HIGH SCHOOL RUGBY AND HOCKEY PLAYERS' KNOWLEDGE OF CONCUSSION AND RETURN TO PLAY GUIDELINES

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ABSTRACT

Background: Concussion is one of the most common injuries in contact sports such as rugby and hockey. Concussion awareness has dramatically increased over the last 20 years. Concussion is a mild traumatic brain injury that often gets overlooked but can be fatal if not taken seriously. Early diagnosis and appropriate management of concussion is vital for safely integrating a player back into sport. Return to play guidelines serves to ensure the safety of the players. Even though a few studies have investigated the knowledge of concussion and the return to play guidelines amongst therapists, there are no South African studies focusing on high school rugby and hockey players.

The aim of the study was to determine the high school rugby and hockey players' knowledge of concussion and the knowledge and adherence to the return to play protocols. The objectives of the study were: 1) to determine the point prevalence of concussion amongst the population, 2) to determine the players' knowledge regarding concussion and return to play guidelines, 3) to determine if the return to play guidelines are being adhered to, and 4) to explain the findings or any discrepancies from the surveys between knowledge and adherence to the return to play guidelines in more depth qualitatively.

Study design: A mixed-methods approach, and an explanatory sequential design was utilised. Phase A was quantitative utilising self-developed surveys and phase B was qualitative utilising focus group discussion.

Study setting: The study was conducted at Westville Boys' High School, based in Westville, KwaZulu-Natal.

Population and sampling: Approximately 1300 boys attend this school, of which 240 play rugby and 176 play hockey in the winter months. Yamane's formula for sample size calculation was utilised to determine the ideal sample size at 230 pupils for phase A. A total of 221 participants completed the surveys; 139 were rugby players and 82 were hockey players. Convenience sampling was utilised to complete a newly developed survey based on the literature. A total of 24 participants were purposively recruited to participate in three focus group discussions with 15 participants attending the focus group discussions in phase B.

Instruments for data collection: In phase A, a newly developed survey based on literature was utilised to obtain the quantitative data and in phase B qualitative data was collected utilising focus group discussions with open ended questions.

Analysis of results: Quantitative data was coded and captured directly into the Statistical Package for the Social Sciences (SPSS) version 23.0. Descriptive and inferential statistics (chi-square tests) was performed using SPSS.

Qualitative data obtained in phase B of the study was analysed using Creswell's process of thematic analysis.

Results: The point prevalence of concussion amongst participants (N = 221) in this study was 31.2% (n = 69) of the total sample. Of the participants who played rugby, 72.5% (n = 50) suffered at least one concussion, while the prevalence of concussion was 27.53% (n = 19) amongst hockey players. Of those that suffered a concussion only 30.4% (n = 21) had a graded return to play as a treatment of their concussion injury. Less than half of the total population (n = 106) mentioned that a graded return to play after concussion, is part of a safe return to play. In this study knowledge of concussion was determined and only six symptoms were commonly associated with a concussion injury and sixteen of the symptoms are not

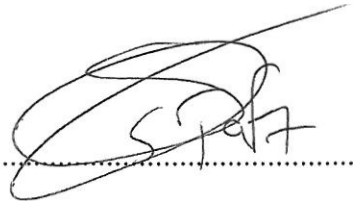
commonly associated with a concussion injury. Those who suffered a concussion injury had a better self-perceived knowledge of concussion. However, when tested, the knowledge of those who had suffered a concussion was on the same level as those who had not suffered a concussion injury previously. Causes of concussion are not well known with 78.3% (n=173) of the population thinking one had to be knocked out to be considered concussed.

Conclusion: A third of the population had suffered a concussion injury, which correlates with the literature around prevalence of concussion. Knowledge of concussion was low with regards to the symptoms of concussion, causes of concussion and the return to play guidelines. More than half of the participants knew about a graded return to play guidelines and of those who had suffered a concussion roughly a third adhered to the return to play guidelines. Confidence and self-perceived knowledge of concussion seems to be greater in those who had suffered a concussion when compared to those who had not suffered a concussion but actual knowledge of concussion between the groups shows no difference.

Keywords: Concussion, Return to play guidelines, High school, Hockey, Rugby, Knowledge

DECLARATION

I hereby declare that "High school rugby and hockey players' knowledge of concussion and return to play guidelines" is my own work, and that I have not submitted it or any part of it for a degree at any university. All the sources that I have used or quoted have been indicated by means of complete references.

Signature:  Date: 17/11/17

St. John Taft

DEDICATION

I dedicate my Master's to my parents and step parents who have believed in me from the start, given me encouragement and the motivation to always do my best.

My late gran who passed away towards the end of my study, will always be in my heart and never ever forgotten. Always asking me how my Master's was going and always telling me "never give up because it will be worth it at the end".

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Thanks to the sports physician who helped me with constructing the survey, your time and effort is noted and greatly appreciated.

All my friends who always encouraged me to be better and work harder, thank you.

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CTE – Chronic traumatic encephalopathy

FGD – Focus group discussion

GP – General practitioner

LOC – Loss of consciousness

NFL – National Football League

PCS – Post-concussion symptoms

PTA – Post-traumatic amnesia

SCAT – Sport Concussion Assessment Tool

SPSS – Statistical Package for the Social Sciences

TB - Tuberculosis

TBI – Traumatic brain injury

USA – United States of America

WHO – World Health Organization

CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1 Introduction

This chapter will provide the rationale and background for the study. It will provide an overview of the problem statement, the significance of the study, the research questions, the aims and research objectives of the study. It will also give a brief definition of terms and an outline of the thesis.

1.2 Background to the study

Doctor Bennet Omalu, a Nigerian-born doctor working in America as a coroner, was the first person to discover chronic traumatic encephalopathy when he performed an autopsy on former National Football League (NFL) player, Mike Webster (Cantu, 2007). Mike Webster was a former professional football player who died unexpectedly in 2002, at the age of 50. Mike Webster who was once the star of the Pittsburgh Steelers professional football team, suffered years of cognitive and intellectual problems, mood disorder, depression, drug abuse and multiple suicide attempts. Dr Omalu linked multiple concussion with the newly found chronic traumatic encephalopathy (CTE). Dr Omalu further confirmed his diagnosis of chronic traumatic encephalopathy with other Pittsburgh Steeler players over the next couple of years, Justin Strzelczyk (d. 2004 at 36), Terry Long (d. 2005 at 45), Andre Waters (d. 2006 at 44), and Tom McHale (d. 2008 at 45). It was only in 2009 that the NFL acknowledged Dr Omalu's findings, seven years after the first reported case of CTE (Ezell, 2013).

There has been increased interest in the research amongst healthcare workers on the diagnosis, treatment and outcomes of mild traumatic brain injuries such as concussion (McCrea, 2008). In the last five years, the World Health Organization (WHO) and Centers for Disease Control (CDC) have made significant efforts to increase the public's awareness

of the dangers and risks associated with concussion (McCrea, 2008). In response to this increase in awareness of concussion, the "safe return to play guidelines" for concussion was developed and made public at an international conference on concussion held in Zurich in 2012 (McCrory, Meeuwisse, Aubry, Cantu, Dvorak, Echemendia, & Sills, 2013).

Concussion is the third most common rugby injury in South Africa (Shuttleworth-Edwards, Noakes, Radloff, Whitefield, Clark, Roberts, Essack, Zoccola, Boulind, Case, & Smith, 2008). Between 2002 and 2006, 175 concussions were reported from 1366 South African rugby players who performed baseline testing (Shuttleworth-Edwards et al., 2008).

In a recent rugby match between South Africa and Ireland in 2016, well-known player Patrick Lambie was tackled late and struck by the opposing team's player's hip. Lambie lay on the ground motionless and was eventually stretched off the field of play and only returned to rugby over two months after this initial concussion (Burnard, 2016). The following week post injury the newspapers stated that Lambie would be back after one week of rest. Fortunately, Patrick Lambie had access to medical resources and could be assessed regularly for concussion. His return to play was subsequently delayed by two months due to having post-concussive symptoms (Burnard, 2016). For the majority of amateur rugby and hockey players in South Africa, who do not have the resources to be assessed as regularly, the scenario might be very different, and players could potentially return to play too soon risking severe long-term complications. In July 2016, just weeks after Patrick Lambie's concussion, a young talented schoolboy rugby player from the Valke club in Gauteng died of bleeding on the brain due to a concussive blow he sustained playing for his school (Kempton express, 2016). He sat on the bench for his school team for two weeks and was complaining about headaches at the Valke Craven-week training camp before he returned to play for his school. The coach allowed him to sit out of contact sessions, but he should not have been cleared to

play (Kempton express, 2016). Players who do not have the medical resources that professional rugby players have are at a loss when it comes to diagnosis, recognition of red flags and coordinated return to play procedures. This was not the first time a schoolboy rugby player had died due to the complications of concussion. On the 29th January 2011, a 14-year-old boy was playing rugby for his school in Ireland when he got multiple knocks to the head; the last knock knocking him out cold and motionless. He subsequently died in hospital due to second impact syndrome, a rare complication of concussion in which the brain takes too many concussive knocks in a short amount of time (Bull, 2013). The player was assessed three times by his coach for concussion and each time was deemed to be fit to carry on playing (Bull, 2013). According to the report, he was heard saying to a teammate that he did not remember the last tackle he had made, and he did not know the score during the game as he asked someone who was winning. His teammate and the deceased both laughed this off. At this point the player should have been taken off the field immediately. However, this was not the case and this boy continued to play, sustaining a further three hits to the head, resulting in the loss of his life. The coroner's report suggested that the player died from not one concussive hit, but a few smaller hits accumulated (Bull, 2013). The father of the deceased mentioned in an awareness video that the main thing to come from the inquest was the lack of awareness of concussion, he stated that "the coach, referee, players and parents had never been made aware of this (talking about concussion). If the mom had known about this she would have had the confidence to walk on and state that her son is clearly showing signs of concussion and remove him from the field" (Bull, 2013).

Due to the high incidence of concussion amongst rugby players in South Africa and the severity of its implications, the South African Rugby Union (SARU) developed a concussion guideline for coaches in 2017 (Boksmart, 2017). Boksmart has developed six R's for concussion which are: recognise (the need to be able to identify the signs and symptoms of

concussion in your players), remove (when suspecting a concussion one should remove the player from the field), refer (referring a player to a medical doctor who understands concussions for a thorough medical assessment), rest (resting players for the minimum stand-down periods before entering the graduated return to play process), recover (signs and symptoms of being fully recovered before starting the return to play process), return (return to sport safely which includes being free of signs and symptoms, medically cleared by a doctor and completing the graded return to play process) (Boksmart, 2017).

Concussion is one of the most common injuries in contact sport that include rugby and hockey (Guilmette, Malia, & McQuiggan, 2007; Holtzhausen, Schwellnus, Jakoet, & Pretorius, 2002). The evaluation of concussion is based on a range of domains including clinical symptoms, physical signs, behavioural changes, cognitive impairment and sleep disturbances (McCrory, 2013). If a player does not understand that symptoms of concussion vary considerably, they could potentially place themselves at risk for further injury. Risks of concussion include second impact syndrome and chronic traumatic encephalopathy, which includes early onset cognitive impairment (Patricios, Kohler, & Collins, 2010; Omalu et al., 2005).

A study in America found that most of the participants know there are long-term complications of concussion (Chrisman, Quitiquit, & Rivara, 2013) leaving a small proportion of participants who do not know there are long-term complications. Education regarding concussion at the moment is focused mainly on educating and the return to play protocols and not the long-term disability of concussion (Cook et al., 2003; Bagley et al., 2012). Players who suspect they have suffered a concussion do not report concussion thinking their concussion is not serious enough to report the injury (Fraas, Coughlan, Hart, & McCarthy, 2014). An American study found that sixty percent of the participants would

continue playing in a hypothetical situation if they suffered a concussion (Chrisman, Quitiquit, & Rivara, 2013). These studies show a poor knowledge of concussion and adherence to the return to play protocols that are in place, among sportsmen. In a South African context there are no studies focusing on high school rugby and hockey players' knowledge of concussion and return to play guidelines. This study will try and determine the extent of their knowledge of concussion and the return to play guidelines.

1.3 Rationale for study

Concussion is a serious and potentially life-threatening injury that is often overlooked in high school rugby and hockey players (Kempton express, 2016; Bull, 2013). Concussion awareness is becoming a top priority for contact sporting codes (Patricios, 2010). Determining high school players' knowledge of concussion and return to play guidelines, can assist with awareness and prevention programmes. This can then also be used to further educate players of contact sport on the possible risks, complications and long-term side effects of concussion.

1.4 Problem statement

The knowledge of concussion by physiotherapists, parents and sports coaches has been well studied (Sullivan, Bourne, Choie, Eastwood, Isbister, McCrory, & Gray, 2009; McGran & Keating, 2012). Even though physiotherapists and coaches frequently make the final decision to return to play, players are often unaware of the symptoms of concussion, and under-report them to coaches (Bull, 2013). If players are not knowledgeable on the symptoms and dangers of concussion they might ignore it and not report it in order to be available for selection to play (Fraas, Coughlan, Hart, & McCarthy, 2014). This could result in more severe complications and even long-term disability amongst contact sports players (Omalu, et al., 2005). Very few studies have explored high school rugby and hockey player's knowledge of

concussion and return to play guidelines globally (Sye, Sullivan, & McCrory, 2006), and there is currently no research being conducted on this topic in South Africa.

1.5 Research questions

1. What is the point prevalence of concussion amongst a sample of high school rugby and hockey players at a typical South African high school?

2. What is the current knowledge of the signs and symptoms and dangers of concussion amongst high school rugby and hockey players at a typical South African high school?

3. What is the adherence of a typical South African high school rugby and hockey players to the return to play guidelines?

4. Does having knowledge of the return to play guidelines ensure adherence to these guidelines amongst a sample of high school rugby and hockey players at at a typical South African high school?

5. What are the underlying reasons why players who have knowledge of concussion potentially do not adhere to return to play guidelines?

1.6 Study aim

The overall aim of this study is to determine if high school rugby and hockey players at Westville Boys' High school is knowledgeable on concussion and if having knowledge of concussion ensures adherence to the safe return to play guidelines.

1.7 Objectives of the study

1. To determine the point prevalence of concussion within the sample of high school rugby and hockey players at Westville Boys' High School.

2. To determine Westville Boys' High School rugby and hockey players' knowledge of concussion and return to play guidelines.

3. To determine if high school rugby and hockey players are adhering to the return to play protocols that are in place.

4. To explain the findings or any discrepancies from the surveys between knowledge and adherence to the return to play guidelines in more depth qualitatively.

1.8 Significance of the study

Physiotherapists have been the first line practitioners at school sporting events for quite some time, and it is the exception rather than the rule that a doctor is present at a school sporting event. Physiotherapists or coaches are mainly responsible for identifying and diagnosing a concussion (Provvidenza & Johnston, 2009). However, as most players do not understand concussion and the possible complications of multiple concussions in quick succession, players tend to under-report or ignore symptoms of concussion and return to play sooner rather than later putting themselves at risk for another concussion. This trend to return to play quicker and risk personal harm could be minimised if players were knowledgeable about the return to play guidelines and the possible complications of concussion. The significance of the study is to try and raise awareness of the symptoms of concussion and the dangers of ignoring return to play guidelines amongst high school rugby and hockey players (who often diagnose themselves), in order to prevent long-term disability. If a lack of knowledge of

concussion is detected amongst this population, Physiotherapists could assist with health promotion on the topic at school level.

1.9 Definition of terms

Concussion - "Concussion is a trauma-induced change in mental state that may or may not involve loss of consciousness. The injury may manifest with any combination of physical, cognitive, emotional and sleep-related symptom clusters, including headache, dizziness, nausea, visual disturbances, amnesia, poor concentration, irritability, depressed affect, fatigue and drowsiness." (Patricios et al., 2010, pg 226)

Knowledge - Facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject (Stevenson, 2010).

Rugby- a team game played with an oval ball that may be kicked, carried, and passed from hand to hand. Points are scored by grounding the ball behind the opponent's goal line (thereby scoring a try) or by kicking it between the two posts and over the crossbar of the opponent's goal (World rugby, 2014).

Hockey- a team game played between two teams of eleven players each, using hooked sticks with which the players try to drive a small hard ball towards goals at opposite ends of a field. In North America it is called *field hockey* to distinguish it from *ice hockey*. For the purpose of this study the term "hockey" only refers to *field hockey* (Stevenson, 2010).

Return to play guidelines - A set of guidelines that have a step by step protocol to integrate a concussed athlete back into sport to ensure that the player is not risking himself by going back to early into sport (McCrory et al., 2013).

High school learner – Also known as secondary school which is a learner who has passed grade seven and is in between grade eight to twelve in South Africa (Intergate Immigration, 2015).

1.10 Outline of the thesis

Chapter one

In this chapter, the background to the study topic is introduced, and the rationale for the study explained. The problem that will be studied is presented and the research questions, aims and objectives are listed. Furthermore, the significance of the study and the potential implications are highlighted. Lastly the key terms that will be used throughout this thesis are defined.

Chapter two

This chapter will provide the literature review of published materials relative to the study to establish a theoretical foundation for the study. This chapter will cover the definition, aetiology, prevalence, risks, complications and grading of concussion. Also covered in the chapter is the conceptual framework used for the study, international policy regarding concussion, post-concussive symptoms affecting concussed athletes and the return to play guidelines used to safely return players onto the playing field.

Chapter three

This chapter will provide insight into the research design, questionnaire design and various techniques used to analyse the data, as well as the steps taken to ensure scientific rigor of the quantitative and trustworthiness of the qualitative data.

Chapter four

This chapter will present the results of the study for the quantitative phase of the study. This will include a descriptive statistical presentation of the key demographic characteristics of the respondents, followed by the analysis of the findings. The data was processed into meaningful results that the reader is able to interpret and understand

Chapter five

This chapter will present the results of the qualitative part of the study. This will include themes that were picked up by the researcher.

Chapter six

This chapter will discuss both the quantitative and qualitative results. It will also compare the relevant findings to the literature, discuss the clinical implications and recommend some options for future research.

Chapter seven

This chapter will provide an overview of the study with a summary of the main findings, limitations of the study will be discussed, clinical recommendations derived from the study and recommendations for future research will be mentioned and finally a conclusion of the study's findings.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter will take a look at the literature surrounding concussion and the theoretical framework. The literature will include the concussion consensus statements and how they progressed from the first conference to the fourth conference. Grading of concussion has developed over the years and will be reviewed to what it is today. The aetiology, prevalence, evaluation, complications and risk factors of concussion will be reviewed, the prevalence of concussion, the evaluation of concussion and the different symptoms of concussion and the possible complications of concussion. Return to play guidelines have been developed and post-concussion will be discussed in this chapter.

