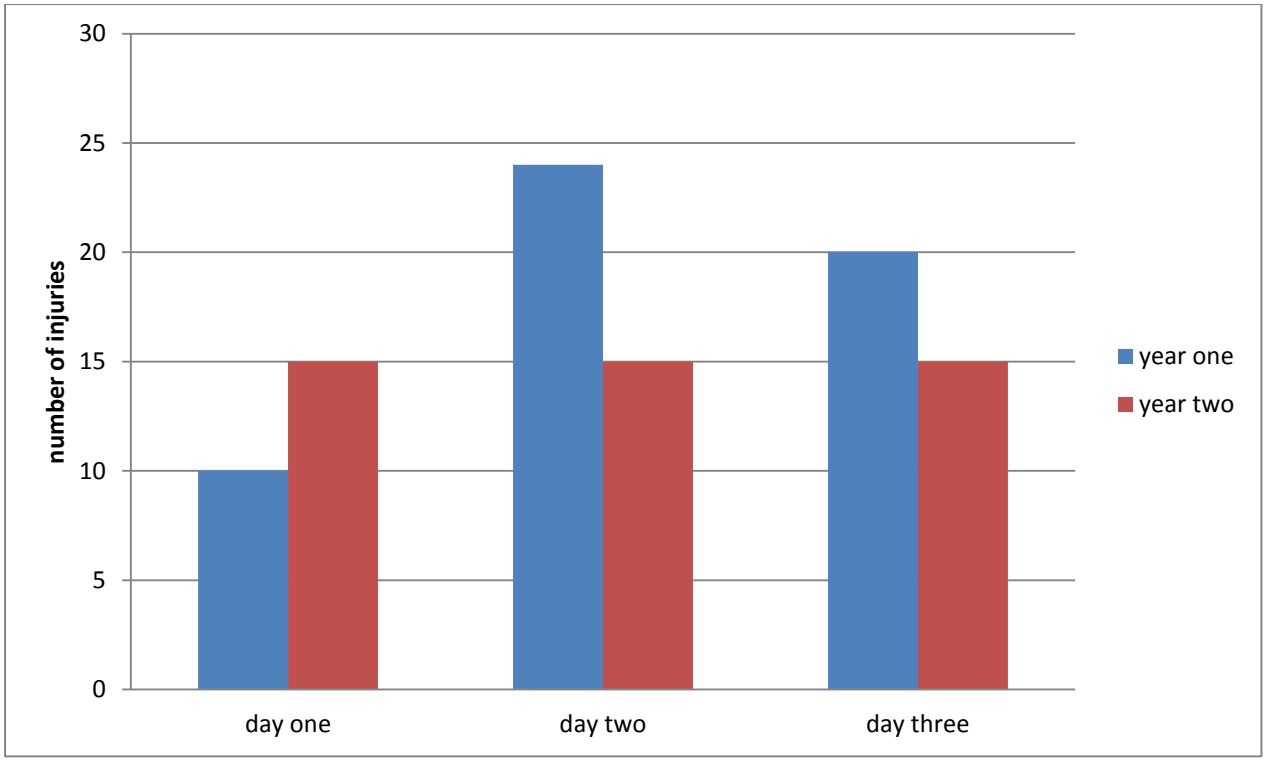


Figure 3. Injury frequencies on different festival days over the two years

3.4 Mechanisms of injury

The mechanism of injuries was mostly related to tackles, accounting for almost a third of the injuries, followed by accidental collision (figure 4).