2.2 Conceptual framework/Theoretical framework

2.2.1 Theory of planned behaviour

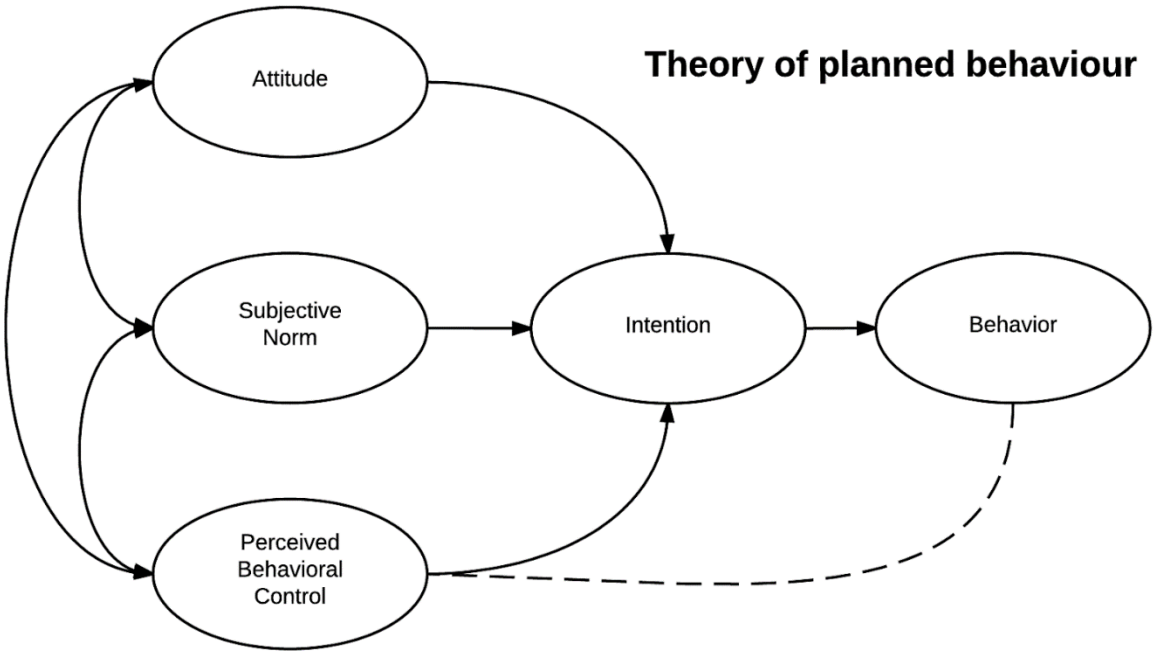


Figure 2.1: Theory of planned behaviour. Adapted from "Entrepreneurial education's and entrepreneurial role models' influence on career choice," by N,J. Muofhe and W,F. Du Toit, 2011, South African Journal of Human Resource Management, 9(1), p. 6.

The theory of planned behaviour (Ajzen, 1991) followed on from the theory of reasoned action. The theory of reasoned action differs to the theory of planned behaviour because it only includes attitude and subjective norms that create behavioural intent. (Ajzen, 1991). Ajzen countered stating that behavioural intent does not always lead to actual behaviour and then added perceived behavioural control, which states that a person is more likely to perform a behaviour if he or she determines the task is achievable. Thus, the theory of planned behaviour was developed by Ajzen to cover non-volitional behaviours for predicting behavioural intention and actual behaviour (Ajzen, 1991).

The theory of planned behaviour consists of three parts namely:

1. *Attitude*, how an individual evaluates the suggested behaviour as favourable or unfavourable and is formed on the basis of the individual's beliefs about the outcomes of behaviour and their evaluations of those outcomes.
2. *Subjective norm,* if they think that other people want them to perform (or not perform) the suggested behaviour. This is formed as a result of the individual's beliefs about how much others would approve or disapprove of the performance of the behaviour.
3. *Perceived behavioural contro*l, the individual's perceived ease or difficulty of performing the particular behaviour (Ajzen, 1991).

Attitude towards behaviour, subjective norm and perceived behavioural control lead to the formation of a behavioural intention. However, perceived behavioural control also has direct control over behaviour on top of having its effect on intention. As a general rule, the more favourable the attitude toward behaviour, subjective norm and perceived behavioural control,

the stronger the person's intention to perform the behaviour in question. Behavioural intention does not always lead to actual behaviour of a suggested action (Fishbein & Ajzen, 2010).

The theory of planned behaviour is relevant to the study in that if a rugby or hockey player has a suspected concussion and has the attitude that a concussion is not dangerous, has a coach, parent or team mates pressuring him to play and perceives playing with the suspected concussion as manageable, the player will then play a sport with a suspected concussion.

2.2.2 Health belief model

The health belief model (Hochbaum, 1958) attempts to explain and predict health behaviours. Mainly predicting health behaviours is done by focusing on the attitudes and beliefs of individuals. The health belief model was developed in the 1950s after a failed response to a free tuberculosis (TB) screening program when people responded poorly to obtaining a free chest x-rays to screen for TB (Hochbaum, 1958; Janz & Becker, 1984).

The health belief model is based mainly on four perceptions that serve as the main constructs namely (perceived seriousness, perceived susceptibility, perceived benefits and perceived benefits) and has three other points namely (modifying factors, cues to action and self-efficacy) that add onto the definition of the health belief model (McCormick-Brown, 1999) (Hayden, 2009).

1. *Perceived seriousness* speaks to an individual's belief about the seriousness or the severity of a disease. This may come from the person's belief about the difficulties would create or the effects it would have on his or her life in general (McCormick-Brown, 1999).
2. *Perceived susceptibility* (personal risk) is one of the more powerful perceptions in getting people to change their behaviour. The greater perceived risk the greater the chances of the person changing his/her behaviour to decrease the risk. When you add

perceived susceptibility and perceived seriousness, this results in perceived threat. When perceived threat is to a serious disease where there is a real risk, this often results in behaviour changes (Hayden, 2009)

3. *Perceived benefits* refer to a person's opinion of the value and usefulness of a new behaviour in decreasing a risk of developing a disease (Hayden, 2009).
4. *Perceived barriers* refer to an individual's own evaluation of the obstacles in the way of behaviour patterns. This perception is very important in determining behavioural change (Janz & Becker, 1984).
5. *Modifying factors* are individual characteristics that influence personal perception such as past experience, culture, educational level and skill to name a few. The four major perceptions are modified by these factors (Hayden, 2009)
6. *Cues to action* are events, people or things that move people to change their behaviour. The health belief model suggests that behaviour is also influenced by cues to action (Graham, 2002).
7. *Self-efficacy* was added to the original four beliefs of the health belief model in 1988. This is the belief in one's own ability to do something. Generally speaking people do not try to do something new unless they think they can do it. If someone believes that a new behaviour is beneficial (perceived benefit), but does not think they will be able to perform the task (perceived barrier), chances are they will not try to do attempt it (Hayden, 2009).

The health model is applicable to this particular study in a way that if an athlete does not perceive the concussion as serious enough to stop playing he will not stop. If the athlete does not feel that he could be susceptible to the long-term effects or the complications of a concussion he will also continue to play in a game with a suspected concussion. The perceived benefits of an action need to be seen as beneficial to the athlete who has suffered a

concussion. If an athlete thinks that there is no benefit to stop playing a sport with a concussion he/she will most likely not stop or report the concussion.

2.3 The development of the concussion consensus statement in sport

There have been four major international conferences on concussion in sport. The first international conference of concussion in sport was held in Vienna, in 2001 and it was the first of its kind. The second international conference of concussion in sport took place in 2004 in Prague, the third and fourth international conference of concussion in sport were both held in Zurich, the first conference taking place in 2001 and the fourth conference in 2012 (McCrory, 2013).

The focus of these four conferences on concussion in sport were the epidemiology of concussion, basic and clinical science of concussion, the grading system of concussion, cognitive assessment, new research methods, protective equipment, management, prevention, and long-term outcome from concussive injury (Cantu, 2006).

The first international conference on concussion in sport which took place in Vienna in 2001 was pivotal in the progress of recognising concussion as a serious injury in sport (Cantu, 2006). The conference revised the definition of concussion and established five conclusions about the nature of concussion. These conclusions were: 1) “concussion may be caused by a direct blow to the head, face, neck, or elsewhere on the body with an ‘impulsive’ force transmitted to the head”; 2) a “concussion typically results in the rapid onset of short lived impairment of neurological function that resolves spontaneously”, 3) “concussion may result in neuropathological changes but the acute clinical symptoms largely reflect a functional disturbance rather than structural injury”, 4) “concussion results in a graded set of clinical syndromes that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course” and 5) “concussion is typically

associated with grossly normal structural neuroimaging studies" (Aubry, Cantu, Dvorak, Graf-Baumann, Johnston, Kelly, Lovell, McCrory, Meeuwisse, & Schamasch, 2002, pg 6).

Another important consensus statement that was reached at the Vienna conference was that "neuropsychological testing is one of the cornerstones of concussion evaluation and contributes significantly to both understanding of the injury and management of the individual" (Aubry et al., 2002, pg 8). A new initiative that was proposed and agreed on is that all concussed athletes should follow a stepwise process to return to sport (Aubry et al., 2002). Finally, there was no single grading system endorsed at the conference and it was agreed that all concussions should be clinically assessed (Aubry et al., 2002). At the end of the conference a small group of experts were given a mandate by the conference delegates and the organising bodies to draft a document which highlights the agreement position reached by those in attendance at the meeting. This document was then published in the British Journal of Sports Medicine in 2002 (Aubry et al., 2002).

The second international conference on concussion in sport was well attended in Prague in 2004 (Cantu, 2006). There had not been any breakthrough in scientifically validated information on concussion between the two conferences. Some might view the second document just as an update of the first. In the first international conference in Vienna the historically known numerical grading system was abandoned. In the second international conference on concussion in sport held in Prague there was a development of simple and complex concussions, where a simple concussion is a concussion where the injury progressively resolves without any complication over 7 - 10 days. With a simple concussion, despite limiting participation in sport (practices and competition), no further intervention is required, and the player generally returns to sport without complications (McCrory, Johnston, Meeuwisse, Aubry, Cantu, Dvorak, Graf-Baumann, Kelly, Lovell, & Schamasch, 2005).

Complex concussions refer to concussions where the athletes suffer persistent symptoms, specific sequelae, prolonged loss of consciousness or cognitive impairment that is prolonged after injury. The complex concussion also includes athletes who have suffered more than one concussions or repeated concussions from progressively less force. Athletes who suffer complex concussion should be managed in a multidisciplinary manner (McCrory et al., 2005). A pocket-sized side line assessment card for clinicians was introduced in the second international conference in sports as well as the Sport Concussion Assessment Tool (SCAT), which was developed to create a standardised tool that could be used for patient education and clinician assessment of sport concussion (Cantu, 2006; McCrory et al., 2005).

The third international conference on concussion in sport was held in November 2008 in Zurich, Switzerland. At this conference there was a unanimous decision to scrap the idea of simple versus complex concussion due to the reasoning that the terminology did not fully describe the entities (McCrory, Meeuwisse, Johnston, Dvorak, Aubry, Molloy, & Cantu, 2009). In a unanimous decision it was agreed that evaluation and assessment of concussion contained in the third consensus statement on concussion in sport can be applied to children and adolescent athletes from the age of 10 and up. Below 10 years of age, children report different concussion symptoms from adults and therefore would need age appropriate symptom checklist as a component for assessment. One needs to use an age-appropriate assessment when dealing with children below the age of 10 and may also need to include the parent or teacher for input of the incident to ensure one does not miss any important details pertaining to the incident. The panel strongly endorsed that no child who is suffering any concussion symptoms should return to practice or play, even though this could take longer than adults. Cognitive rest was also highlighted for the concussed adolescent with special reference to the child's need to limit exertion with activities of daily living, limiting schooling and other cognitive stressors which could include watching television and text

messaging (McCrory et al., 2009). Chronic traumatic encephalopathy (CTE) was also introduced in the third international conference on concussion in sport where there was anecdotal neuropathological evidence of CTE. The panel discussion resulted in no consensus at this stage regarding the significance but did mention that clinicians have to be mindful of the long-term effects when dealing with the management of patients. This third international conference on concussion in sport also added and updated the Sport Concussion Assessment Tool (SCAT) to develop the SCAT2 (McCrory et al., 2009).

The final Zurich consensus statement was designed to add and build on principles outlined in the previous documents. By using a formal consensus-based approach to develop further conceptual understanding of concussion. The Sport Concussion Assessment Tool 3 (SCAT3) has been developed for any health professionals that are involved with the concussed athletes at all levels of the sport (recreational, elite or professional). The authors of the consensus do acknowledge that concussion and the science of it is an evolving science and therefore management and return to play decisions remain at the realm of clinical judgement on an individualised basis. Once again, the authors updated and improved on the Sport Concussion Assessment Tool to make the SCAT3 (McCrory, Meeuwisse, Aubry, Cantu, Dvorak, Escemendia, Engebretsen, Johnston, Kutcher, Raftery, Sills, Benson, Davis, Ellenbogen, Guskiewicz, Herring, Iverson, Jordan, Kissick, McCrea, McIntosh, Maddocks, Makdissi, Purcell, Putukian, Schneider, Tator, & Turner, 2013). The improvements included including a thorough neck examination and stating that a patient be initially assessed via the Glasgow coma scale for severity of injury then followed by documenting the athlete's symptoms. A stand down of at least 15 minutes was endorsed as to allow the athlete to not be influenced by fatigue or exertion (McCrory, 2012).

2.4 Evaluation of concussion

In the 2009-2010 academic year in America, high schools reported 7257 sport-related injuries, of those 1056 (14.6%) were concussions. Of the players who sustained concussions the most commonly reported symptoms of concussion were headache (94.3%), dizziness/unsteadiness (75.5%), difficulty concentrating (53.9%), confusion/disorientation (44%) and visual disturbances/sensitivity to light (34.4%). Loss of consciousness was rare and was only associated with 4.2% of concussions. Amnesia was recorded with 21.6% of concussions (Meehan et al., 2011).

To monitor the symptoms of a concussion the 4th concussion conference in Zurich 2012 revised the 2nd Sports Concussion Assessment Tool (SCAT) and urged professionals to utilise the 3rd Sports Concussion Assessment Tool (SCAT3) when assessing a suspected concussion (SCAT3, 2013). The SCAT3 identified headache, "pressure in the head", neck pain, nausea and vomiting, dizziness, blurred vision, balance problems, sensitivity to light, sensitivity to noise, feeling slowed down, feeling like "in a fog", "don't feel right", difficulty remembering, difficulty concentrating, fatigue or low energy, confusion, drowsiness, trouble falling asleep, more emotional, irritability, sadness, nervous or anxious as subjectively asked post-concussive symptoms (SCAT3, 2013; Cournoyer & Tripp, 2014).

Evaluation of concussion involves the assessment of a range of domains including clinical symptoms (somatic, cognitive and/or emotional symptoms), physical signs, behavioural changes, cognitive impairment and sleep disturbance (McCrory et al., 2013). If any one or more of these symptoms are present, the player, parents, coaches and/or medical professionals should suspect a concussion and the appropriate management should be taken (McCrory et al., 2013).

When a player shows any symptoms of a concussion on the field or on the side line, the 4th International conference on concussion in sport refined and established five important steps that should be followed when evaluating a concussion.

1. The player should be evaluated by a licensed healthcare provider using standard emergency management principles and the cervical spine should be treated as a neck injury until cervical spine injury can be excluded.
2. The treating healthcare provider must determine the appropriate disposition of the player as quickly as possible. The player should be safely removed from the practice or play arena and referred to a physician if no healthcare provider is available.
3. Once the player's other first aid issues have been addressed, an assessment of the concussive injury should be done by utilising the SCAT3 or other side line assessment tools.
4. For the first few hours following injury the player should not be left alone and needs to be monitored for deterioration.
5. On the day of diagnosed concussion, the player should not return to sport at all. (McCrory, et al., 2013, pg. 251).

Concussion should be seen as an evolving injury in the acute stage, therefore appearance of symptoms or cognitive deficit might be delayed several hours following a concussive episode (McCrory, et al., 2013).

2.5 Point prevalence of concussion in rugby and hockey

Over 62 000 concussions occur in high school sport in America and American Football accounts for roughly 63 percent of the total number of concussions (Guilmette, Malia, & McQuiggan, 2007). American football consistently causes the highest number and percentage of concussions at the high school and college levels in sport (Lincoln et al., 2011). This

ranges from 0.33 per 1000 exposure (Gessel, Fields, Collins, Dick, & Comstock, 2007) to 0.61 per 1000 exposure (Schulz, 2004). An exposure is classified as a single practice or competition where a player could be exposed to injury (Zemper, 2003). Baseball however, only has as low as 0.05 per 1000 exposure (Gessel, 2007) and a high of 0.11 per 1000 exposure (Schulz, 2004). More than 75% of concussions that were reported happened from player to player contact and 15.5% of concussions happened from contact with the playing surface (Meehan & d'Hemecourt, 2010).

According to recent epidemiology and prospective clinical studies, an estimated three to eight percent of players playing in high school and college American football teams sustain a concussion (Guskiewicz, Weaver, Padua, & Garret, 2000; Echemendia, Putukian, Mackin, Julian, & Shoss, 2001; Barr, & McCrea, 2001). In an Irish study that focused on concussion injuries in professional rugby players 44.9% of the respondents admitted to having sustained a concussion (Fraas, Coughlan, Hart, & McCarthy, 2014). Concussion was the most commonly reported rugby incident for the South African players that played in the 1999 super 12 rugby season. Concussion also accounted for twenty percent of the total reported injuries in the 1999 super 12 rugby season for all South African players (Holtzhausen, Schwellnus, Jakoet, & Pretorius, 2002). Another South African study identified that among three South African schools the average of self-reported concussions was 2.3 ranging from 0-7 for rugby players and only 0.4, range from 0-1, for a hockey player (Shuttleworth-Edwards et al., 2008). In an American study, 1532 football players across 20 different schools were surveyed regarding concussion. Out of the 1532 football players, 29.9% reported having previous concussions. Fifteen-point-three (15.3) percent reported sustaining a concussion in that season, of that 15.3%, only 47.3% reported their injury (and most of the time the injury was reported to an athletic trainer). From the study the most common reasons a player did not report the injury were: 1) player not thinking injury was serious enough to warrant medical

attention (66.4%), 2) player did not want to be withheld from the game (41%), 3) lack of awareness of possible concussion (36.1%) (McCrea et al., 2004). In a study that focused on epidemiology of concussions in 20 different high school sports the authors found that in field hockey, competition play (as opposed to practice) was responsible for most of the concussions. Concussion was three times more likely to occur during competition than in practice. In football concussions mainly occurred during running/open plays and resulted from player on player contact, more specifically in the tackling and being tackled, resulting in 62.5% of concussions. In field hockey however, concussions mainly occurred during player equipment contact, resulting in 60.8% of concussion injuries with contact between ball-player equalling 37.3% and contact between stick-player equalling 23.5%. In the same study the researchers refined the total concussions into specific positions where midfielders were most likely to get concussed at 35.3%, followed by defender at 29.4% and then forwards 21.6% (Marar, McIlvain, Fields, & Comstock, 2012).

Considering the lower number of pupils who participate in hockey when compared to football, pupils who play hockey in high school and college in the USA have a high incidence of concussion. In hockey, concussion injuries accounted for 6.3% of practice injuries and 10.3% of match injuries (Hootman, 2007). In the 2009-2010 and 2010-2011 season of women's hockey in America, 181 high schools participated in a cohort study and out of 212 injuries reported 93 were concussions (43.9%) (Kriz, Comstock, Zurakowski, Almquist, Collins, & d'Hemecourt, 2012).

2.6 Aetiology of concussion

The word concussion was introduced to the medical dictionary in the 16th century (Ommaya, Rockoff, Baldwin, & Friauf, 1964). In 1705 a post-mortem examination was performed by a doctor Littre (a medical examiner) on a patient who hit their head on a wall. The patient fell

down, was unconscious and died a few minutes later. The post-mortem examination showed no damage to the brain to the naked eye and this was potentially the first documented case of a concussion (Ommaya et al., 1964). Concussion comes from the Latin word 'concutere' which means to shake violently (Maroon, Lovell, & Norwig, 2000). Concussion is defined by the Canadian Academy of Sport Medicine for the layman as any hit to the head that is either direct or indirect that can cause a change in behaviour, awareness, and/or physical feeling. (Patricios et al., 2010). The pathophysiology of a concussion is not well known. However, there has been research that shows complex cascades of neurochemical changes in the brain with moderate to severe brain injuries (Giza & Hovda, 2001). According to Hovda (1995), a concussion is considered a mild traumatic brain injury (TBI), and the pathology of the injury should then be similar to that of a TBI (Hovda, 1995). Sullivan et al., (2006) found that many players thought that one had to be "knocked out" to sustain a concussion. Thinking one had to be "knocked-out" could be a big factor when it comes to reporting of concussion and can lead to under reporting of injury (Sullivan et al., 2006).

Aetiology of concussion in sport may include direct head impact from other players or teammates, falls on the ground or being struck by inanimate objects such as sticks, balls or poles. A concussion can be caused by any external force to the body that can induce a sufficient enough head/neck acceleration that could lead to a concussive injury (Delaney, Al-Kashmiri, & Correa, 2014).

The temporal region may be more vulnerable to concussion than other areas of the head due to it being considered in the blind spot of the players, therefore the players are not anticipating the collision. Direct impact to the temporal region result in more shear stress to that area of the brain relative to the frontal and occipital areas (Delaney et al., 2014). A 2010 study which was conducted in America on junior ice hockey players suggested that

anticipation of the impact to the head can also lessen the impact severity of the blow. Therefore, failure to properly prepare for a collision and contract cervical muscles prior to impact likely increases the degree of head/neck acceleration following impact to the head (Mihalik, Blackburn, Greenwald, Cantu, Marshall, & Guskiewicz, 2010).

Concussion may result from high-speed acceleration-deceleration head motions that do not require a direct blow to the head. Regardless of direct head impact being the most likely aetiology of concussion (Delaney et al., 2014). To identify the precise mechanism or body part that caused the concussion in sport can prove to be difficult in sports like rugby, football or hockey as these sports sometimes struck in the head, pushed/fall on the ground and stood/ other people fall on them all in one play (Delaney et al., 2014).

2.7 Grading of concussions

There is no empirical evidence for the merit of any of the different grading systems (Broglio, Vagnozzi, Sabin, Signoretti, Tavazzi, & Lazzarino, 2006) therefore there has been no universally accepted concussion grading system (Slobounov, 2008).

There have been many attempts to grade concussions (Collins, Lovell, Iverson, Cantu, Maroon, & Field, 2002). The grading of concussions was initiated in 1966 by a subcommittee on classification of sport injury from the congress of neurological surgeons (Schneider & Kriss, 1973). The subcommittee decided to divide this new term (concussion) into three grades (Table 2.1), they based the grading of concussion on the severity and duration of the symptoms and included the rate of recovery as well (Schneider & Kriss, 1973).

Table 2.1: Grading system from the subcommittee on classification of sports injury.

Concussion grading system (1966)

	LOC = loss of consciousness.
Grade 1	No LOC, Slight confusion, None or very transient memory loss, Very rapid recovery
Grade 2	LOC <5 min, Momentary confusion, Mild retrograde amnesia, Complete recovery within 5 min
Grade 3	LOC >5 min, Confusion >5 min, Prolonged retrograde amnesia, Slow recovery (>5 min)

In 1986, a neurosurgeon further defined concussion by combining elements of various definitions (Cantu, 1986). Table 2.2 shows how Cantu grades concussion based on how long one is unconsciousness and the time of post traumatic amnesia (PTA) (Table 2.2). This brought about confusion when a player who was not knocked unconscious and did not experience any post-traumatic amnesia but who was experiencing post-concussive symptoms example headache, dizziness, concentration and balance problems. The fact that post-concussive symptoms was not an indicator for grading a concussion brought concern when categorising a player into a grade one or three (Cantu, 1986).

Table 2.2: Cantu (1986) grading system

1	No LOC; Post Traumatic Amnesia (PTA) <30 min
2	LOC <5 min; PTA >30 min and <24h
3	LOC >5 min or PTA >24h

The American Academy of Neurosurgery in 1997 based their grading of concussion based on the symptom of concussion, with a high priority still given to duration of unconsciousness and post traumatic amnesia (Table 2.3). They added into the grading system confusion and any disturbance of neural function and stated that if a player has any loss of consciousness they are immediately graded as a grade three (American Academy of Neurology, 1997).

Table 2.3: American Academy of Neurology (1997) grading system

1	No LOC; transient confusion; concussion symptoms or mental status abnormality resolve in <15 min
2	No LOC; transient confusion; concussion symptoms or mental status abnormality last >15 min
3	Any LOC, either brief or prolonged

The McGill grading system (Table 2.4) was designed as a research tool changed the grading system by subdividing the grade 1 concussion into A, B and C. He uses this to emphasise the importance of evaluating the post-concussive symptoms (PCS). Post-concussive symptoms help identify the 75% of concussions that do not have post traumatic amnesia and loss of

consciousness as the major signs, these 75% of concussions are the most common in sport related concussions (Leclerc, Lassonde, Dupuis, Guerin, DelCarpio, Lacroix, Delaney, & Johnston, 1999).

Table 2.4: McGill grading system

Grade 1	No LOC, no PTA
1A	No Post-concussive symptoms (PCS), only seconds of confusion
1B	PCS and/or confusion that resolved within 15 min
1C	PCS and/or confusion that do not resolved within 15 min
2	PTA <30 min and/or LOC <5 min
3	PTA >30 min and/or LOC >5 min

In the first concussion conference based in Vienna, the experts in the field of concussion who attended this conference did not endorse any single grading system for concussion. Due to the absence of any scientifically validated return to play guidelines, the experts recommended the inclusion of side-line evaluation of signs and symptoms of concussion as well as the continuous assessment until all post-concussive symptoms have resolved (Cantu, 2006).

2.8 Risk factors for sport-related concussions

If one has sustained a concussion previously one is at higher risk to sustaining a second concussion. A study that utilised high school and college football players over a two-year period wanted to measure the relative risk of cerebral concussion among those with a history of concussion compared to those having no previous concussion (Zemper, 2003). A total of

15,304 players were included in the study and out of the total population 975 had a history of concussion and 14,329 had no history of concussion prior to the two-year study. In the two-year study period 572 new concussion were reported; of which 161 participants had a history of concussion prior to the two-year study period which gives a re-injury rate of 16.5%. Of the 572 new concussions 411 had no history of concussion prior to the study period and therefore given an injury rate of 2.9% of those who have not suffered a concussion previously. The study showed that the risk of sustaining a cerebral concussion is nearly six times greater for players who have a history of concussion compared to those who have not sustained one before (Zemper, 2003).

If you suffer a second concussion the force that is needed to produce a concussive blow decline for every concussion that is received and takes longer to heal per concussion. You are four times more likely to suffer a second concussion after you have suffered one (McBride, 2012).

The sport you play may or may not increase your risk for concussion. The more contact in the sport you play the more at risk you are to sustain a concussion. In America, American football consistently causes the highest number and percentage of concussions at the high school and college levels in sport (Lincoln et al., 2011).

Seventy-eight-point-five (78.5) percent of concussions sustained occurred in competition and the rest in the practice setting (Meehan & d'Hemecourt, 2010). Therefore, when playing matches against other teams (competition), one is at a higher risk for concussion.

Gender does seem to have an influence on concussion with regard to sports that are played by males and females. Research has found that girls have twice the rate of concussion for same sports that boys play (Lincoln et al., 2007 & Gessel et al., 2007). Sociological factors could be what differs male from female, this includes different societal pressures that are placed on

the athletes, stigma that is perceived and the potential risk of being removed from the field of play associated with males leading to decreased reporting (Dick, 2009). There was also a difference in self-reported symptoms that were reported with high school boys and girls. Girls reported more drowsiness and sensitivity to noise and boys reported more confusion/disorientation and amnesia (Frommer et al., 2011). The recovery times and return to play were similar for both genders (Frommer et al., 2011). The recovery time may be prolonged in young athletes and young athletes are more susceptible to a concussion that is accompanied by a catastrophic injury (Harmon, et al., 2013).

2.9 Complications of concussion

If players do not report concussion they predispose themselves for further injury such as second impact syndrome (Patricios, Kohler, & Collins, 2010). Second impact syndrome is very rare and occur when the brain has not fully recovered from a concussion injury and suffers another blow. During the second blow the brain swells further, cerebral blood flow increases and therefore brain pressure increases which could lead to death (Cantu, 2001). Second impact syndrome was first discovered in 1984 when a 19-year-old college football player suffered a head injury. The player lost consciousness and returned to play in the same game and subsequently received another concussive knock. After complaining of a headache four days later he collapsed and died (Wetjen, Pichelmann, & Atkinson, 2010). Ongoing monitoring 48-72 hours post injury is very important in order to detect severe complications of concussion such as intracranial space occupying lesions and impact convulsions (Noakes, 1996; & Schneider, 1961).

Late complications of a concussion can include post-concussion syndrome (Omalu et al., 2005). This syndrome occurs when symptoms of a concussion manifest for days to weeks post initial concussion and symptoms include headache, memory loss, mood swings, inability

to sleep and can be debilitating (Omalu et al., 2005). Chronic traumatic encephalopathy is another possible complication of concussion and the result of repeated long-term exposure to concussive blows. Each concussive blow exponentially increases the risk resulting residual brain damage (Omalu et al., 2005). Later in life depression can be a likely symptom if you suffered multiple concussions in your playing days. Early onset mild cognitive impairment has also been linked to multiple concussions (Omalu et al., 2005).

2.10 Return to play guidelines

The return to play process started after the first concussion conference held in Vienna where the experts recommend that the concussed athlete follow a stepwise process to return to sport (Cantu, 2006).

The guidelines that are used to help reintegrate a concussed player back to contact sport were developed at the concussion conferences and redefined at each subsequent conference until the latest one in Zurich in 2012 (McCroy et al., 2012). According to these guidelines, a player who has sustained a concussion should stop play immediately, and be removed from the field. The concussed player should then rest (physically and cognitively) until asymptomatic. Once asymptomatic the player starts the next phase, the player starts light aerobic exercise such as walking, cycling or swimming. Phase three entails sport specific drills such as running drills with no head contact. Phase four requires non-contact training drills, so the player can join practices but not to engage in contact. Phase five is a full contact practice following medical clearance and phase six is full match play. At any point in the six phases the player feels any post-concussive symptoms they must stop and go down to the previous phase of recovery (McCroy et al., 2012).

During the recovery of a concussion it is also useful to do neuropsychological testing to help monitor symptoms. This form of testing is only useful if the player has performed a baseline testing prior to injury (Broglio, Macciocchi, & Ferrara, 2007)

2.11 Knowledge and adherence to concussion and the return to play guidelines

One study based on high school rugby players in New Zealand found that participants recognised only a few symptoms of concussion namely headache and blurred vision (Sye, Sullivan, & McCrory, 2006). In the same study only 50% of the participants knew about the return to play guidelines even though there is a policy in play for concussed athletes (Sye, Sullivan, & McCrory, 2006). Before returning to play (practice or competition) a concussed athlete needs to be cleared by a medical professional (SCAT3, 2013). However, only a very small percentage of players sought medical clearance prior to returning to practice or competition (Sye, Sullivan, & McCrory, 2006).

2.12 Sport coaches' knowledge of concussion

Rugby coaches in South Africa are required to do a course prior to being allowed to coach a rugby team. The course is known as Bok Smart and is a six-hour teaching DVD on safety in rugby. This six-hour DVD has a small section on concussion which tries to educate coaches on the topic of concussion (BokSmart, 2017). As concussion has become a major concern as young athletes have died and South African rugby union is trying to increase awareness on concussion and the possible complications (Bull, 2013). An American study found that coaches with more than 10 years of experience reported when educated on concussion that they have learnt something new on the topic (Sarmiento, Mitchko, Klein, & Wong, 2010).

2.13 Conclusion

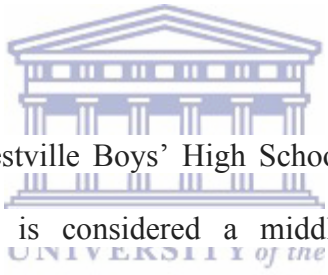
Concussion is a very common injury in contact sport and has a variety of signs and symptoms that can be associated with a concussion. Players seem to be lacking in knowledge of concussion and the return to play guidelines and are not adhering to the protocols that are in place. Young athletes need to be educated on the topic of concussion, the long-term effects of concussion and the risks of not adhering to the return to play guidelines.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

Chapter three discusses the research methodology that guided the research and enabled the researcher to collect and analyse the data. The chapter covers the study setting that was utilised for the study, the study design that was used to conduct the research, population and sampling which was used to recruit participants. The instrument for data collection will be discussed, the procedure for which data was collected, scientific rigor of quantitative and trustworthiness of qualitative data. The analysis of both quantitative and qualitative data, and obtaining of ethics statement will be discussed.

3.2 Study setting



This study was conducted at Westville Boys' High School, based in Westville, KwaZulu-Natal, South Africa. Westville is considered a middle-income area and the school accommodates many students from poor and rich socioeconomic backgrounds (W. Du Plessis, personal communication, 28 February 2016). The majority of pupils are from middle-income families (W. Du Plessis, personal communication, 28 February 2016). The population would be considered inherently heterogenous, (as they are not all the same), but representative of the broader South African population as all classes and races are (potentially) included. Westville Boys' High School is an English-medium, public, model C, secondary school, and has consistently ranked high in academic and sport in the province (W. Du Plessis, personal communication, 28 February 2016). A total of 1300 boys attended this school in 2016 across Grades 8 to 12. Approximately 240 pupils are involved in rugby and 176 pupils plays hockey in the winter months.

3.3 Study design

A mixed-methods approach explanatory sequential design was used for the study (Creswell, Klassen, Clark & Smith, 2011). The mixed-method explanatory sequential design approach is done by collecting, analysing and interpreting first the quantitative data followed by the qualitative data. The advantages of the mixed-method explanatory sequential design are that we can further explore the quantitative data in more detail and it is good when unexpected results arise in the quantitative results (Ivankova, Creswell, & Stick, 2006). Limitation of the mixed-method explanatory sequential design are the lengthy process and the feasibility of resources as one needs to collect and analyse both quantitative data and qualitative data (Ivankova, Creswell, & Stick, 2006). The mixed-method explanatory sequential design was used to strengthen and expand on the quantitative data that was collected by using FGDs. Due to the low numbers of the study a mixed-methods explanatory sequential design was ideal for the study. The study design is a two-phased mixed-method design which starts with collection and analysis of quantitative data. The quantitative data was collected by using a self-developed survey surrounding concussion. After the quantitative results the qualitative results follows which utilised focus group discussions with players who have suffered concussions to gain a better understanding on the topic of concussion and what were the circumstances affecting their non-adherence to the protocols that are in place. Once the focus groups were done the recording transcribed verbatim and analysed by the researcher. The second phase of the study is designed to follow from the quantitative results in order to explain the findings of the first phase in more depth (Creswell, Klassen, Clark, & Smith, 2011). In the current study data relating to point prevalence of concussion, players knowledge regarding concussion and return to play protocols and if the return to play protocols guidelines are being adhered to was first collected quantitatively by utilising a self-developed survey. In order to explain the results of the quantitative survey in more detail after analysis,

it was followed by a qualitative phase. The quantitative results determined which questions would be included in the focus group discussions. During this qualitative phase, focus group discussions (FGDs) were used to collect data. By using FGDs the researcher aimed to further investigate why the students do not or do adhere to the return to play guidelines. The qualitative results assisted in explaining and interpreting the quantitative data in more depth and help provide a better understanding the research problem (Creswell, Klassen, Clark, & Smith, 2011). In the FGDs we expanded why and what were the reasons for some of the participants who did not adhere to the return to play guidelines. A mixed-method explanatory sequential design was chosen because due to the minimal number of participants who were available as the quantitative data was not going to be strong enough so to make the results more credible we had to include a qualitative phase of the study.