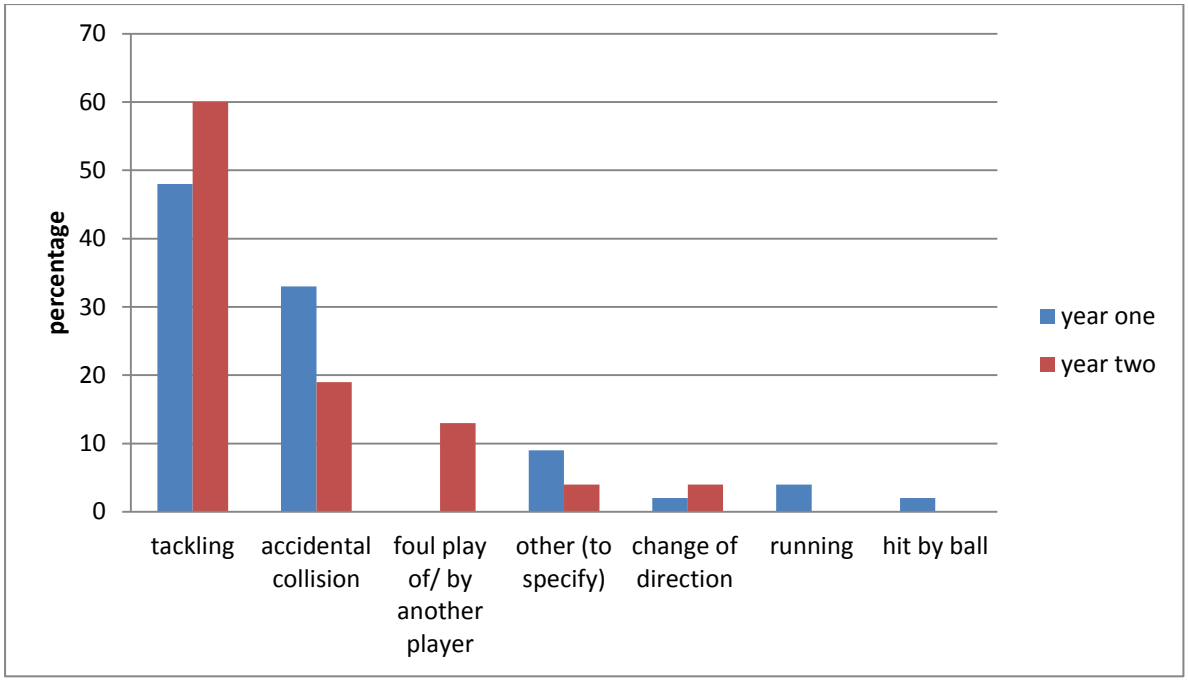


Figure 4. Mechanisms of injury

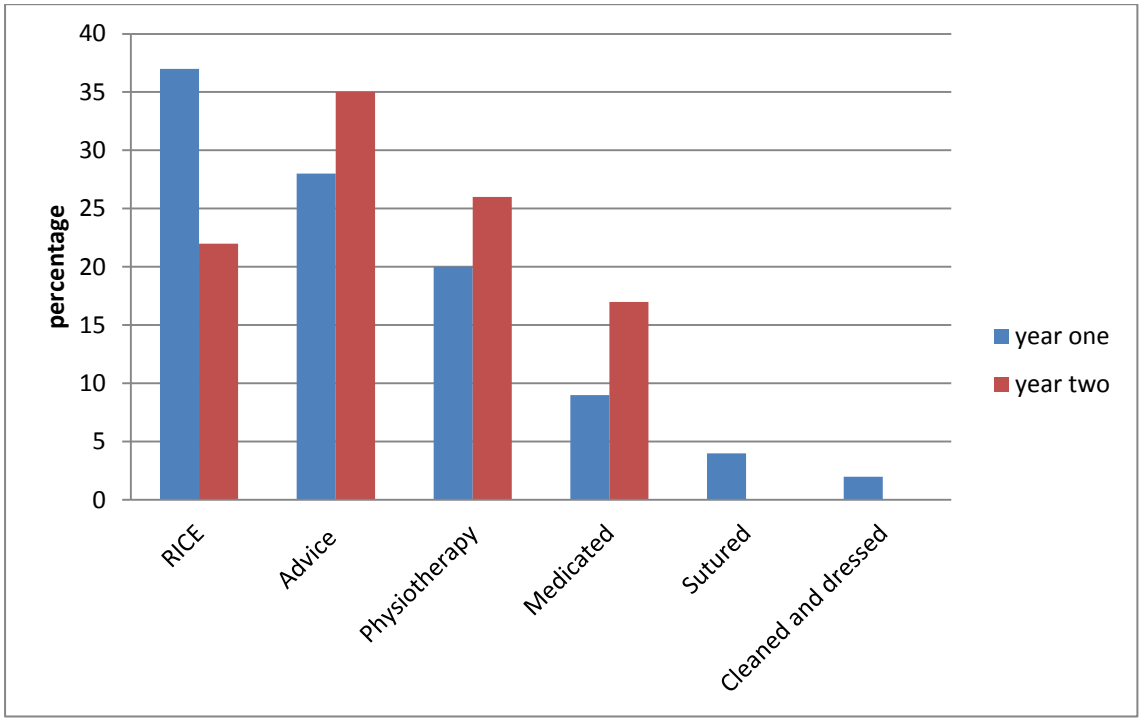
3.5 Injury severity

Over the two years' festivals 27% of those players that were injuredstopped play due to the severity of the injury they sustained in year one and 22% in year two. These injuries that were considered severe enough to remove the player from playing, irrespective of the site or anatomy affected included concussion with symptoms, and musculoskeletal injuries that affected function. Severe injuries necessitating removal from play were not significantly different between the two years ($p=0.6431$, Chi ^{2}). No catastrophic injuries such as severe neck injuries with neurological fallout, were sustained.

3.6 Injury management

Most injured players were given advice on their injuries, as they were mostly minor. Management of injuries (figure 5) indicates that most management required basic

first aid (RICE principle and advise) (20-35%). This was followed by referral for soft tissue therapy using physiotherapy (20%) and medication (9-16%) (non-steroidal analgesics or analgesics). Treatment may not have been mutually exclusive, as, for example, there may have been RICE and physiotherapy. There was no significant difference between the two years (p=0.58).



RICE = Rest, ice, compression and elevation

Figure 5. Management of injuries after assessment.

3.7 Investigations and referral

In both years X-rays were requested, but the numbers were not similar (p= 0.0120, Chi $^{2)}$ (fig. 6). Nine school boys were referred for X-rays in the first year and 19 in the second year with only one school boy referred for an MRI scan in year one. In the first year, of the nine referrals for X-rays, 4 were for neck injuries, 3 suspected fractures, and 2 to exclude an avulsion injury. In the second year of the 19 referrals for X-ray, 5 were for the cervical spine, 11 to assess for fractures, and 3 for dislocations / joint injuries. Two of the players had fractures confirmed and were immobilised and referred on to orthopaedic surgeons for further management.

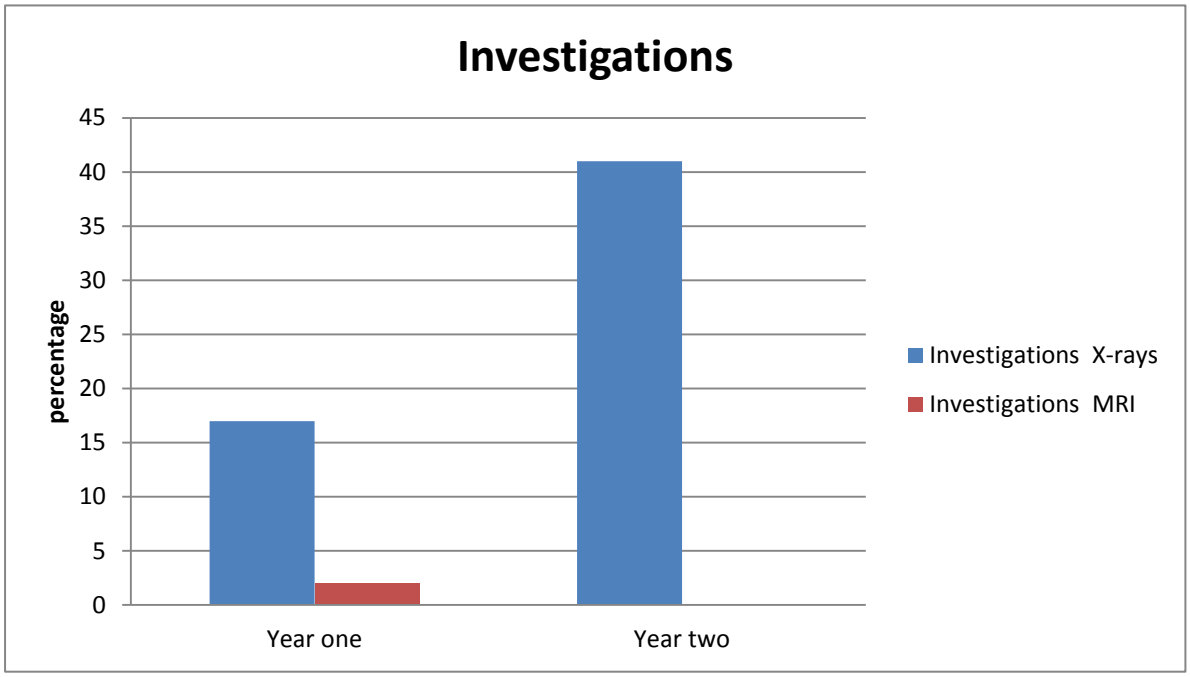


Figure 6. Referrals for investigations.