3.4 Population, sample size and sampling strategy

3.4.1 Phase A: Quantitative data

During the 2016 sporting season, the total population of students at the school who registered to play rugby was 240, and 176 pupils were registered to play hockey. The total study population size was therefore 416. According to Yamane's formula (Yamane, 1967) for representative sample size calculation, 204 participants were recruited into the study at a confidence interval of 95%. An additional ten percent was added to account for attrition, so the total sample size for this study was ideally 224 students who played either rugby or hockey. All players who played rugby or hockey in Grade 8, 9, 10 and 11 were given assent and information forms to give to their parents so that the parents could read and sign if they gave permission for their children to participate in the study. Once the parent and learner had signed the consent form, the learners then completed the survey. Initially the researcher wanted to get a random sample of participants to try and get a good representation from all

the grades with an equal number of hockey and rugby players. Random sampling is when everyone in the entire population has an equal chance of being selected for the research. The advantage of random sampling is that it gives a good representation of the target population and eliminates sampling bias. The disadvantage is that it is not easy to achieve and takes a lot of time, money and effort to achieve random sampling (McLeod, 2014). However, due to a poor response rate it was decided to change to convenience sampling. Advantages of a convenience sampling are that it is easier to collect data and less time consuming to the research. The disadvantages are poor generalisability and can only be generalisable to the sample studied (Bornstein, Jager, & Putnick, 2013). Three hundred and fifty assent and information sheets were handed out to all rugby and hockey players from grades eight to eleven who were in attendance when the assent and information sheets were handed out, 221 responded and filled in the surveys, obtaining a 63.14% response rate. Two hundred and twenty one participants were thus representative of the total population as 204 was the ideal number.

3.4.2 Phase B: Qualitative data

The FGDs were conducted in order to explain why learners who have suffered a concussion did not adhere to the return to play guidelines. A total number of 67 were eligible for the FGDs 24 participants were conveniently selected based on their availability to participate in either of three FGDs based on the dates that were given. The 24 participants were contacted in person and explained when and where the FGDs would take place and what it would entail. Of the 24 that were contacted only 15 participants participated. Three participants participated for the first FGD and six for second and third FGD. The FGDs were conducted in order to explain why learners who have suffered a concussion did not adhere to the return to play guidelines.

3.4.3 Sampling strategy

Phase A of the study utilised convenience sampling strategy was employed while phase B employed purposive sampling.

3.5 Instruments for data collection

A newly developed survey based on the literature was used for phase one of the study (Sye, Sullivan, & McCrory, 2006). The research instrument consisted of 26 items, with a level of measurement at a nominal or an ordinal level.

The advantages of using a survey was obtaining a lot of information in a short period of time. The disadvantages were the topic that was investigated could lack detail and depth of information (Kelley, Clark, Brown, & Sitzia, 2003). A survey was appropriate for this study as the high volume of participants was utilised and was able to filter those who had a concussion and did not adhere to the return to play guidelines. The survey was divided into four sections which collected data relating to A) biographical data, B) point prevalence of concussion, C) knowledge of concussion and D) adherence to the return to play guidelines. The surveys took approximately ten minutes to complete and all data collection was completed in a two-week period.

Phase two utilised focus group discussions to collect qualitative data. Focus group discussions are a research method in a group setting as the source of data with a researcher who plays an active role in facilitating topics selected for discussion (Morgan, 1996). Advantages of a FGD are that individuals feed off one another's statements and can query what one has said, and this leads to further explanation by participants (Morgan, 1996). FGD also have the ability to provide more in-depth understanding of what people have to say when it comes to more complex behaviours and motivations (Morgan & Krueger, 1993). The interviewer also has the ability to ask participants regarding comparisons between

experiences and views that might be different (Morgan, 1996). Two disadvantages of FGD include that sometimes the researcher has more of an impact on the FGD rather than the participants and the researchers constant input could potentially disrupt the flow of the FGD (Morgan, 1996). This study chose to include FGDs as to further understand why participants did not comply with the concussion protocols that are in place and to further credit the quantitative data that was collected. The opening question for the FDGs was "for those of you who suffered a concussion and returned to sport before being cleared by a medical professional, why did you not seek medical clearance?".

3.6 Procedure for data collection

3.6.1 Phase A: Quantitative data

After obtaining ethical clearance from the University of the Western Cape Ethics committee, and permission to conduct the study from the department of education, the principle of the school was contacted to determine if the school's boys were allowed to participate in the study. Permission was obtained from the school principle. The researcher went to the school's sport period and spoke to all hockey and rugby players in grade eight to eleven. All players were given assent and information sheets to give to parents. The researcher then followed up one week later and those who had returned the assent forms were then included in the study. When assent was given by the parents of prospective participants, the pupils were then notified and written informed consent was obtained from the participant and completed the survey on the spot alone in a class room based at Westville Boys' High School. Once the surveys were filled in at the school the surveys were handed in to the researcher. Once all the surveys were completed, the surveys were analysed using the Statistical Package for the Social Sciences version 24.0 (SPSS) and phase one of the study was completed.

3.6.2 Phase B: Qualitative data

Participants who sustained a concussion and indicated that they did not adhere to the return to play guidelines were contacted in person at the school. The researcher then gave them the dates of the FGDs and explained what was needed from the participant and roughly how long it should take. The parents of the participants had already signed an assent form, the participants were asked in person if they would join. If they said "yes" they were to show up on the date and time given. Food and cooldrink was provided for the participants to eat and drink whilst the FGDs were being conducted. Before the FGDs started each participant was again told what was expected of them and they all signed a confidentiality form. The FGDs were conducted at the researcher's personal office at the school premises. The FGDs lasted roughly 40 minutes per focus group. These focus groups were audio recorded and transcribed for analysis.

3.7 Analysis of data

3.7.1 Phase A: Quantitative data

Each variable in a question was allocated a code and captured onto the Statistical Package for the Social Sciences version 24.0 (SPSS). Data was analysed for descriptive and inferential statistics. For descriptive statistics bar graphs, pie charts, tables, cross tabulations, standard deviations and means were used. For inferential statistics correlations and hypothesis tests (chi-square tests) were done in order to determine relationships between variables of interest.

3.7.2 Phase B: Qualitative data

Data was analysed using thematic content analysis through a process of coding and categorising to derive at themes. Initially data was transcribed, and the researcher became familiar with the data by reading through the transcripts and identifying possible patterns. After the researcher became familiar with transcripts, codes were used to document broad patterns in the text. Themes that overarch each other are grouped together to condense the

themes. The researcher also at this point clarified what the themes were exactly. The next step is to look at how the themes supported the data and if they formed coherent patterns. Once themes were identified and the researcher felt they made sense to the study themes were then named and how each theme related to each other and what was interesting about those themes. Once themes were named and identified as themes, the report writing started and the qualitative results were discussed in the results section (Cresswell, 2007).

3.8 Scientific rigor of quantitative data

3.8.1 Validity

The survey was reviewed by experts in the field of concussion, one sport physiotherapist who has many years of experience working with professional rugby teams and a sport physician, to determine the content and face validity (Lynn, 1986). The physiotherapist made no changes to the survey. The sport physician made a few changes to the survey. He changed the way in which the answers would be answered instead of asking the participants to explain in their own words, rather give them blocks to tick off for easier analysis of the data. Once changes were made both physician and researcher agreed the survey was ready to be handed to the participants and filled in for data collection (Pitney, 2004).

3.8.2 Reliability

The most important factor to consider in order to determine the accuracy of data collected is **reliability**. Reliability is computed by taking several measurements on the same subjects. A reliability coefficient of 0.70 or higher is considered as “acceptable”. The reliability scores for all sections exceed the recommended Cronbach’s alpha value of 0.879. This indicates a degree of acceptable, consistent scoring for these sections of the research. A test-retest was done to determine if the newly developed instrument for the study (survey) was reliable. Ten participants filled in the surveys initially and the same ten participants filled the surveys again

a week later to determine if the survey was consistent. The researchers correlated the results and found no discrepancies and continued with the study. The researcher randomly selected ten participants which their parents had already assented to participate and got the participants to do a pilot study. A pilot study with the ten boys was done in order to assess the internal validity. Internal validity refers to how well the instrument accurately measures what the researcher is intending to measure (Pitney, 2004). Participants were asked to comment on the difficulty of the questions and if any questions seem ambiguous, no one commented on the survey and no changes were noted. These pupils were added to the sample population (Pitney, 2004).

3.8.3 Generalisability

This study was only generalisable to Westville Boys' High School. However, it can be used as a base for future studies similar to this in a South African context (Pitney, 2004). Generalisability refers to how findings of a study can be applied in another situation (Shenton, 2004).

3.9 Trustworthiness of qualitative data

3.9.1 Credibility

The voice recordings of the FGDs were transcribed by a professional. Once this was done, member checking was performed by giving the transcripts to the participants of the focus groups and asked to read what they said and to confirm that what has been written down is in fact what they had said (Shenton, 2004).

3.9.2 Transferability

The transferability refers to qualitative data and how one can use what was said in one study and apply it to another study (Shenton, 2004). Transferability was maintained in this study by accurately documenting the steps of the study. The findings of the study are not transferable as there were too few participants involved and the study was only conducted at one public high school in Durban, South Africa. The methods of the study however, are transferable as the steps are carefully and accurately documented and can be utilised in future research of a similar nature (Shenton, 2004).

3.9.3 Dependability

A pilot focus group of six invited participants was conducted at the researcher's office based at the school premises a week before the main focus groups to ensure that the semi-structured questioning was bringing up topics that were relevant to the study. (Shenton, 2004).

3.9.4 Confirmability

The transcripts of the focus groups and the initial common trends that the researcher pointed out was given to a supervisor to confirm that the trends that have been established are likely trends and are not bias trends that the researcher had picked up (Shenton, 2004). Member checking was performed to ensure that the themes accurately reflect the intentions of the participants

3.10 Ethics statement

Ethics clearance (Appendix E) was obtained by the University of the Western Cape Research Ethics Committee (HS16/5/33). Permission to conduct the study was obtained from the Department of Education (Appendix F). Permission was obtained from the principle of Westville Boy's High School (Appendix G). Assent was obtained by the parents (Appendix B) of the boys who are under the age of 18. Written informed consent (Appendix C) was

obtained from the boys once the parents had given assent. All participants were made aware that their participation was voluntary, and that they could withdraw from the study at any time without negative consequences. Confidentiality was ensured at all times, but anonymity could not be assured to the participants of the FGDs due to other participants knowing the fellow participants and could break confidentiality. A FGD confidentiality binding form (Appendix I) was signed by all participants of the FGDs to hopefully ensure that what is said in the FGDs remains confident. Only the researcher, supervisor and transcriber had access to the data, and electronic data were stored on a password protected computer. Surveys are stored in a locked cabinet in the researcher's personal office.

CHAPTER FOUR: QUANTITATIVE RESULTS

4.1 Introduction

This chapter presents the results and discusses the findings obtained from the questionnaires in this study. The self-developed surveys were the primary tool that was used to collect data and were distributed to learners at Westville Boys' High School. The data collected from the responses was analysed with SPSS version 24.0. This chapter will present the descriptive statistics in the form of graphs, cross tabulations and other figures for the quantitative data that was collected. Inferential techniques include the use of correlations and chi square test values; which are interpreted using the p-values. The response rate for this study was 100% as all 220 questionnaires that were given to selected participants were completed and returned.

4.2 Section A: Biographical Data

This section summarises the biographical characteristics of the respondents.

All participants were male, the average age of participants was 15.32 (SD +/- 1.35) years and ranged from 13-18 years. Three quarters of the sample (75.1%) were between the ages of 13 to 16 years. Nearly a third of the participants were attending Grade eight at the time of data collection (Table 4.1). No Grade 12 learners were allowed to participate due to national government policy.

Table 4.1: Participants' distribution by grade

	Frequency (%)
Grade 8	70 (31.7%)
Grade 9	48 (21.7%)
Grade 10	47 (21.2%)
Grade 11	49 (22.2%)
Missing	7 (3.2%)
Total	221 (100%)

The majority (62.9%) of participants in this study played rugby as opposed to hockey. (Figure 4.1).

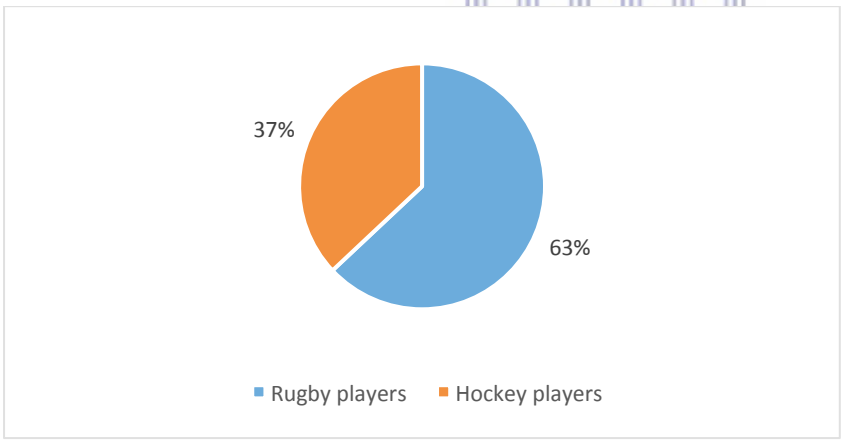


Figure 4.1: Participants' distribution by sport

4.3 Section B: Prevalence, diagnosis and management of concussion

4.3.1 Prevalence of concussion

Approximately a third (31.4%) of the total sample (N=221) indicated that they had sustained a concussion injury anytime in their sporting career. (Figure 4.2).

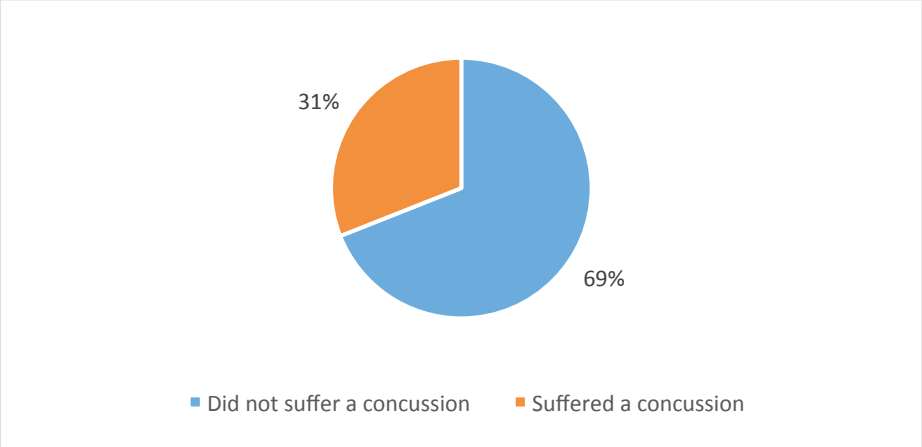


Figure 4.2: Prevalence of concussion

In total 108 concussions were sustained by the 67 participants who suffered a concussion. Seventy-eight percent of all 108 concussions were sustained by rugby players. The prevalence of concussion was 46.2% higher amongst rugby players than amongst hockey players. Two participants did not answer this question (Table 4.2).

Table 4.2: Descriptive statistics of the number of concussions sustained per sport

Sport	Frequency N=67	Mean	Total number of concussions sustained	Std. Deviation	Range
Rugby	49 (73.1%)	1.7347	85 (78.7%)	+- 1.05624	1-5
Hockey	18 (26.9%)	1.2778	23 (21.3%)	+- .57451	1-3
Total	67	1.6119	108 (100%)	+- .96852	1-5

Sixty-two-point-seven (62.7) percent (n=42) of the total sample (rugby and hockey players) suffered only one concussion. The remainder of the participants suffered more than one

concussion with five being the maximum amount of concussions sustained by a single participant (Figure 4.3).

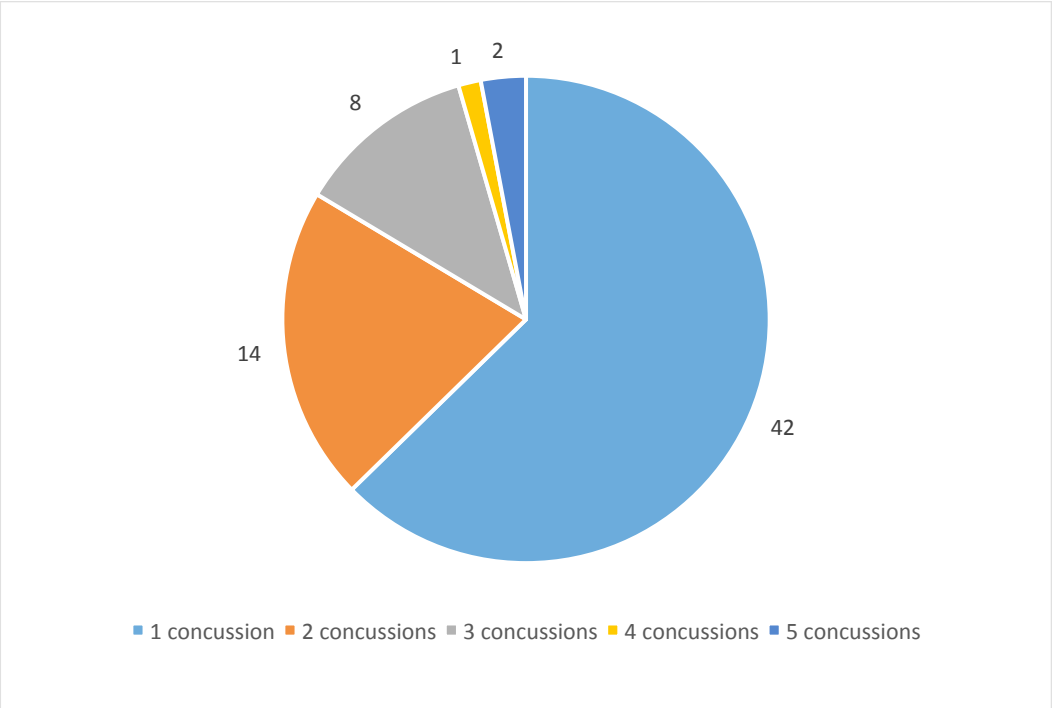


Figure 4.3: Number of concussions sustained

The majority of the hockey players only sustained one concussion 77.8% (n=14). Only 22.2% (n=4) of the hockey players suffered more than one concussion compared to the rugby players where 42.8% (n=21) suffered more than one concussion (Figure 4.4).

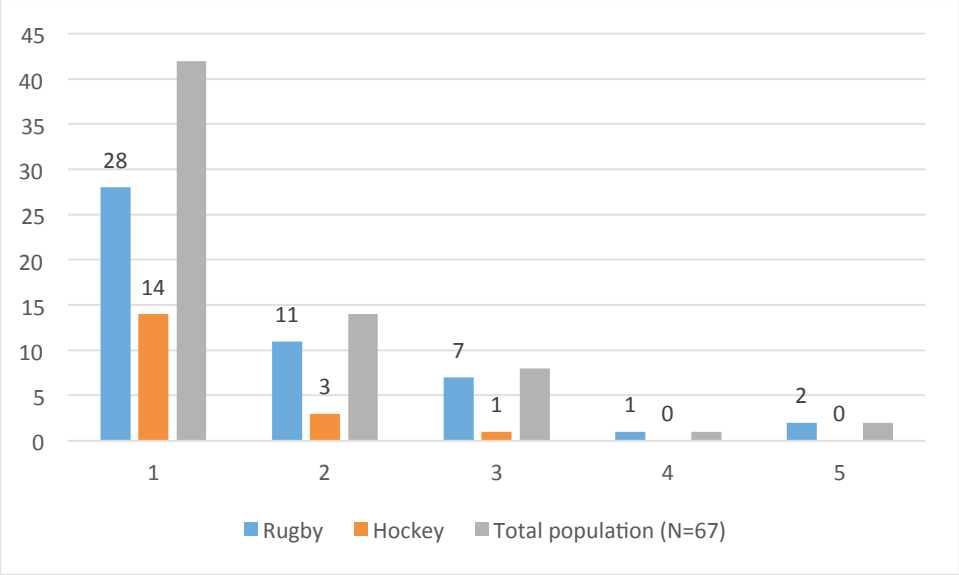


Figure 4.4: Comparison of number of concussions sustained by sport

4.3.2 Initial diagnosis of concussion

In this study, a sports physician diagnosed the majority of concussions (29%), followed by the general practitioner (17%) and then the coach (16%) (Figure 4.5).

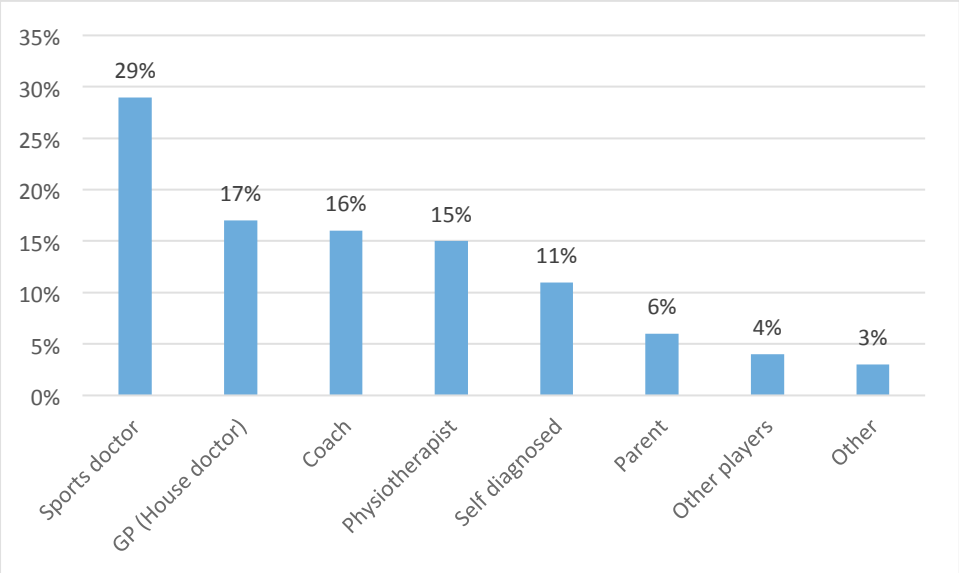


Figure 4.5: Person responsible for diagnosing concussion

Approximately half (46.4%) of all concussions were sustained more than 12 months ago. The remainder being sustained within a year of when the surveys were completed. Figure 4.6 shows the distribution of when the concussions were sustained (Figure 4.6).

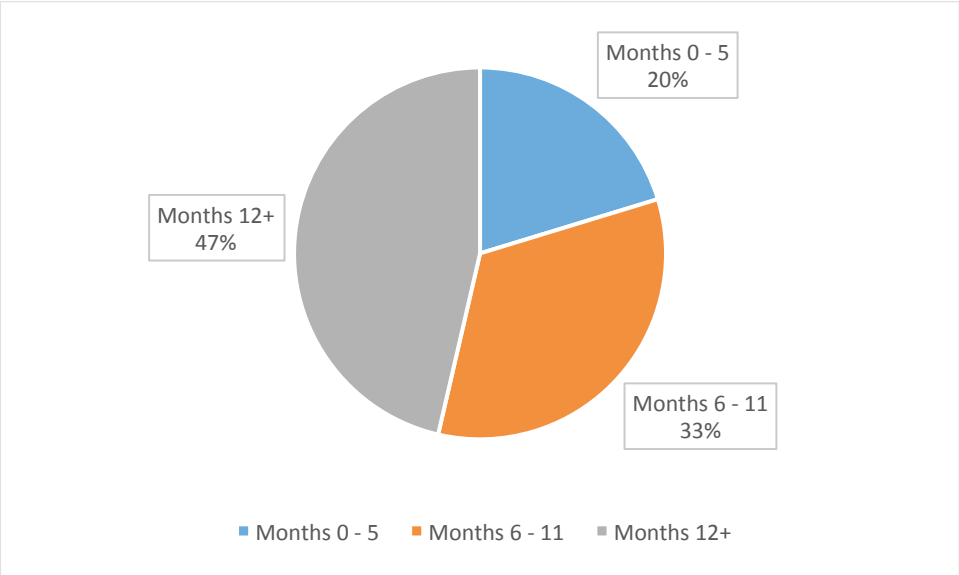


Figure 4.6: Time frame of sustaining last concussion

4.3.3 Self-reported management of concussion

A quarter (25.4%), of those that suffered a concussion rested for less than 10 days. More than half (55.2%) rested between 10 days and 21 days and the remainder of the participants rested for more than 21 days (Table 4.3).

Table 4.3: Numbers of days off sport after concussion

	Frequency (%)
< 10	17 (25.4%)
10 – 21	37 (55.2%)
> 21	13 (19.4%)
Total	67 (97.1%)

Thirty-point-four (30.4) percent (n=21) of participants followed a graded return to play protocol and approximately 20.2% (n=14) of those who suffered a concussion injury indicated that they had received no treatment (Table 4.4).

Table 4.4: Treatment of concussion

Type of treatment	Frequency (%)
Physical rest	47 (68.1%)
Cognitive rest	29 (42%)
Graded return to play protocols	21 (30.4%)
Nothing	12 (20.2%)
Medication	10 (14.5%)
Further investigations (x-ray, CT scan, MRI)	5 (7%)

Of the participants who have suffered a concussion only 53.7% were cleared by a medical professional before they returned to sport (Figure 4.7).

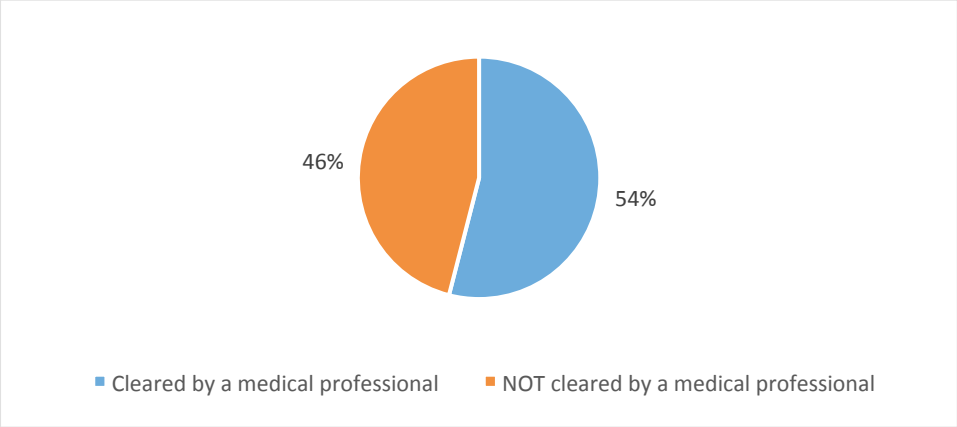


Figure 4.7: Medically cleared before returning to sport

4.4 Section C: Knowledge of concussion

This section investigates all respondents' knowledge of concussion. The results will be reported under five sub-headings namely 1) Perceived knowledge of symptoms of

concussion, 2) Actual knowledge of symptoms of concussion; 3) Knowledge of causes and components of concussion; 4) Knowledge of complications of concussion and health seeking behaviour and lastly 5) Source of knowledge on concussion. For most of the sections, the results are presented separately for those who HAVE and those who HAVE NOT suffered a concussion for ease of comparison.

4.4.1 Perceived knowledge of symptoms of concussion

The majority of the participants (75.1%; n =166) felt that they were knowledgeable on the symptoms of concussion (Figure 4.8). There was a statistically significant difference in perceived knowledge of percussion (p=0.003) between those who have suffered a concussion previously and those that have not. In the group of those that have suffered a concussion 92.1% (n=58) reported that they know what the symptoms of concussion are while 74% (n=109) of those who have not suffered a concussion have indicated that they know what the symptoms of concussion are.

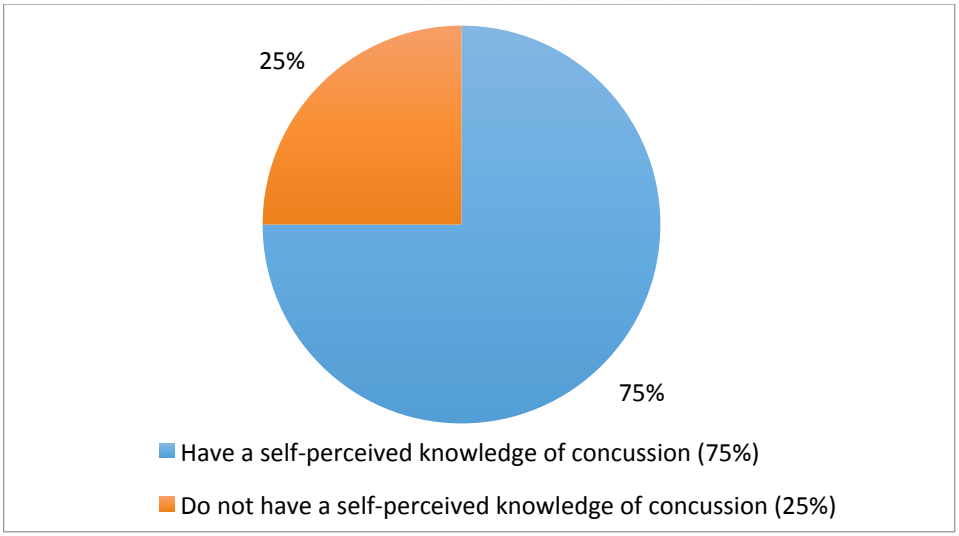


Figure 4.8: Self-perceived knowledge of symptoms of concussion for the total sample

4.4.2 Actual knowledge of symptoms of concussion

From the list of 22 symptoms of concussion as identified in the SCAT3 (McCroy et al., 2013), only 31% (n = 7) of the symptoms were recognised by more than 65% of the participants, indicating a very low level of awareness of these symptoms.

From the total population (N=221) the symptoms that were most commonly identified (response rate of above 65%) included *headache* at 97.3% (n=215)*, nausea and vomiting* at 90.5% (n=200)*, dizziness* 85.1% (n=188), *poor concentration* 71.9% (n=159*), poor memory* 71.5% (n=158), *poor balance* 69.7% (n=154), and *confusion* 68.3% (n=151). Symptoms that were least commonly identified (below 40% response rate) included feeling *"mentally slow"* 36.7% (n=81), *sleeping more than usual* 35.3% (n=78), *sleeping less than usual* 25.3% (n=56), *feeling like you're "in a fog"* 26.2% (n=58)*, difficulty falling asleep* 16.3% (n=36), *more emotional than usual* 19% (n=42), *irritable, sad or depressed* 17.2% (n=38) and *nervous or anxious* 11.8% (n=26) (Figure 4.9).

A statistically significant difference between the two groups (who suffered a concussion and those who did not) was only identified for one symptom namely *sensitivity to light.* Of those who had suffered a concussion, 69.6% recognised this as a symptom compared to 49% in the group who had not suffered a concussion before (p = 0.005).

The average level of recognition for all symptoms was 48.34% for all symptoms (which means all symptoms averages out get less than half recognition) which shows a poor recognition percentage for the total population of the symptoms of concussion. Showing that certain symptoms are better recognized than other symptoms.

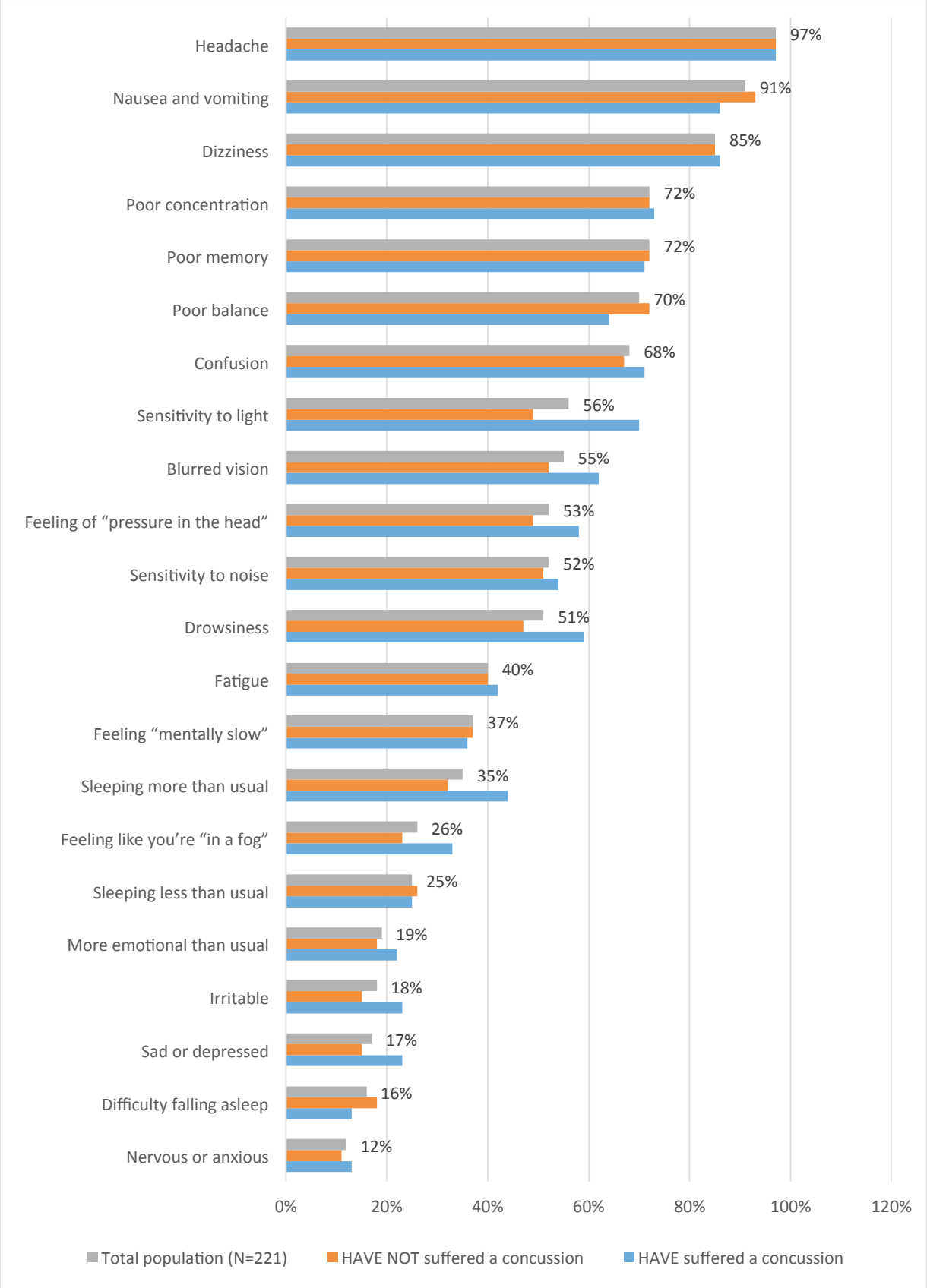


Figure 4.9: Frequency of identification of symptoms of concussion taken from the SCAT3

4.4.3 Knowledge of causes and components of concussion

Overall, participants who previously HAVE suffered a concussion had a similar grasp of- and recognition of the individual components that cause and define a concussion (47.21%) as those who HAVE NOT suffered a concussion before (49.9%). There was however a statistically significant (p = 0.001) difference of 19.7% between the groups for an individual cause namely "Indirect blow to the head".

The two components that were ***most*** commonly associated with a concussion (identified by more than 70% of the participants) were; 1) *direct blow to the head* with 80% (n=177) and 2) *loss of consciousness ("knocked out")* with a 78.3% (n=173) response rates respectively. The ***least*** commonly identified components amongst participants in this study (with a response rate of less than 30%) were 1) *indirect blow to the head* with 18.1% (n=40), 2) *trouble falling asleep* with 18.6% (n=41) and 3) *slight change in normal behaviour* with a 26.7% (n=59) response rate (Figure 4.10).