3.8 Side of injury and age

Data with respect to side of injury refers to left and right but also to “other”, (figure 7). “Other” refers to injuries where side of injury is not applicable for (example central / both sides; face, neck).

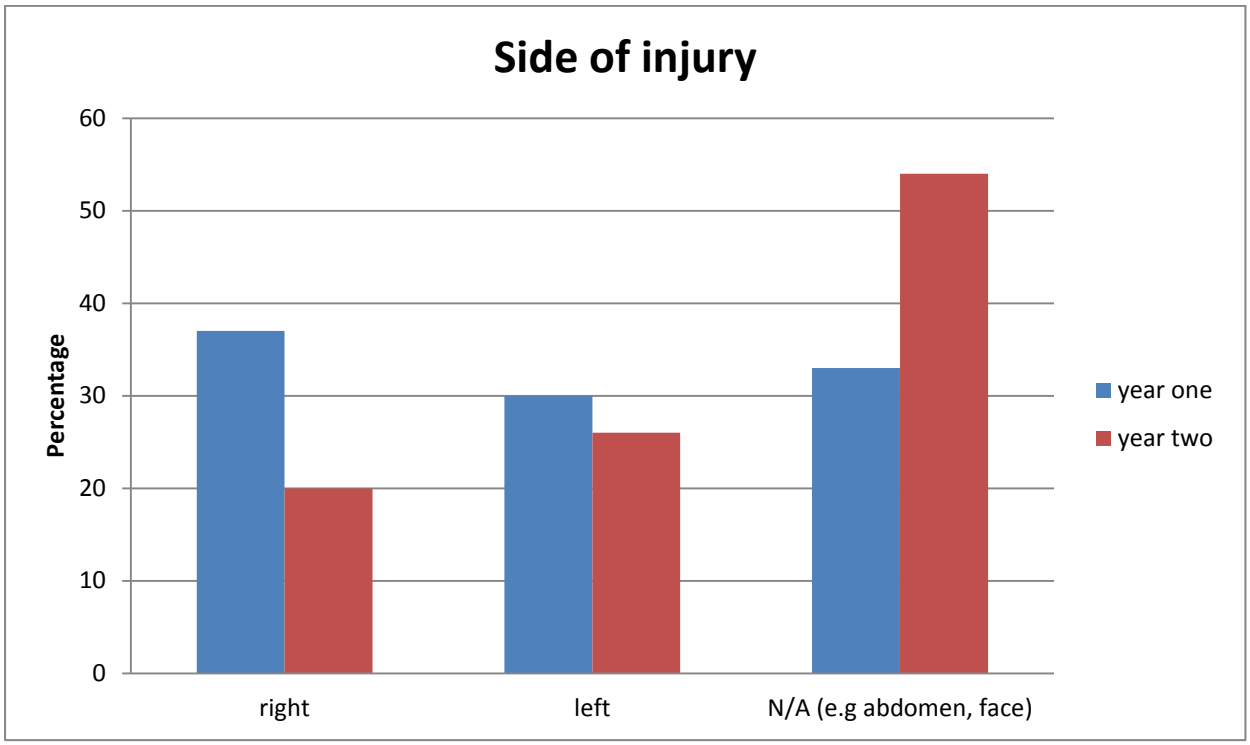


Figure 7. Side of injury

4. Discussion

Details of injuries at school level and senior club level rugby have been reported in Great Britain, Australasia and South Africa (Lee & Garraway, 1996) (Roux, Goedeke, Visser, van Zyl, & Noakes, 1987) (Nathan, Goedeke, & Noakes, 1983) (Davidson R. M., 1987) (Sugerman, 1983), but are lacking from the last decade or two.

Over the two years of rugby festivals it was found that injuries occurred at a frequency rate in the first year of 16.8%, and 15.2% of all players in the second year. The commonest injuries were of the head and neck, and anatomical structure of soft tissue injuries, with ligament sprains being predominant; followed by haematomas/bruises/contusions, then muscle injuries. There was no statistical difference in the injury numbers between the two years. The types of injuries between the respective days between the two years were not statistically different. Most injured players had not had previous similar injuries.

The tackle was the most common mechanism of injury, accounting for between 40 and 60% of all injuries. Twenty four percent of injuries were deemed severe enough to stop the players from continuing play. Once an assessment is made of injuries on-site, in addition to a decision regarding management, there are times where investigations may be required to assist in decisions of treatment Few players required referral for investigations or specialist physician care and most were managed with simple first aid at the primary care level.

There may be means of influencing behaviour in injury prevention techniques, as shown by Finch, McIntosh and McCrory (2001), where the trust of 15 year old schoolboy rugby players' in protective headgear could lead them to tackle harder;

irrespective of the protection afforded by headgear. Stokes et al (2010) also showed behavioural intervention benefits in tackling.

The discussion following will address the findings of the two rugby festivals over 3 days each with respect to mechanisms of injury, similar previous injury, side of injury, investigations and management.

4.1 Number of injuries

Over the two years in this study a total of 100 injuries were recorded over the two rugby festivals, played over 6 days. Thus an average of just over 16 injuries per day was evident. The injury frequency found in this study is not unlike the results found elsewhere (Nicol, Pollock, Kirkwood, Parekh, & Robson, 2010). An average of 1.5 injuries per match in this study is lower than some other studies (Parekh, Hodges, Pollock, & Kirkwood, 2011) (Roux, Goedeke, Visser, van Zyl, & Noakes, 1987). (Davidson R. M., 1987). In the latter two studies the evidence presented of changes to rules and aspects of refereeing can account for this. With respect to the former study by Parekh et al (2011), they reported injuries in the literature of 70 to 1298 injuries per 10 000 player-hours.

There was no way of logistically recording time exposure of each of the injured boys individually, thus injuries could not be reported as per hour units of exposure. In both years 12 high schools and 10 preparatory schools participated, with 69 matches played (36 and 33 in 2010 and 2011 respectively).

Lee and Garraway (1996) reported that in 154 school rugby players there were 210 separate incidences of injury in 186 injury episodes, 80% occurring in matches. The prevalence rate in matches was 868 (95% confidence interval 73.4-100.2) per 10

000 player-seasons. We found the injury rate was lower amongst the schoolboys participating in the festivals.