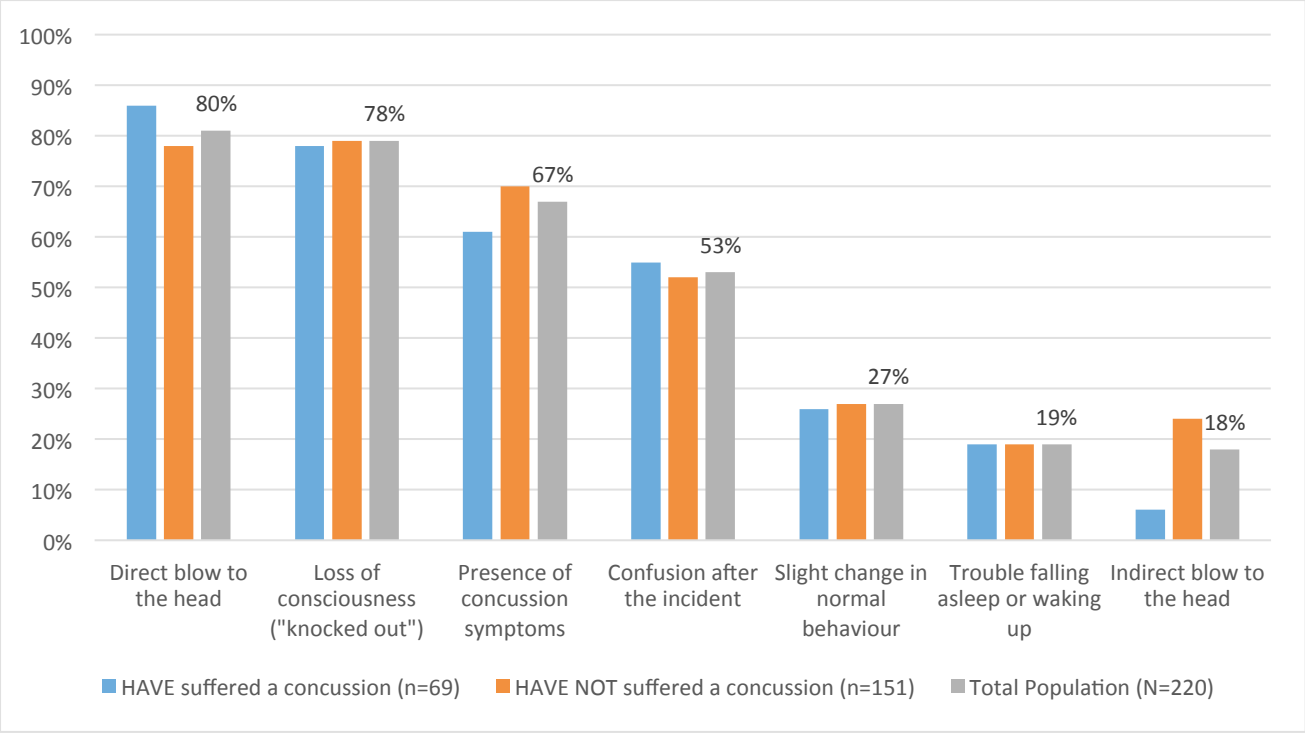


Figure 4.10: Self-perceived knowledge of causes and components of concussion

4.4.4 Knowledge of complications of concussion and help-seeking behaviour

Eighty percent (n=176) of the total population (N=221) indicated that there are long-term complications of concussion (Figure 4.11).

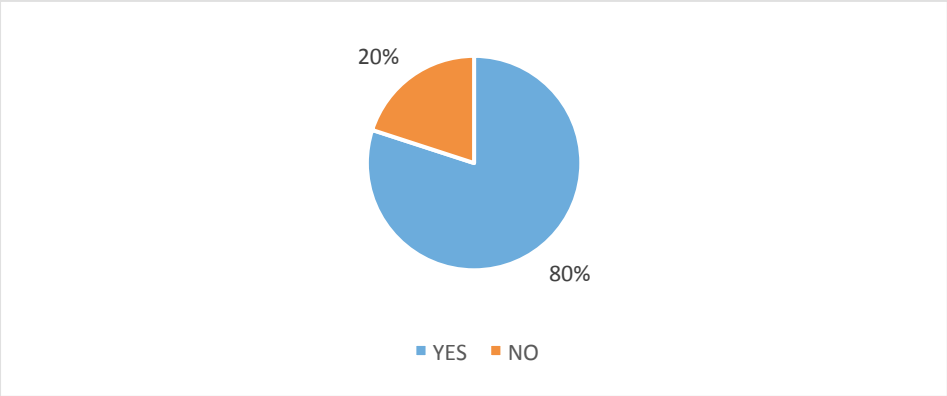


Figure 4.11: Long-term complications of having a concussion

Eighteen-point-one (18.1) percent (n=40) of the total respondents said they would carry on playing in a game if they suspected they had suffered a concussion. A statistical significant difference is noted between the groups (those who HAVE suffered a concussion and those who HAVE NOT suffered a concussion) with a Fischer's p value of 0.025 showing if you have suffered a concussion previously you are almost double as likely to carry on playing in the same game (Figure 4.12).

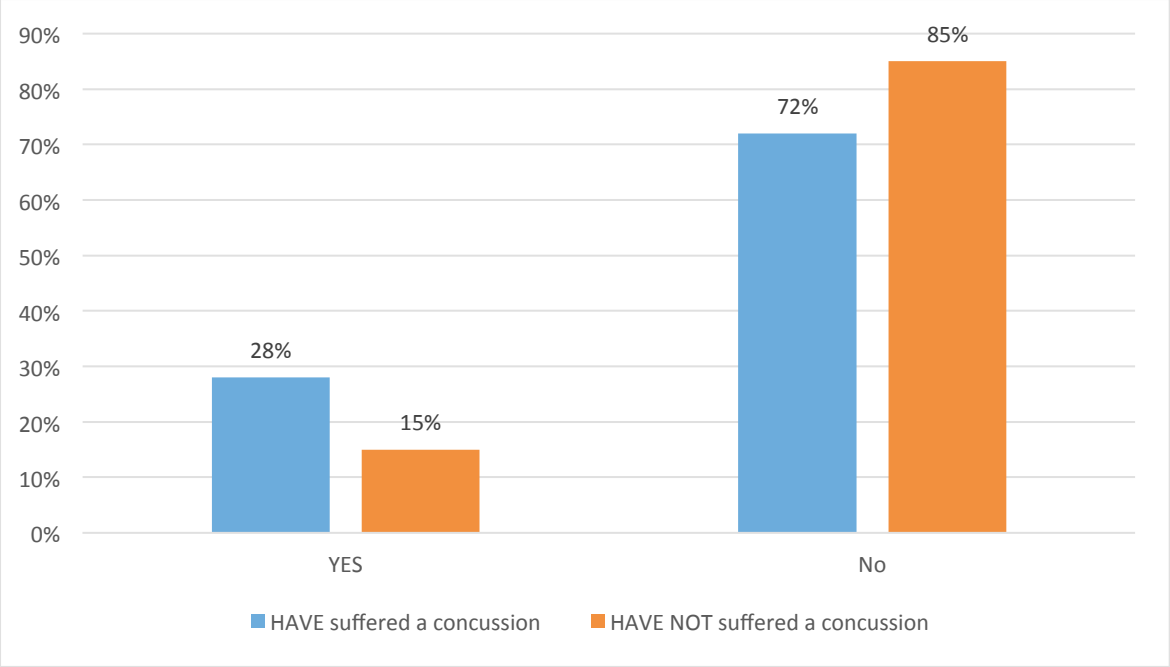


Figure 4.12: Participants' indication that they will continue playing in a game with a suspected concussion

The majority (89.5%; n=198) of the total population will seek help if they have a headache post game where they took a knock to the head. There is no significant difference noted between those who HAVE suffered a concussion and those who HAVE NOT suffered a concussion (Figure 4.13).

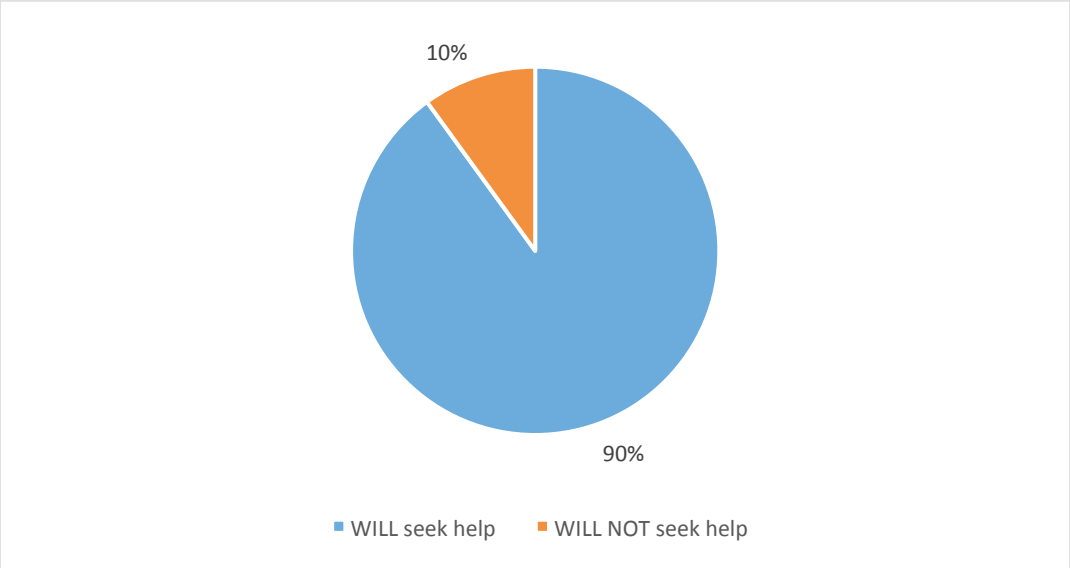


Figure 4.13: Help-seeking behaviour

Those who seek help would first approach either their parents or coaches before seeking help from the physio or doctor (Table 4.5).

Table 4.5: Person most likely to be told if the participant has suffered a concussion

	Total population	HAVE suffered a concussion	HAVE NOT suffered a concussion	Fischer's Exact Test
	N=221			p-value
Parent	Yes 54.3% (n=120)	47.8% (n=33)	57.2% (n=87)	0.244
Coach	Yes 50.2% (n=111)	53.6% (n=37)	48.7% (n=74)	0.562
Physio or Doctor	Yes 41.6% (n=92)	43.5% (n=30)	40.8% (n=62)	0.769
Other players	Yes 10.9% (n=24)	5.8% (n=4)	13.2% (n=20)	0.160

More than three-quarters of the total population (n=214) would be concerned enough to seek help a day or two after a knock to the head and were experiencing a headache whilst watching television or reading. (Figure 4.14).

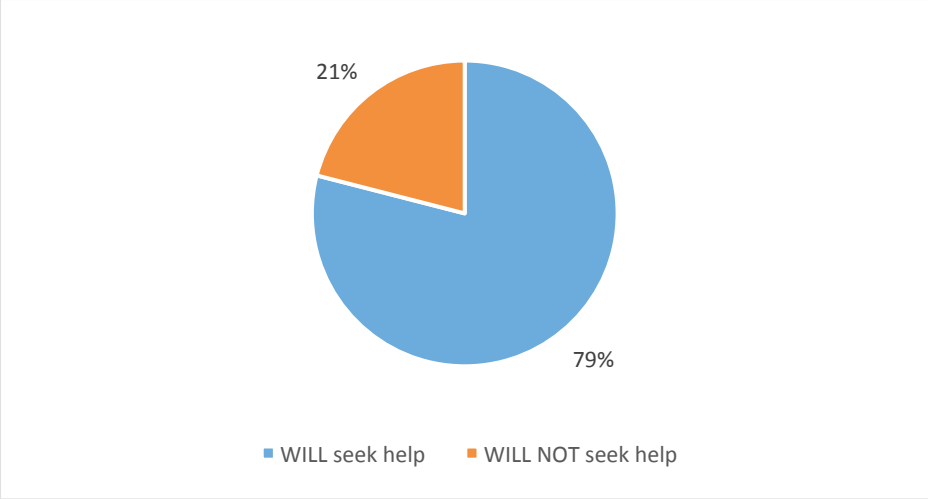


Figure 4.14: Help-seeking behaviour when experiencing delayed symptoms

The majority of both groups felt that they are *slightly confident* in identifying a concussion with no significant difference between those that HAVE suffered a concussion and those that HAVE NOT. It is noted that those who HAVE suffered a previous concussion have more of a self-perceived confidence in identifying a concussion above those who HAVE NOT suffered a concussion previously with a Fischer's exact test p value of 0.001 (Figure 4.15).

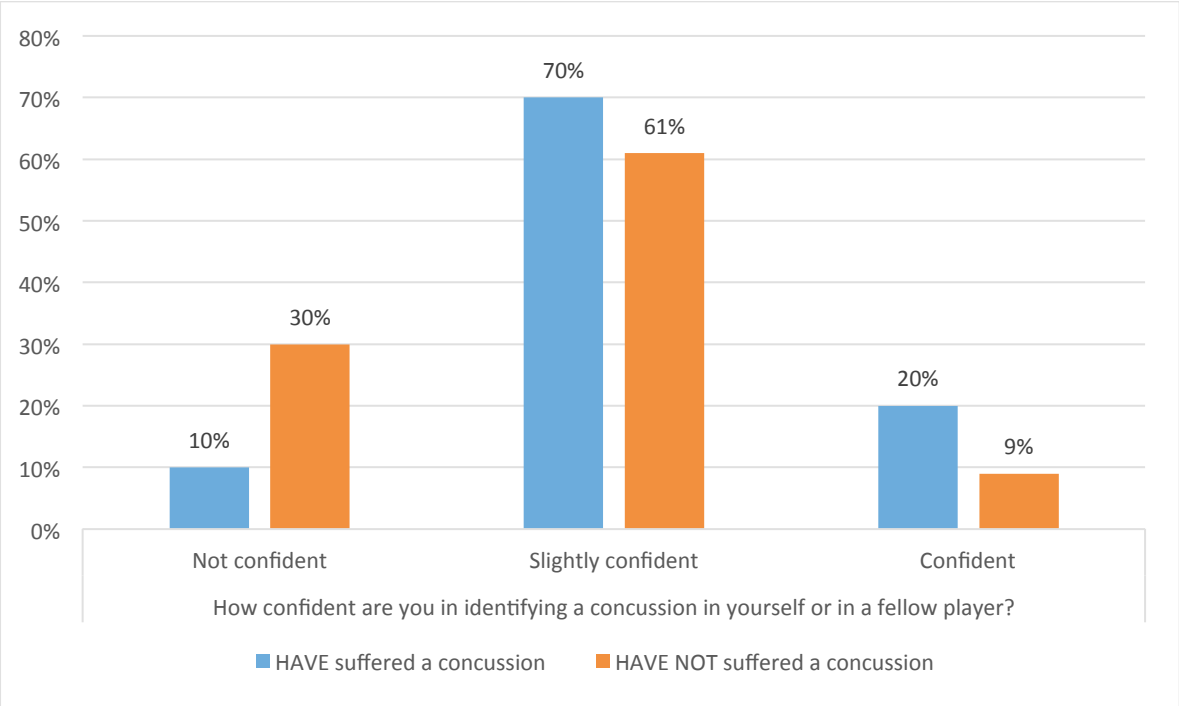


Figure 4.15: Confidence in identifying a concussion

The person who has the most influence on the players to carry on playing in a competitive game if they feel they have suffered a concussion is the coach and team physiotherapist. (Figure 4.16).

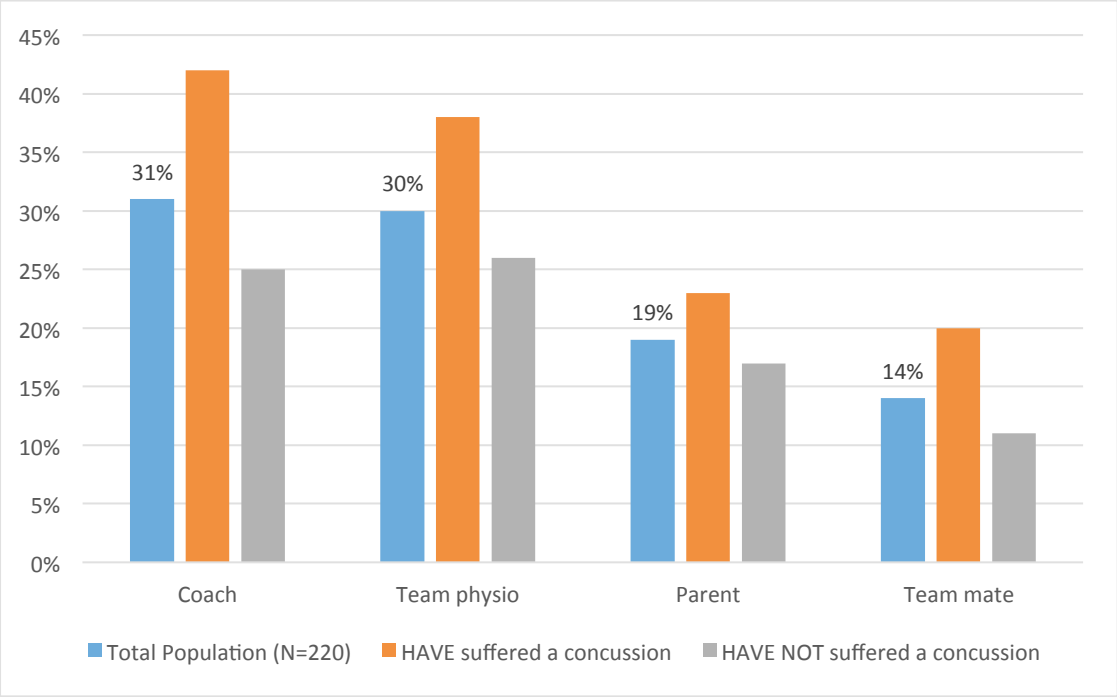


Figure 4.16: Person with most influence on a player to continue playing in a game

A player who is suffering symptoms of a concussion would inform the coach, parent and/or physio/doctor before playing a game or practice. Roughly 86%, of the total population (N=221), reported that they would inform at least one of those three if they feel they are concussed (Figure 4.17).

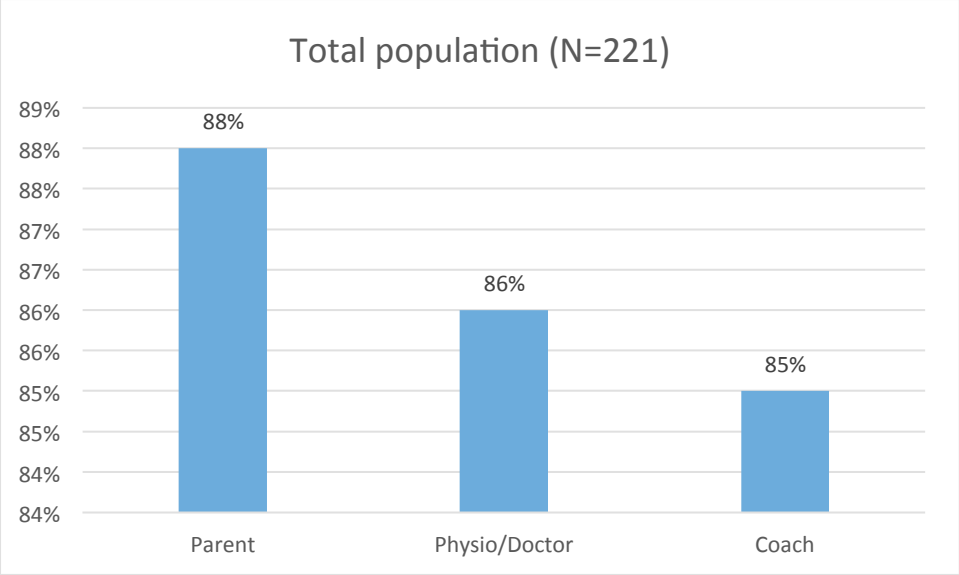


Figure 4.17: Person the player would inform regarding a suspected concussion

4.4.5 Source of knowledge on concussion

Most of the participants (69.2%; n=153) reported that they obtained their knowledge of concussion from the sport coaches. Thirty-eight (38) percent (n=84) of the participants obtained their knowledge of concussion from the medical professionals. It is noted that for those that have suffered a previous concussion, 60.9% (n=42) stated that their knowledge was obtained through a medical professional and for those that have not suffered a concussion injury previously only 28.3% (n=43) stated that knowledge of concussion was obtained through the medical professional which shows a statistically significant difference with a Fischer's p value of 0.000 (Table 4.6).