What has not been previously reported is the distribution of injuries on match days, which are played on three days over the Easter weekend. One could theorise that perhaps injuries would have been higher on the first day, with increased vigour and excitement of the participating boys; or alternatively that the third day would be a more vulnerable time due to player fatigue. However the results show that there was no significant difference in the frequency of injuries on any of the three festival days.

4.2 Injured body areas

The findings in the study were that the majority of injuries were of the head and face followed by the lower limb. On the other hand Nathan et al (1983) and Davidson (1987) studying injuries in schoolboy rugby players over one season found most injuries were of the head and neck injury followed by the lower limb. In children the head size is relatively large compared to the total body, and the head:neck girth is increased, with this having been raised as a possible reason for more head and head-related injuries in younger players (Adirim & Cheng, 2003). In our study the results approximated more toward adults, possibly due to the fact that the participants were in the latter years of schooling and their ages closer to reported adult players.

Studies in professional and amateur rugby league players showed the head and neck being common areas of injury, followed by the lower limb (Gabbett, 2004) (Carvell, Fuller, Duthie, & Cockin, 1983) (Clark, Roux, & Noakes, 1990) (Hoskins,

1978) (Kew, et al., 1991) (McCoy, Piggot, Macafee, & Adair, 1984). Whether the nature of play in the time of the different studies, with more recent times showing increased intensity and competitiveness, had anything to do with that or other factors are at play is unclear. Further, changes in refereeing and or coaching may influence the site of injury, but cannot be determined. Law changes related to tackles and to scrums at the time may also have played a role. The next commonest injury was to the knee and hand/fingers/thumb.

4.3 Side of injury

With respect to the side of injury, injuries were not more prevalent on any one side.

4.4 Previous similar injury

In chronic and / or overuse injuries having had a similar previous injury is a known risk for another similar injury occurring (Hagglund, Walden, & Ekstrand, 2006) (Dvorak, Junge, & Chomiak, 2000). This risk trend is also found in young players (Emery, Meeuwise, & Hartmann, 2005) (Kucera, Marshall, Kirkendall, Marchak, & Garrett, 2005). However in the setting of acute traumatic injuries typically sustained in the rugby festivals this was not the case, where it was shown that there was no significant history of a previous similar injury having occurred.

4.5 Mechanism of injury

The most common injuries were related to tackles, accounting for 48-60% of all injuries, followed by accidental collision. The mechanisms of injury in this study are

similar to other studies (Roux et al, 1987) which showed that the majority (55%) of injuries over one rugby season occurred in tackles.

As one would expect, non-contact mechanisms of injury, such as occur with running, are far less frequent in the collision sport of rugby.

4.6 Injury severity

In the literature there are many different ways of defining injury severity, with most using time off from activity as a measure. This varies, with several reporting injuries as being severe when players are off for one week or more (Fuller, et al., 2006) (Roux, Goedeke, Visser, van Zyl, & Noakes, 1987).

In this study, due to the nature of the festival and many participants from numerous schools and that there is no follow up by the school medical services after the festival; with the only way to assess severity to any degree was to record whether the player could continue playing the match in which they sustained the injury, or for the remainder of the festival. Numerous players were advised not to continue for that match or indeed other matches during the festival; however it is unknown whether they heeded this advice.

The worst injuries in rugby are those affecting the cervical spinal cord, and by definition would be considered severe. Law changes in schoolboy rugby in 1990 led to an estimated 46% reduction in spinal cord injuries, as shown in a study looking at these injuries in the Western Cape between 1990 and 1997 (Noakes, Jakoet, & Baalbergen, 1999). However recovery from spinal cord injuries are more likely in schoolboys than in adults (Noakes, Jakoet, & Baalbergen, 1999) (Quarrie, Cantu, & Chalmers, 2002). Fortunately there were no catastrophic neck injuries in the study

cohort. This could be related to the controlled environment where refereeing is of a specified standard, and the matches are closely watched both in live form and being televised. This may have bearing on reducing chances of foul and dangerous play. Using data from this study and similar research can further address mechanism to reduce injuries.

4.7 Injury management

The standard internationally accepted and evidence-based approach to musculoskeletal trauma is the RICE principle: “rest”, “ice”, “compression” and “elevation”, which reduces swelling and pain (Dyment, 1986) (Bleakley, et al., 2007) (Thornton & Sewickley, 1997) (Johannsen & Langberg, 1997) (Landry & Gomez, 1991).

Most management of injuries at the rugby festivals required basic first aid (RICE principle). This was followed by referral for soft tissue therapy using physiotherapy and medication. This correlates to the nature of injuries where intervention would be appropriate for soft tissue injuries of ligaments, muscles and contusions.

A factor that was not assessed and that has influence as a barrier to adequate management is the financial burden. The detail of how resources are funded at the St John’s College rugby festivals is not readily available for discussion here, but certainly involves sponsorship and subsidy, which may not easily be available to other event hosts. This has not been assessed and it is unknown if it is too much or too little. Such analysis could be useful to reduce costs for other festivals.

4.8 Investigations

Nine players were referred for X-rays in the first year and 19 in the second year. This is a wide variation in the difference between the two years. The clinical criteria for referral would be similar in both years, and one must conclude that the level of injuries were different, such that where there were ligament injuries they did not appear to have bony pathology associated with them, or were not of a nature or severe enough to cause joint instability. Why that should be different over the two festivals is unclear. Most indications for X-ray would be to assist with management decisions.

There are times when other factors in this festival rugby-playing environment may play a role in the decision on whether to do any investigation, such as where parent pressure is present, confirmation of an injury or to show radiological pathology for purposes of convincing the coach or player not to allow them to continue playing. Any investigation that may have been performed at a later stage and related to the injury would not be known, as this research data is only of those players sent directly from the rugby festival.

Much effort has shifted in recent years towards preventing injury; and in the rugby festival setting, the majority of injuries are acute traumatic injuries and very few are secondary to chronic overuse injuries. Thus the prevention of injuries must address extrinsic factors for reducing the incidence of injury, which will be revealed in the injury mechanism. Accidental contact, foul play and other contact would need to be addressed to reduce match injury .

4.9 Limitations

The study had a number of limitations, which taking cognisance of, will allow for better research in this field in future.

The data collection forms used a standardised international form (Fuller, et al., 2006) which had flaws in some respects for this study. These were that there was no place for recording dominance of the players, nor their age. Details of how many matches played and how much time played would also add value. This affected the depth of the results of the research, but not nominally in the broader context.

Although results were analysed as grouped data with respect to numbers of participating players and number of matches, it was difficult to relate exposure accurately to individual players. The methods of analysis of data in this study however has precedent in other studies, but may be considered lacking for individual risk determination where exposure in participation is measured in matches and not time.

Some injured players may have not presented to the available medical centre at the festivals for assessment or management and this data was not available for inclusion in the study.

The mechanism of injury, as reported by the players themselves may not be completely accurate. There may also be the case where foul play is involved either with an opponent, and especially more so with the injured player himself, where they do not want to report it. Indeed very few reported foul play, which in all likelihood is not a true reflection. Particularly with contact forms of injury, it may be that in the fast paced time of play there are times that the players could not properly recollect the actual mechanism of injury.

Another limitation is that the results cannot be extended to all schoolboy rugby festivals and schoolboy rugby competitions, or even playing in normal matches taking place weekly with adequate time to recover between matches. These festivals were hosted by a school that had resources with respect to funding, raising monies for the event with access to expert medical care with good facilities, and access to qualified referees. Schools without these may have more and/or more severe injuries.

5. Conclusion

Schoolboy rugby injuries do occur and can range from minor to catastrophic. This is in fact logical due to the nature of it being a collision sport. What was shown in this study of two annual rugby festivals was that there were a total of 100 injuries that were assessed and managed by the medical personnel. The majority of injuries were to the head/face, and were mostly concussion, then the neck area, followed by the knee and hand/fingers/thumb. Most injuries were not severe enough to necessitate investigations or withdrawal from play and only required basic first aid.

With a capacity of over 2000 people, compliance with the law necessitates adequate services (Government Gazette, 2010), notwithstanding the importance of the medical and paramedical personnel's competency and skills in dealing with head and neck and other injuries. Thus adequate and appropriate medical preparedness and provision is essential. Under the correct circumstances of schoolboys playing rugby,

injuries can be minimised and when injuries do occur, these can be optimally managed at field side. They can also be referred for radiological investigation for suspected neck and other injuries; more as a precautionary measure than for clear signs of pathology.

There is the need for a lot more data with many different variables, including age, venues, type of matches and so on, to get a full picture and to see if there are situations where injuries increase. Such data can be used to show injuries can be kept to a minimum.

Another way to keep data is through a national register of sports injuries, or at least rugby injuries at schools, which would be useful to analyse data in efforts to reduce the incidence of, and optimise management. Such registers exist, for example, in the United States of America and in New Zealand, where the latter has a body responsible for managing sports injuries, similar to that for work-related and traffic-related injuries (Orchard & Finch, 2002). They concluded that only with an established infrastructure for monitoring injuries, will it be possible to prevent injuries and promote safe physical activity. Such initiatives contribute to understanding injuries and are important in prevention programmes and promoting physical activity in a healthy manner for the overall benefit of communities.

It would be important to collect the right data and thus the forms used previously at St John's College and in this study should be modified to make them more appropriate; such as including day of match (for festivals), age, limb dominance, weight / BMI, tackler / tackle, follow up assessments etc. Information related to venues and facilities may have value for coaching and refereeing standards. Most matches are recorded either for television coverage or by the schools and teams. It

would be of great benefit for future research to make us of such video recordings for analysis to ascertain true mechanisms of injury and other pertinent information.

Providing medical services at rugby events such as these festivals is a requirement and adequate standardised record keeping is recommended to increase knowledge and monitor trends as the dynamic nature of the game of schoolboy rugby continues to develop and change.

Research of schoolboy rugby injuries will assist in approaches to injury prevention, considering risk with appropriate statistical techniques such as logistic regression with large amounts of data, mechanisms of injury and behaviours.by having more information on injuries at rugby festivals, in addition to traditional injury prevention strategies, and physical factors, behaviour modification may be explored.

Very little research has been done on schoolboy rugby injuries in the last decade in South Africa. None has been done for the unique situation of intense rugby match playing over 5 days at rugby festivals. The data from this study show that with good refereeing and coaching, injuries at schoolboy rugby matches can be kept low. Those injuries that do occur can be treated with basic first aid principles. These data should be used as a benchmark against which other injury patterns in schoolboy rugby can be measured.

6. References

Abernethy, L., MacAuley, D., McNally, O., & McCann, S. (2003). Immediate care of school sport injury. *Inj Prevention, 9*, 270-273.

Adirim, T. A., & Cheng, L. (2003). Overview of injuries in the young athlete. *Sports Med, 33*(1), 75-81.

Bleakley, C. M., O'Connor, S., Tully, M. A., Rocke, L. G., Macauley, D. C., & McDonough, S. M. (2007). The PRICE study (Protection Rest Ice Compression Elevation): design of a randomised controlled trial comparing standard versus cryokinetic ice applications in the management of acute ankle sprain. *BMC Musculoskelet Disord, 19*(8), 125.

Board, I. R. (2010, Jan 2). *SA Rugby Forum*. Retrieved from http://www.rugbyrefs.com/archive/index.php/t-8932.html?s=303083a80c52e398f39308f1ab98fcee

Boran, S., Lenehan, B., McCormack, D., & Poynton, A. (2011). A 10 year review of sports-related spinal injuries. *Br J Med Sci, 180*, 859-863.

Brittanica, E. (2013). *Merriam Webster dictionary*. Retrieved Feb 4, 2013, from http://www.merriam-webster.com/dictionary/rugby

Brooks, J. H., Fuller, C. W., Kemp, S. P., & Reddin, D. B. (2005). Epidemiology of injuries in English professional rugby union: part 1 match injuries. *Br J Sports Med, 39*, 757-766.

Carvell, J. E., Fuller, D. J., Duthie, R. B., & Cockin, J. (1983). Rugby football injuries to the cervical spine. *Br J Sports Med, 286*, 49-50.

Clark, D. R., Roux, C., & Noakes, T. D. (1990). A prospective study of the incidence and nature of injuries to adult rugby players. *S Afr Med J, 77*(11), 559-562.

Cunningham, A. (2002). An audit of first aid qualifications and knowledge among team officials in two youth football leagues: a preliminary study. *Br J Sports Med, 36*(4), 295-300.

Darrow, C. J., Collins, C. L., Yard, E. E., & Comstock, R. D. (2009). Epidemiology of severe injuries among United States high school athletes:2005-2007. *Am J Sports Med, 37*(9), 1798-1805.

Davidson, R. M. (1987). Schoolboy Rugby injuries, 1969-1986. *Med J Aust, 147*(3), 119-120.

Davidson, R., Kennedy, M. J., & Vanderfield, G. (1978). Casualty room presentations and schoolboy rugby union. *Med J Aust, 1*(5), 247-249.