Table 4.6: Person responsible for participants' knowledge of concussion

	HAVE suffered a concussion				HAVE NOT suffered a concussion				Fischer's exact test
	n=69				n=152				p-value
	Yes		No		Yes		No		
	Count	%	Count	%	Count	%	Count	%	
Parent (n=71)	22	31.9%	47	68.1%	50	32.9%	102	67.1%	1.000
Sport coach (n=153)	50	72.5%	19	27.5%	104	68.4%	48	31.6%	0.636
Internet/books (n=94)	25	36.2%	44	63.8%	70	46.1%	82	53.9%	0.189
Teacher (n=14)	3	4.3%	66	95.7%	11	7.2%	141	92.8%	0.557
Medical professional n=84)	42	60.9%	27	39.1%	43	28.3%	109	71.7%	0.000
Other (n=38)	7	10.1%	62	89.9%	32	21.1%	120	78.9%	0.057

Figure 4.18 shows a graphical representation of the person responsible for the participants' knowledge of concussion. Figure 4.18 also shows the difference between the two groups (those who have suffered a concussion and those who have not suffered a concussion) with regards to where the participants' knowledge of concussion was obtained from (Figure 4.18).

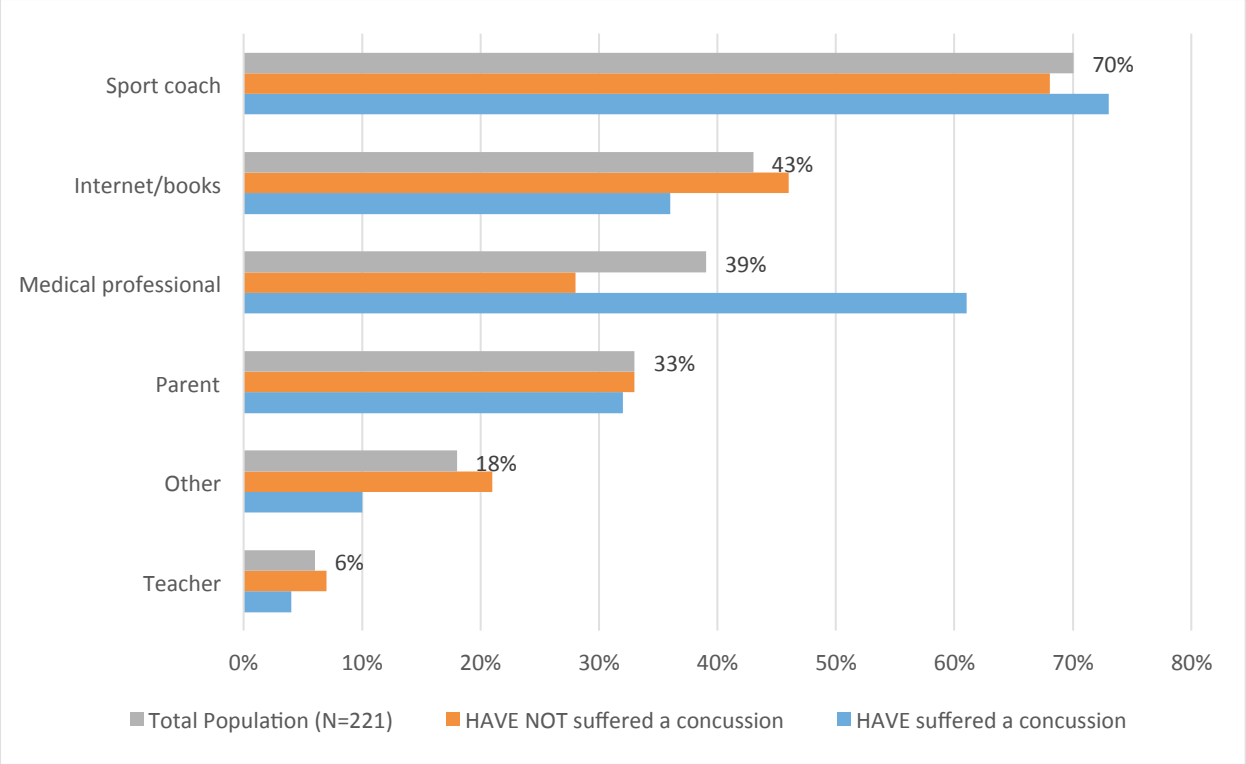


Figure 4.18: Person responsible for knowledge of concussion

4.5 Section D: Adherence to the return to play guidelines

When asked to identify the correct statements relating to safe return to play, the most commonly identified phrase by all participants was "*return to play after a period of rest"* with a response rate of 67.4% (n=149). This was followed by "*gradual return to sport activity once symptom free"* with a response rate of 48.2% of the total population (N=221). There was a statistically significant difference (p=0.030) in the frequency of responses to "*gradual return to sport activity once symptom free"* between those who HAVE suffered a concussion and those that HAVE NOT suffered a concussion previously indicating that those who HAVE suffered a concussion might be more aware of the guidelines (Figure 4.19).

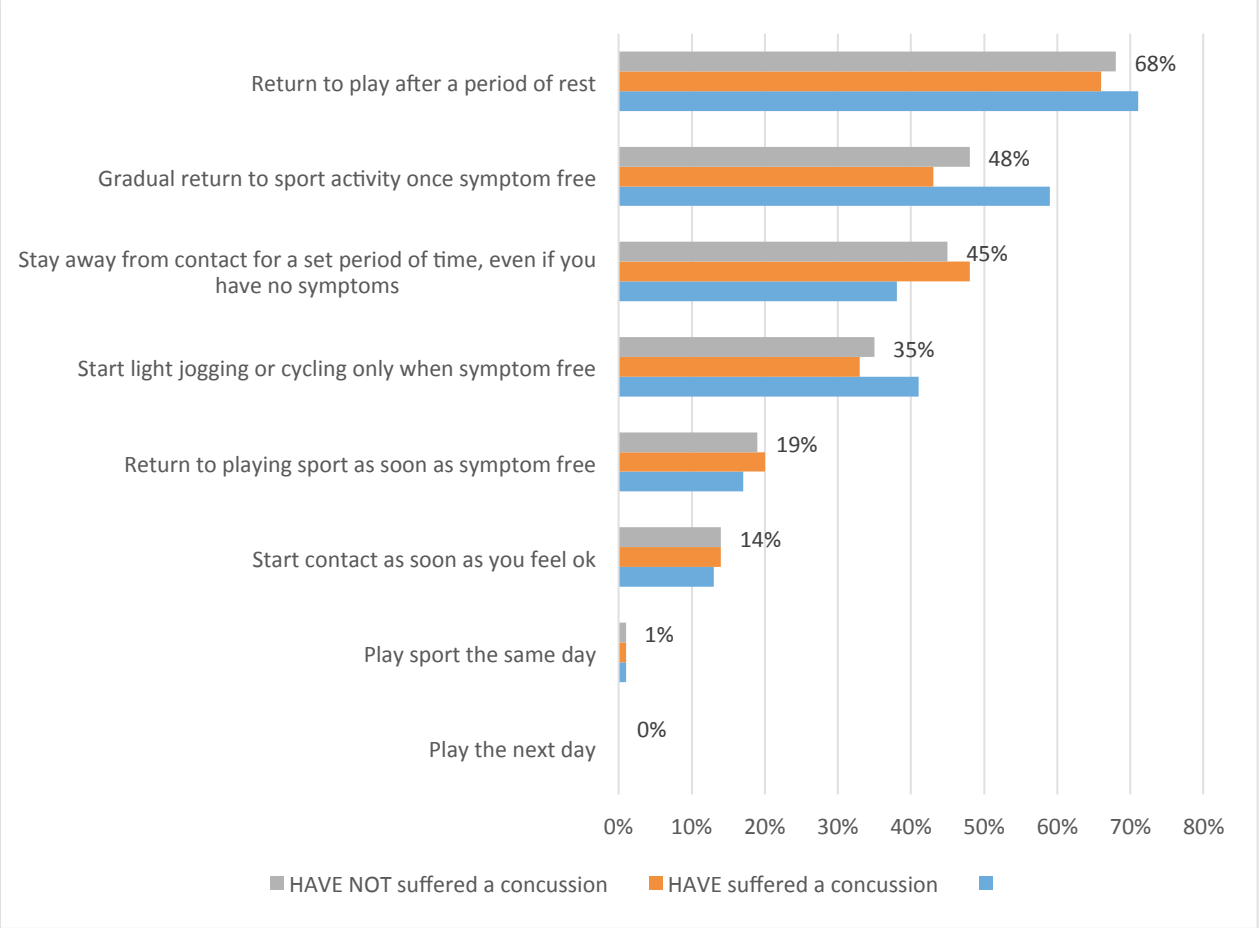


Figure 4.19: Self-perceived protocol for safe return to sport

According to the participants in this study (N=221) the person who should clear you before you play sport after a concussion is mainly the doctor at 70.5% and the sport doctor at 64.1% of the total population. The physiotherapist was mentioned by just more than half the total population. According to the majority (93%) of the total population the parent should not be responsible for clearing a player to return to sport with a very small percentage indicating that the parent is the most appropriate person to clear you to return to sport (Figure 4.20).

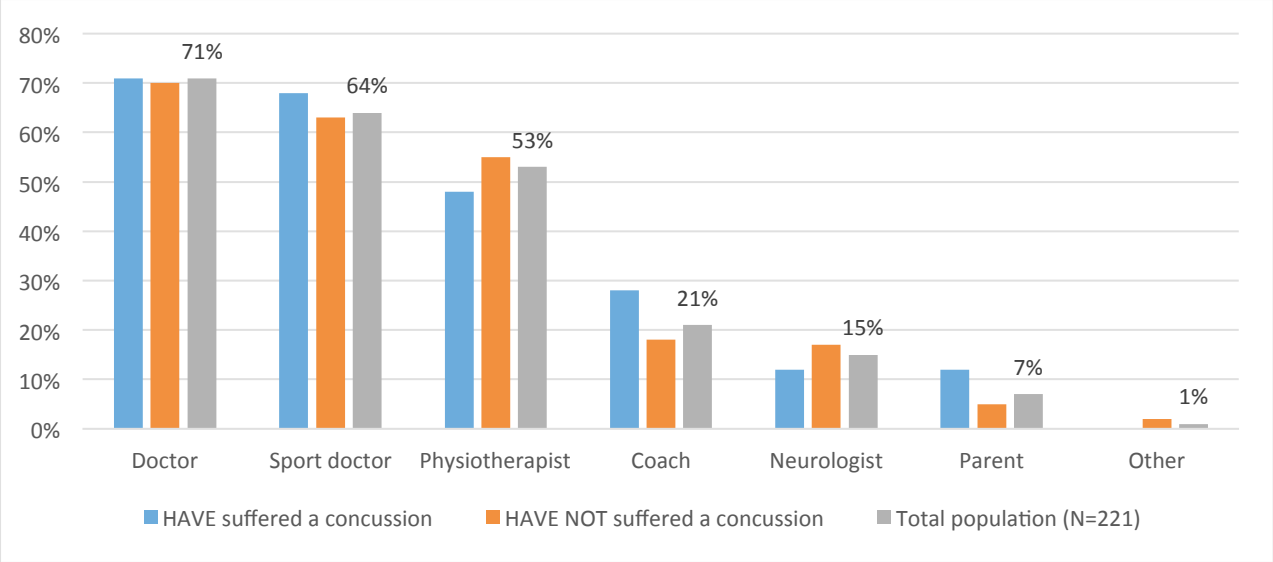


Figure 4.20: Participants' self-perceived knowledge of person who should clear you before returning to sport

CHAPTER FIVE: QUALITATIVE RESULTS

5.1 Introduction

This chapter presents the finding of the focus group discussions. The purpose of the FGDs were to explain the results of the quantitative survey in more depth and to explain why players who have sustained a concussion did not adhere to the return to play guidelines.

5.2 Emerging themes

From the three focus group discussions (FGDs) that were conducted subsequent to the quantitative phase two themes were identified namely: A) Self-diagnosis of concussion with inadequate knowledge, and B) Non- adherence to the return to play protocols.

5.2.1 Theme A: Self-diagnosis of concussion with inadequate knowledge

Participants in the focus group stated that they would report concussions to their parents, coaches or medics.

> FG1 P1 "*tell my parents how I feel and see what they say, maybe go to the doctor to get it checked.*"

They only reported these concussions if they felt that the injury was serious enough to warrant external help.

> FG2 P2 "*I had a delayed concussion, but I didn't know if it was a concussion and my mom didn't take me to any doctors or anything I just carried on playing.*"

When asked how they would make the decision if the suffered a concussion or not, they reported using Google to look up the symptoms of concussion.

FG3 P5 "*what a normal teenager would do is he would probably Google the concussion symptoms and then if he has any of them after getting the knock then he would probably know he is concussed."*

Another pupil mentioned that even though he was told by an external person that he had suffered a concussion injury he still continued to play.

FG2 P3 "*I went to Grant Khomo trials last year and got a knock and they told me I got a concussion I carried on playing that weekend and I didn't go to the doctor because I felt fine."*

One participant in the focus groups mentioned that he did not realise that concussion was so serious.

FG2 P2 *"I am surprised at the whole topic as I didn't know concussion was so serious to still have effects years later."*

5.2.2 Theme B: Non-adherence to the return to play protocols

The majority of the pupils who participated in the focus groups did not adhere to the return to play guidelines. Even though most of the participants agreed on the importance of being cleared by a medical professional before returning to play the majority of the participants either ignored the return to play protocols that are in place or skipped a few steps in the protocol.

FG3 P4 *"I somewhat do it depending on the extension of the injury if it's not that serious and they say maybe recovery time is less than a week or week maybe it's not that important to rest that week."*

FG3 P3 *"personally depends on how bad it is so for instance now I have a concussion from Saturday, but I feel like I could still play, personally I think I can go back maybe after resting on the weekend maybe two days..."*.

When exploring the underlying reasons for non-adherence to return to play protocols, three categories were identified namely; **a) peer pressure**, **b) intrinsic motivation and c) ignorance**.

a) Peer pressure

Some participants returned to sport earlier than supposed to because of feeling of peer pressure or the team was under pressure.

FG1 P2 "*I remember it was a process like four weeks or something I returned like a little bit earlier I think it was to the fact that maybe it was just like pressure on the team or peer pressure or something like that."*

FG3 P1 "I think maybe sometimes it could be your teammate as I was saying that they need you this weekend or something in that regard ..."

b) Intrinsic motivation

The majority of students in the focus groups mentioned that intrinsic factors contribute to them not wanting to report concussions or not follow the correct return to play protocols. These include not wanting to let down the team, not wanting to get dropped a team (especially if they have worked hard to get into that team), passion for the sport and school, what grade you are in, the team you play for or how late it is in the season.

FG3 P4 *"I wanted to play as quick as possible."*

FG3 P2 *"I wanted to play, I needed to play."*

FG3 P6 "*for me in terms of our last year of high school whether it being your last two or three games um you kind of want to finish off those last two games as you are leaving high school so for me that would stop me, obviously depending on my symptoms and if I was severely concussed."*

FG3 P1 *"I think knowing that if you get concussed you will probably get dropped a team and for matrics your last year it is a hard thing if it is late in the season and you got to come back."*

FG2 P4 *"...when you love rugby you don't want to just not play you know what I mean like if you get told you have a concussion then you know you out for about a month and a lot of people don't want that to not play for their school*."

Some of the participants mentioned that they would try and hide a concussion from a coach or parent because they worried about not being able to participate.

FG1 P1 "*also the same sir I don't want to its more myself trying to, my parents and coaches know if you injured they won't let you play, it's more like me telling myself not to go off now."*

FG2 P1 "*also at the time you take your hit you might think you concussed you think you can hide the symptoms and all of that, so you can just carry on playing..."*

c) Ignorance

Most participants knew and felt that it was important to be cleared by a medical professional before returning to play after suffering a concussion. This was evident when asked if they feel it is important to be cleared by a medical professional before returning to sport.

FG2 P5 "*yes because if you take another knock without being ready to go play again it can be really bad. I have heard stories of people who can't play rugby again."*

FG3 P5 "*yes, it is important because at the end of the day it is your life on the line and I would rather be safe than die on the field."*

However, this protocol is not being followed by some of the participants who suffer concussions.

FG3 P2 *"I don't besides, understanding what I am supposed to do or what is happening I still feel that the need to play is more than the need to be safe for me."*

CHAPTER SIX: DISCUSSION

6.1 Introduction

This chapter reflects on the main findings that were obtained through the quantitative data and the qualitative data regarding knowledge of concussion and the adherence to the return to play protocols that have been put in place. The chapter focuses on the participants' biographical data, point prevalence of concussion, knowledge of concussion, and the adherence to return to play protocols. The findings are compared to the literature and recommendations are also discussed regarding the implications for the participants.

6.2 Biographical data

The majority (60%) of participants in this study played rugby as opposed to hockey. This finding is in line with the national trend where rugby is more popular than hockey. Rugby is a very popular sport in South Africa and according to World Rugby (2017), South Africa has a total of 405,438 registered rugby players who play rugby union in all ages from school (junior and high), club and professional levels. The fact that rugby in South Africa has the second highest number of registered players in the world indicates that rugby is a very popular sport in South Africa. This is the second highest in the world second only to France who have 542,242 registered rugby players (World Rugby, 2017). While there is no data for the number of registered hockey players in South Africa, hockey is slowly increasing in popularity as well. Due to rugby being more popular, more people then play the sport at a school level. Ideally educational efforts should be aimed at all sports, but rugby should be targeted first as more players are involved and at higher risk for sustaining a concussion.