Dupont, G., Nedelec, M., McCall, A., McCormack, D., Berthoin, S., & Wisloff, U. (2010). Effect of 2 soccer matches in a week on physical performance and injury rate. *Am J Sports Med, 38*(9), 1752-1758.

Dvorak, J., Junge, A., & Chomiak, J. (2000). Risk factor analysis for injuries in football players. Possibilities for a prevention program. *Am J Sports Med, 28(suppl)*, 69-74.

Dyment, P. G. (1986). Management of minor soft tissue trauma in adolescent athletes. *J Adolesc Health Care, 7*(6 Suppl), 133S-135S.

Emery, C. A., Meeuwise, W. H., & Hartmann, S. E. (2005). Evaluation of risk for injury in adolescent soccer: Implementation and validation of an injury surveillance system. *Am J Sports Med, 33*(12), 1882-1891.

Fuller, C. W., Brooks, J. H., Cancea, R. J., Hall, J., & Kemp, S. P. (2007). Contact events in rugby union and their propensity to cause injury. *Br J Sports Med*, 862-867.

Fuller, C. W., Ekstrand, J., Junge, A., Andersen, T. E., Bahr, R., Cvorak, J., . . . Meeuwisse, W. H. (2006). Consensus statement on injury definitions and the data collection procedures in studies of football (soccer) injuries. *Br.J.Sports Med*, 193-201.

Fuller, C. W., Ekstrand, J., Junge, A., Andersen, T. E., Bahr, R., Dvorak, J., . . . Meeuwisse, W. H. (2006). Consensus statement on injury definitions and the data collection procedures in studies of football (soccer) injuries. *Br J Sports Med*, 193-201.

Fuller, C. W., Molloy , M. G., Bagate, C., Bahr, R., Brooks, J. M., Donson, H., . . . Wiley Preston. (2007). Consensus statement on injury definitions and data collection procedures for studies of injuries in rugby union. *Br J Sports Med, 41*, 328-331.

Fuller, C., & Drawer, S. (2004). The application of risk management in sport. *Sports Med, 34*, 349-456.

Gabbett, T. J. (2004). Incidence of injury in junior and senior rugby league players. *Sports Med, 34*(12), 849-859.

Gabbett, T. J., Jenkins, D. G., & Abernethy, B. (2011). Physical collisions and injury in professional rugby league match-play. *J Sci Med Sport, 14*, 210-215.

Government Gazette. (2010). Safety at sports and recreational events bill. *(29078), ISBN 978-1-77037-619-9*. Republic of South Africa, Deprtament of Sport and Recreation.

Grinsell, M. M., Butz, K., Gurka, M. J., Gurka, K. K., & Norwood, V. (2012). Sport-related kidney injury among high school athletes. *Pediatrics, 130*(1), 2011-2082.

Grisogono, V. (1981). The injuries service at the Crystal Palace. *Br J Sports Med, 15*(1), 39-43.

Hagglund, M., Walden, M., & Ekstrand, J. (2006). Previous injury as a risk factor for injury in elite football: a prospective study over two consecutive seasons. *Br J Sports Med, 40*(9), 767-772.

Haseler, C. M., Carmont, M. R., & England, M. (2010). The epidemiology of injuries in English youth community rugby union. *Br J Sports Med, 44*, 1093-1099.

Hattingh, J. (2003). *A Prevention Programme for Rugby Injuries Based on an Analysis Among Adolescent Players.* Thesis submitted for the degree Philosophiae Doctor in Educational Science (Teaching and Learning) , University of Potchesfstroom.

Hazinski, F., Markenson, D., Neish, S., Gerardi, M., Hootman, J., Nichol, G., . . . Potts, J. (2004). *Response to cardiac arrest and selected life-threatening medical emergencies: the medical emergency response plan for schools: a statement for healthcare providers, policymakers, school administrators, and*

community leaders. American Heart Association, American Academy of Pediatrics, American College of Emergency Physicians, American National Red Cross, National Association of EMS Physicians.

Holtzhausen, L. J., Schwellnus, M. P., Jakoet, I., & Pretorius, A. L. (2006). The incidence and nature of injuries in South African rugby players in the rugby Super 12 competition. *S Afr Med J, 96*(12), 1260-1265.

Hoskins, T. W. (1978). Rugby injuries to the cervical cord. *BMJ, 2*(6154), 1783.

Hughes, T. (2000). Prevention of rugby related cervical spinal injuries by radiographic screening. Christchurch: Spinal Network Conference.

Jagger, R. G., Abbasbhai, A., Patel, D., Jagger, D. C., & Griffiths, A. (2010). The prevalence of dental, facial and head injuries sustained by schoolboy rugby players. A pilot study. *Prim Dent Care, 17*(3), 143-146.

Jakoet, I., & Noakes, T. D. (1998). A high rate of injury during the 1995 Rugby World Cup. *S Afr Med J, 88*(1), 45-47.

Johannsen, F., & Langberg, H. (1997). The treatment of acute soft tissue trauma in Danish emergency room. *Scand J Med Sci Sports, 7*(3), 178-181.

Johnson, A., Doherty, P. J., & Freemont, A. (2009). Investigation of growth, development, and factors associated with injury in elite schoolboy footballers: prospective study. *BMJ, 338*, 490-493.

Kerr, Z. Y., Collins, C. L., Pommering, T. L., Fields, S. K., & Comstock, R. D. (2011). Dislocation/separation injuries among US high school athletes in 9 selected sports: 2005-2009. *Clin J Sports Med, 21*(2), 101-108.

Kew, T., Noakes, T. D., Kettles, A. N., Goedeke, R. E., Newton, D. A., & Scher, A. T. (1991). A retrospective study of spinal cord injuries in Cape Province rugby players, 1963-1989. Incidence, mechanisms and prevention. *S Afr Med J, 3*(80), 127-133.

Knowles, S. B., Marshall, S. W., & Guskiewicz, K. M. (2006). Issues in estimating risks and rates in sports injury research. *J Athl Train*(41), 207-215.

Kohler, R., Miller, R., Bonner, B., & Louw, A. (2002). Laparoscopic treatment of an isolated gallbladder rupture following blunt abdominal trauma in a schooboy rugby player. *Br J Sports Med, 36*, 378-379.

Kucera, K. L., Marshall, S. W., Kirkendall, D. T., Marchak, P. M., & Garrett, W. E. (2005). Injury history as a risk factor for incident injury in youth soccer. *Br J Sports Med, 39*(7), 462.

Landry, G. L., & Gomez, J. E. (1991). Management of Soft Tissue Injuries. *Adolesc Med, 2*(1), 125-140.

Laskowski, E. R., Najarian, M. M., Smith, A. M., Stuart, M. J., & Friend, J. F. (1995). Medical coverage for multievent sports competition: A comprehensive analysis of injuries in the 1994 Star of the North Summer Games. *Mayo Clin Proc, 70*(6), 549-555.

Lee, A., & Garraway, W. (1996). Epidemiological comparison of injuries in school and senior club rugby. *Br J Sports Med, 30*, 213-217.

Macaskill, M. (2009, Mar). Surgeon hits out over school rugby injuries. *The Sunday Times*. Retrieved Feb 5, 2013, from http://www.timesonline.co.uk/tol/news/uk/scotland/article5908126.ece

Macintosh, A. S. (2005). Rugby Injuries. In C. D. Maffulli N (Ed.), *Epidemiology of Pediatric Sports Injuries: Team Sports.* (pp. 120-139). Basel, Karcher.

MacQueen, A. E., & Dexter, W. W. (2010). Injury trends and prevention in rugby union football. *Curr Sports Med Rep, 9*(3), 139-143.

Maharaj, J. C., & Cameron, I. D. (1998). Increase in spinal injury among Rugby Union players in Fiji. *Med J Aust, 168*(8), 418.

McCoy, G. F., Piggot, J., Macafee, A. L., & Adair, I. V. (1984). Injuries of the cervical spine in schoolboy rugby football. *J Bone Joint Surg, 66*(4), 500-503.

Nathan, M., Goedeke, R., & Noakes, T. D. (1983). The incidence and nature of rugby injuries experienced at one school during the 1982 rugby season. *S Afr Med J, 64*(4), 132-137.

Nicol, A., Pollock, A., Kirkwood, G., Parekh, N., & Robson, J. (2010). Rugby union injuries in Scottish schools. *J Pub Health, 32*, 1-6.

Noakes, T. D., Jakoet, I., & Baalbergen, E. (1999). An apparent reduction in the incidence and severity of spinal cord injuries in schoolboy rugby players in the western Cape since 1990. *S Afr Med J, 89*(5), 540-545.

Nutton, R. W., Hamilton, D. F., Hutchison, J. D., Mitchell, M. J., Simpson, A. H., & Maclean, J. G. (2012). Variation in physical development in schoolboy rugby players: can maturity testing reduce mismatch? *BMJ Open, 2*(4), 1-6.

Orchard, J. W., & Finch, C. F. (2002). Australia needs to follow New Zealand's lead on sports injuries. *Med J Aust, 177*(1), 38-39.

Palairet, T., & Xiong, X. (2000). A study of rugby and rugby league spinal injuries in New Zealand between 1996 to 2000. Christchurch: Spinal Network Conference.

Palmer-Green, D. S., Stokes, K. A., Fuller, C. W., England, M., Kemp, S. P., & Trewartha, G. (2013). Match injuries in English youth academy and schools rugby union: an epidemiological study. *Am J Sports Med, 41*(4), 749-755.

Parekh, N., Hodges, S. D., Pollock, A. M., & Kirkwood, G. (2011). Communicating the risk of injury in schoolboy rugby: using Poisson probability as an alternative presentation of the epidemiology. *Br J Sports Med, 46*(28), 611-613.

Quarrie, K. L., Cantu, R. C., & Chalmers, D. J. (2002). Rugby union injuries to the cervical spine and spinal cord. *Sports Med, 32*(10), 633-653.

Raftery, M., Parker, R., Stacey, E., Peat, J., & Wang, H. (1999). *Incidence of injury in junior rugby league in the Penrith and district junior rugby league area.* The New Children's Hospital, Children's Hospital Institute of Sports Medicine, Research and Development Office. Westmead: The NSW sporting injuries committee and Australian Rugby League.

Readhead, C. (2012). *Supersport*. Retrieved Feb 5 , 2013, from SARU: http://images.supersport.co.za/SARU%20Tournament%20Medical%20and%20Safety%20Minimum%20Standards%20Document%20(Participant%20Medical%20and%20Safety%20measures%20)2012%20v5%20Final.pdf

Rechel, J. A., Collins, C. L., & Comstock, R. D. (2011). Epidemiology of injuries requiring surgery among high school athletes in the United States: 2005-2010. *J Trauma, 71*(4), 982-989.

Rotem, T. R., Lawson, J. S., Wilson, S. F., Engel, S., Rutkowski, S. B., & Aisbett, C. W. (1998). Severe cervical spinal cord injuries related to rugby union and league football in New South Wales, 1984-1996. *Med J Aust, 168*(8), 379-381.

Roux, C. E., Goedeke, R., Visser, G. R., van Zyl, W. A., & Noakes, T. D. (1987). The epidemiology of schoolboy rugby injuries. *S Afr Med J, 71*(5), 307-313.

Rugby, S. A. (2013). *S A Rugby - Rugby in South Africa*. Retrieved from S A Rugby: http://www.sarugby.net/content.aspx?contentid=19255

SARU. (2009). *Boksmart*. Retrieved Feb 4, 2013, from South African Rugby Union: http://boksmart.sarugby.co.za/content/what-is-boksmart

SARU. (2009). *Boksmart serious injury protocol*. Retrieved Feb 4, 2013, from SARU: http://boksmart.sarugby.co.za/content/serious-injury-protocol

SARU. (2012). Retrieved 1 13, 2013, from http://images.supersport.com/Participation%20Requirements%20for%20SARU%20Youth%20Week%20Tournaments%20-%20Medical%20and%20Anti-Doping%202013.pdf

Scher, A. T. (1978). The rugby high tackle : an avoidable cause of cervical spine injury? *S Afr Med J, 53*(25), 1015-1018.

Scher, A. T. (1982). "Crashing" the rugby scrum: an avoidable cause of cervical spinal injury? Case reports. *S Afr Med J, 61*(24), 919-920.

Scher, A. T. (1998, Jan). Rugby injuries to the cervical spine and spinal cord: a 10-year review. *Clin Sports Med, 17*(1), 195-206.

Secin, F. P., Poggo, E. J., Luzuriaga, F., & Laffaye, H. A. (1999). Disabling injuires of the cervical spine in Argentine rugby over the last 20 years. *Br J Sports Med, 33*(1), 33-36.

Silver J, R. (1979). Rugby injuries to the cervical cord. *Br Med J, 1*, 192-193.

Sparks, J. P. (1981). Half a million hours of rugby football: the injuires. *Br J Sports Med, 15*, 30-32.

Stokes, J. V., Luiselli, J. K., & Reed, D. D. (2010). A behavioral intervention for teaching tackling skills to high school football athletes. *J Appl Behav Analysis, 43*, 509-512.

Stoops, T. (2013). *School sports news*. Retrieved 1 14, 2014, from http://www.schoolsportsnews.co.za/rugby/where-will-you-go-this-easter/

Sugerman, S. (1983). Injuries in an Australian schools rugby union season. *Aust J Sports Med Exerc Sci, 15*, 5-14.

Taylor, T. K., & Coolican, M. R. (1987). Spinal-cord injuries in Australian footballers, 1960-1985. *Med J Aust, 147*(3), 116-118.

Thornton, J. S., & Sewickley, P. A. (1997). Pain relief for acute soft-tissue injuries. *Phys Sportsmed, 25*(10), 108-114.

Union, S. R. (2014, Feb). *SA Rugby referees*. Retrieved from http://www.sareferees.com/News/scrumming-in-sa-in-2014/2830094/

Upton, P. A., Roux, C. E., & Noakes, T. D. (1996). Inadequate pre-season preparation of schoolboy rugby players - a survey of players at 25 Cape Province high schools. *S Afr Med J, 86*(5), 531-533.

Watson, E. W. (1988). Discriminant analysis of the physiques of schoolboy rugby players, hurlers and non-team members. *J Sports Sci, 6*(2), 131-140.

Wetzler, M. J., Akpata, T., Laughlin, W., & Levy, A. S. (1998). Occurence of cervical spine injuries during the rugby scrum. *Am J Sports Med, 26*(2), 177-180.

Yard, E., & Comstock, D. (2011). Injury patterns by body mass index in US high school athletes. *J Phys Activity & Health, 8*, 182-191.

Annexures

Annexure A

Injury Report Form

(Team) Player-code: Date:

1 A Date of injury: _____ **1 B Date of return to full participation:** _____

2 A Injured body part

- ❑ head / face
- ❑ neck / cervical spine
- ❑ sternum / ribs / upper back
- ❑ abdomen
- ❑ low back / sacrum / pelvis
- ❑ shoulder / clavicle
- ❑ upper arm
- ❑ elbow
- ❑ forearm
- ❑ wrist
- ❑ hand / finger / thumb
- ❑ hip / groin
- ❑ thigh
- ❑ knee
- ❑ lower leg / Achilles tendon
- ❑ ankle
- ❑ foot / toe

2 B Injured body part

- ❑ right
- ❑ left
- ❑ not applicable

3 Type of injury

- ❑ concussion (with or without loss of consciousness)
- ❑ fracture
- ❑ other bone injury
- ❑ dislocation / subluxation
- ❑ sprain / ligament injury
- ❑ lesion of meniscus or cartilage
- ❑ muscle rupture / strain / tear / cramps
- ❑ tendon injury / rupture / tendinosis / bursitis
- ❑ haematoma / contusion / bruise
- ❑ abrasion
- ❑ laceration
- ❑ nerve injury
- ❑ dental injury

❑ other injury (please specify): _____

4 Diagnosis (text or Orchard code): _____

5 Has the player had a **previous injury** of the same type at the same site (i.e. is this injury a recurrence)?

- ❑ no
- ❑ yes

If **YES**, specify date of player's return to full participation from the previous injury: _____

6 Was the injury caused by **overuse** or **trauma**?

- ❑ overuse
- ❑ trauma

7 When did the injury occur?

- ❑ training
- ❑ match
- ❑ warm-up

8 How did the injury happen?

❑ Overuse (no acute trauma)

Contact with another player

- ❑ foul play of/by injured player
- ❑ foul play of/by another player
- ❑ tackling
- ❑ accidental collision
- ❑ heading duel

no contact with other player

- ❑ change of direction
- ❑ running
- ❑ jumping
- ❑ shooting
- ❑ hit by ball

❑ others, please specify _____

9 Did the injury necessitate absence from training or matches?

- ❑ no
- ❑ training
- ❑ yes If yes, for how long?_____
- ❑ match

Annexure B

ST JOHN'S COLLEGE

29 February 2012

TO WHOM IT MAY CONCERN

PROFESSOR DEMITRI CONSTANTINOU

This serves to confirm that St John's College grants Professor Constantinou, Adjunct Professor: Sports and Exercise Medicine at the University of the Witwatersrand, permission to use our rugby festival injury data for research purposes, with the proviso that no confidential information will be made public.

RDT Cameron
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Headmaster: Roger Cameron MA (UCT) BD (London) Sec. T. Dip. (UCT)

Annexure C

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Dr Demitri Constantinou

CLEARANCE CERTIFICATE	**M120229**
PROJECT	Injuries at two Johannesburg High School Rugby Festivals: Analysis & Recommendations
INVESTIGATORS	Dr Demitri Constantinou.
DEPARTMENT	Dept of family Medicine/emergency Medicine
DATE CONSIDERED	24/02/2012
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 24/02/2012 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Dr Alison Bentely

DECLARATION OF INVESTIGATOR(S)
To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

Faculty of Health Sciences
Medical School, 7 York Road, Parktown, 2193
Fax: (011) 717-2119
Tel: (011) 717-2076

Reference: Ms Salamina Segole
E-mail: salamina.segole@wits.ac.za
27 March 2012
Person No: 8219871
TAA

Professor D Constantinou
P.O.Box 2491
Bedfordview
Bedfordview
2008
Bedfordview, South Africa

Dear Professor Constantinou

Master of Science in Medicine (Emergency Medicine): Change of title of research

I am pleased to inform you that the following change in the title of your Research Report for the degree of has been approved:

From:	**Injuries at two Johannesburg High School rugby festivals-analysis and recommendations**
To	**Injuries at Johannesburg High School rugby festivals**

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Professor Demitri Constantinou
MBBCh (Wits), BSc (Med)(Hons)Sports Science (UCT), FFIMS
Sports Physician
PR1402730

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E-mail: demitri.constantinou@wits.ac.za

P.O. Box 2491, Bedfordview, 2008

9 March 2012

Professor PE Cleaton-Jones
Chair: HREC – Medical

Dear Professor Cleaton-Jones

Change of title of research

I have recently had approval and clearance for research approved by the HREC-Medical committee (M120229) for research on rugby injuries (see attached).

In the protocol assessor review of the Division of Emergency Medicine, as per their recommendation, I have changed the title to **"Injuries at Johannesburg high school rugby festivals".**

The change of title form has been signed and submitted to the Faculty of Health Sciences Postgraduate Office.

Yours sincerely



D Constantinou