6.3 Point prevalence of concussion

In this study the point prevalence of concussion for the total sample of rugby and hockey players was 31.4% (n=69) of the participants. Of those who were concussed (N=69), the majority (73%) of participants sustained a concussion whilst playing rugby as opposed to the 23% (n=18) who suffered a concussion while playing hockey. The overall prevalence of concussion in this study is comparable with a similar study on school-going American football players which reported a prevalence of 30% (McCrea et al., 2004). This is also similar to a study in a South African context where the prevalence ranged from 13-38% for school-going pupils in provincial rugby tournaments (Brown et al., 2012) and slightly above the prevalence of the 20% in the 1999 international super rugby season (Holtzhausen et al., 2002). A possible reason for the high reported prevalence of concussion in the current study can be because this study focused on overall concussion prevalence over the players' playing careers, which could be higher than the prevalence of a single season or week-long tournaments which was reported on in similar studies.

In a long-term study which focused on women's field hockey from 1989-2003, concussions accounted for 9.4% of all game injuries (Dick, et al., 2007). This reported prevalence is significantly lower than the 27% reported in this study. Gender does seem to have an influence on concussion with regard to sports that are played by males and females. Research has found that girls have twice the rate of concussion for same sports that boys play (Lincoln et al., 2007; Gessel et al., 2007). Even though the prevalence of concussion in hockey is much lower than rugby it is still the most common injury that occurs in the sport. In the long-term study which focused on injuries in women's field hockey concussion became the most common injury in the later stages of the study (Dick, et al., 2007). This could be due to the awareness of the injury improving and therefore reporting of concussion improved.

The relatively high prevalence of concussion amongst secondary school rugby and hockey players in this study is a concern when considering that they will potentially continue playing rugby and hockey after school and at the club rugby level where the injury protocol is not as strict. The high prevalence on concussion in rugby when compared to hockey can be attributed to the nature of the sport where rugby involves more direct contact than hockey.

A lot of emphasis has been put on trying to decrease the risk of concussions in rugby with rules changes and being a lot stricter with dangerous play or tackles to the head. The referees are also educated on concussion and have the power to send a player off the field if they feel they have suffered a concussion. Protective gear for rugby include scrum caps and mouth guards which have been found to not reduce risk of concussion and mainly help with superficial injuries (cuts to the ears and head and protecting of dental injuries) (McCrory, 2001; Dunham, 2013). Due to most hockey concussions coming from head on equipment, hockey changed the rules where the ball may not be lifted from the ground unless it is deemed a flick shot. This rule change protects players from getting struck with the ball in the head or any other part of the body when the ball is going at a high velocity. The researchers could look at the prevalence of hockey concussions or focus mainly on hockey players. More long-term research needs to take place with regard to concussion incidence across South African school sports.

6.3.1 Total amount of concussions per player

In this study, 49 rugby players sustained concussions totalling 85 concussions with an average of 1.73 concussions per player. The maximum number of concussions suffered was five. Eighteen hockey players sustained concussions with an average of 1.28 concussions per hockey player. For hockey players the maximum number of concussions sustained was three. Rugby players suffered more multiple concussions with 43% of the rugby players suffering

more than one concussion and two people suffering a total of five concussions. Fourteen out of eighteen hockey players suffered only a single concussion with one person sustaining three concussions. This is similar to that of an Irish study which investigates the self-reported incidence of concussion in professional rugby players in Ireland with 44.9% of the participants reported suffering a concussion with 32.3% of them sustaining more than one concussion with four being the most in one season of rugby. The average number of concussions for this Irish study was 1.42 concussions per rugby player who suffered a concussion in the rugby season 2010-2011(Fraas, Coughlan, Hart, & McCarthy, 2014). Another study identified that between three South African schools the average of self-reported concussions was 2.3 ranging from 0-7 for rugby players and only 0.4, range from 0-1, for a hockey player (Shuttleworth-Edwards et al., 2008). This current study focused on total concussions throughout the players playing career and this could be why the average number of concussions is higher for both sports as those studies focused on specific seasons or a specific period of time.

If you suffer a second concussion the force that is needed to produce a concussive blow decline for every concussion that is received and takes longer to heal per concussion. You are four times more likely to suffer a second concussion after you have suffered one (McBride, 2012). Players who then suffer a concussion are more likely to suffer a second concussion, increasing the odds for re-injury. A second concussion that occurs before the brain heals properly from the initial concussion could slow recovery or increase the likelihood of having long-term problems. Permanent brain damage, brain swelling, or death is possible with repeated concussions (Centers for Disease Control and Prevention, 2007; Centers for Disease Control and Prevention, 1997). Players, coaches, parents and medical staff then need to be more aware of this risk and ensure players are fully recovered from their first concussion before they return to sport. If a player does sustain a second concussion, then they need to be

made aware that it may take longer to heal than the first concussion and that the protocol in place is a generalised protocol for a single concussion. Proper concussion history needs to be taken into consideration by sport doctors or medical professionals when players present with multiple concussions. Coaches, parents and the players of both rugby and hockey need to be educated on the risk of second impact syndrome and the chances of second concussions after a first one. As concussion is one of the most common injuries in rugby and hockey education needs to be directed to the players, coaches and parents to ensure adherence and proper reporting of injury. Research in this regard can be directed at second or third concussion protocols to ensure that players are getting proper recovery times post second or third concussions. Development of an application that can be used by all health care professionals to monitor player concussions and return to play protocols and previous concussion history can be a useful tool to address this challenge.

6.3.2 Time of last concussion

The medical professionals (sport doctor, GP (house doctor) or physiotherapist) were responsible for 61% of all concussion diagnoses. A study reported that when Irish professional rugby players sustained concussions the person they mostly reported the concussions to, was the physiotherapist or the team doctor at 32.1% for both (Fraas, Coughlan, Hart, & McCarthy, 2014). Another study suggested that participants diagnosed their own concussions based on knowledge gained through their personal experience or experience that they have seen from a friend or team mate (Chrisman, Quitiquit, & Rivara, 2013). Thirty-nine percent of the participants in the study conducted by Chrisman, Quitiquit and Rivara (2013) were then diagnosed by non-medical professionals which could result in less reporting of concussions because the non-medical professionals could not know the symptoms or signs of concussions or know the wrong information and then could say a

player is not concussed when they actually are concussed therefore bringing the prevalence down. The coaches' poor knowledge of concussion could lead to players playing rugby or hockey with possible concussion injuries and risking further brain damage or death. Post-concussion red flags could be missed due to ill-informed coaches giving wrong or not complete information to players who have suffered a concussion. Sending someone home without the proper advice could be seriously harmful and could lead to death. Therefore, more concussion education needs to happen to the players, coaches and parents so they can be well informed of all possible dangers of concussion to hockey and rugby players so that if a player informs a parent or coach then they know very well about the signs and symptoms and can advise accordingly. Focus needs to be placed on educating them on who the correct person is to report concussions to.

6.4 Knowledge of concussion symptoms

6.4.1 Self-perceived knowledge of concussion

In this study 79% of the total population felt that they know what the symptoms of concussion are. There was however a substantial difference in the perceived knowledge of concussion symptoms and the actual knowledge of symptoms which will be discussed in the following section. Furthermore, there was a statistically significant difference between those who have suffered a concussion and those who have not suffered a concussion. Those that have suffered a concussion felt that they knew what the symptoms of a concussion are more than those who have not suffered a concussion. Self-perceived knowledge of concussion has not been studied according to my knowledge. I feel that those who have suffered previous concussions have gone through the ordeal before and might think that because they have gone through it once that they know the symptoms. They could be looking back on experience of suffering their concussion and using that as reference point to for their knowledge. Also, knowledge is obtained through the medical professionals who help the concussed players and

therefore because they have been formally educated by medical professionals they might feel they know the symptoms better. The fact that because they have been formally educated does not mean they know the symptoms better than those who have not suffered a concussion, as is clear in the following sections.

6.4.2 Knowledge of symptoms of concussion

In the survey a total of 22 correct symptoms of concussion were given to the participants and they were asked to identify the symptoms that was a result of a concussion. Only 43% of all the participants could correctly identify all 22 symptoms of concussion. More than half of the participants did not recognise all the symptoms. The top five symptoms that were most commonly identified (a 70% or above identification rate) were headache (97% response rate), nausea and vomiting (91% response rate), dizziness (with an 85% response rate), poor concentration and poor memory both with a 72% response rate and poor balance with a 70% response rate. The five symptoms that were least commonly identified were nervous or anxious with a 12% response rate, difficulty falling asleep with 16%, sad or depressed with 17%, irritable with 18% and more emotional than usual with 19%. The findings in this study are similar to an American study which focused on American football players in high school (Cournoyer & Tripp, 2014). In this American study headache, dizziness and balance problems scored above 90%, poor memory and difficulty concentrating scored 80% and 68% respectively; however, nausea and vomiting scored only 52% in this particular study (Cournoyer & Tripp, 2014). Irritability, nervous or anxious, being more emotional, trouble falling asleep and behaviour or personality change were the five lowest scoring symptoms in the American study (Cournoyer & Tripp, 2014).

In another Canadian study headache and dizziness were the highest identifiable symptoms for the study from a range of ages from 10 years old up to the open age group (Cusimano,

Chipman, Volpe, & Donnelly, 2009). The difference in South Africa can be attributed to the fact that a lot of emphasis has been placed on nausea and vomiting as a symptom of concussion rather than that of dehydration or overeating before competition which is what one study suggests (McLeod, Schwartz, & Bay. 2007). The current study was on based at one school and this can only be generalisable to one population this could have caused the differences between my findings and those of the other studies. The symptoms of concussion that are poorly identified as being a symptom of concussion needs to be focused on in educational interventions or training instead of the symptoms that are highly identifiable with concussion. We, however, cannot dismiss the symptoms with high identifications as some athletes may not know them. All symptoms of concussion must therefore be presented to athletes with special emphasis on the poorly identified symptoms. Future research then needs to take place across the whole county in order to make the findings generalisable and to properly identify the symptoms that are not associated with concussion as much. If symptoms are being missed, then players who have concussions but are not experiencing the most common symptoms are not identifying their injury as concussion and concussions are then going unreported. The non-reporting of concussions could lead to under-reporting of concussion and therefore the prevalence number that has been found is in fact wrong and the prevalence number should be actually higher.

The results showed that both groups identified the symptoms similarly and that the symptoms that were identified as high for one group was also high for the other group and if a symptom had a low response rate for one group it had a low response rate for the other group. Therefore, those who have suffered a concussion and those who have not suffered a concussion showed no difference in their knowledge of concussion. A few studies have found that those with prior experience or experience of having a concussion identified concussion symptoms better than those who did not suffer a concussion (Bagley et al., 2012; Cook et al.,

2009). When identifying concussion symptoms those who have suffered a concussion and those who have not suffered a concussion showed no difference besides for one, even though there was a statistically significant difference in their self-perceived knowledge of concussion symptoms. The findings based in this study are then different to those in the literature which could be attributed to the differences in how the studies were conducted or that those that have suffered a concussion have not been educated properly. If players are not understanding the information given to them by the educators, then educators may need to change the way that concussion is being taught. The format in which the information is being provided can be adapted in order to make it more interesting and understandable.

Only one symptom (sensitivity to light) had a statistically significant difference where those who sustained a previous concussion accurately identified it 70% of the time and those who have not suffered a concussion mentioned this only 49% of the time. This symptom fell in-between a high and low response rate overall and even though it had a significant difference it still had a poor response rate in total with a 56% response rate. The difference could have come from the medical professional informing those who have had a concussion regarding this specific symptom. The difference could have also been a coincidence and found that 70% of those who suffered a concussion experienced sensitivity to light as a symptom and therefore knew from past experience.

6.4.3 Confidence in identifying a concussion

Players who have suffered a concussion previously feel that they are more confident in identifying a concussion in themselves or in others with 20% indicating that they are confident and only 9% of those who have not suffered a concussion indicated being confident in identifying a concussion. Around 60% for both groups mentioned that they are slightly confident in identifying a concussion. One study which focused on reporting of concussions

to the coach or medical personnel found that 22.3% of the participants were confident in identifying a concussion under various challenging conditions (Kroshus, Baugh, Daneshvar, & Viswanath, 2014). This is similar to our study which had a 20% confidence rate in identifying a concussion. The majority of the respondents in the current study mentioned that they were slightly confident in identifying a concussion which could be interpreted as having a basic understanding of concussion and that the participants felt that they could potentially identify a few symptoms. The implications of this can be that if they feel they are confident in identifying a concussion they should know what the symptoms are and therefore be able to make an informed decision based on this. The participants will be able to identify concussion in other team members and potentially report these to the coaches or team physiotherapists. Those that are slightly confident might miss some symptoms and put themselves at risk for further injury.

6.4.4 Where knowledge of concussion was obtained from

Most of the participants (70%) in the current study mentioned that their knowledge of concussion was obtained through the sport coaches. This is important to note, because if sport coaches are giving the wrong information to players then the players could potentially be at risk. It could also potentially highlight the importance of targeting sports coaches for educational interventions. In a study in America, a third of all coaches with more than 10 years of coaching experience reported learning something new regarding concussion (Sarmiento, Mitchko, Klein, & Wong, 2010). Sport rugby coaches in South Africa are required to do a BokSmart course which has a section regarding concussion in the six-hour video teaching course. This training has a big emphasis on concussion and educating coaches and officials. Sport coaches in future, all sports not just rugby, should be more educated and more emphasis placed on the topic concussion and the return to play protocols and some research could focus on sport coaches' knowledge of concussion, in all sports, and return to

play guidelines in a South African context. The BokSmart course can also be adapted for players to emphasise the importance of concussion and the possible complications of concussion.

6.4.5 Knowledge of causes of concussion

When asked what causes a concussion, a direct blow to the head and loss of consciousness ("knocked out") were the two most common phrases that were chosen from the list provided with a positive identification rate of 81% and 79% respectively. Sullivan et al., (2006) found that many players thought that one had to be "knocked out" to sustain a concussion. The least most common phrases were indirect blow to the head (18%) and trouble falling asleep or waking up (19%). This shows us that participants do not associate knocks that are not direct to the head or knocks that does not cause you to be "knocked out" as serious enough to cause a concussion. In a Canadian study they found that 63% of atom players (10 years old) and 26% of bantam players (14 years old) did not know how a concussion was sustained or mentioned that in order for a player to be considered concussed he had to lose consciousness (Cusimano, Chipman, Volpe, & Donnelly, 2009).

This has implications because when a player receives a blow which is not direct to the head and if the player does not know that an indirect knock to the head can cause a concussion the player might not think it is a concussion and could possibly continue playing or not report the injury to the relevant personnel. It is also evident from the symptoms of concussion and the causes of a concussion that the most common symptoms and cause of symptoms that are highly associated with a concussion are the symptoms and causes that seem to have a more direct/obvious effect on the person. For instance, a direct blow to the head and loss of consciousness have a high response rate, however, slight change in normal behaviour and trouble falling asleep or waking up have relatively low response rates.

The same for the symptoms where nervous or anxious, difficulty falling asleep and sad or depressed have low response rates and headaches, nausea or vomiting and dizziness have high response rates. Someone who is concussed would notice a headache or dizziness quicker or easier compared to feeling nervous or anxious. Players then will not identify knocks to the rest of the body as concussion causing and then think that it is not a concussion and not treat it as such. If the participants do not know what can and cannot cause concussion, then this can affect the way in which they report concussions. Education needs to be put on the cause of concussion and not just the symptoms of concussion.

6.4.6 Knowledge of long-term complications of concussion

Eighty percent of the total population in this study knew that there are long-term complications of concussion. This finding is similar to a qualitative report which stated that most of the participants mentioned long-term complications of concussion which included permanent disability and death from a concussion (Chrisman, Quitiquit, & Rivara, 2013). This then leaves 20% of the total population in the current study who do not think there are long-term complications to sustaining a concussion injury. If participants do not believe that there are any complications associated with a concussion, they could potentially continue playing whilst having a concussion as the player might not think that their injury is serious enough to stop playing. As current education protocols have mainly focused on symptom identification and protocols for reporting of concussions (Cook, et al. 2003; Bagley, et al. 2012; Echlin, et al. 2010).

If education is focusing primarily on symptom identification and reporting of concussions, then there will be a gap in knowledge of long-term complications of concussion. The participants were asked if they know if there are long-term complications of concussions and were not asked to identify the complications. Participants were then not asked regarding their

knowledge and only if they have heard of long-term complications of concussion. If a player knows that not reporting a concussion can cause complications later, they might be more inclined to report concussions. All players need to be made of aware of the complications of concussions and the education needs to place focus on this aspect of concussion.

6.5 Adherence to graded return to play protocols

6.5.1 Compliance of return to play protocols

In this study the knowledge of return to play protocols as well as adherence thereto were poor. In the knowledge of concussion section only 48% of the total population mentioned that a gradual return to sports activity once symptom free is required for a safe return to play after suffering a concussion. From those who suffered a concussion 30.4% of them had a graded return to play protocol for treatment of their concussion and a quarter of those also rested for less than 10 days before going back to play sport. This shows poor adherence to the protocols that are in place. This is similar to a study that examined high school rugby players' concussions and out of the 62% of athletes that suffered a concussion 20% did not report their concussions (Sye, Sullivan, & McCroy, 2006). Five percent of those who suffered a concussion mentioned resting between 10-21 days as treatment, which falls in the minimum amount of days of 19 days post injury.

In an Irish professional rugby team, a player who self-reported sustaining four concussions did not report any of his suspected concussions and had symptoms lasting from one to five days and did not slow down his sporting commitments at all (Fraas, Coughlan, Hart, & McCarthy, 2014). We do not know if this player knew the long-term risks of a concussion but possibly if he knew about the seriousness of the long-term complications possibly he would have either reported the concussions or stopped playing. Educating players not just on concussion symptoms but also on the long-term complications can possibly help to try and reduce the under reporting of concussions. Less than half of the participants chose gradual return to sport activity once symptom free. This is concerning as from the 4th conference of concussion summit in Zurich, the panel of professionals in the field of concussion came up with a graded return to play protocol. This protocol has a minimum length of one week with a six-step protocol and a 24-hour gap between each step totalling- and including day of injury,

seven days minimum. This is the minimum standard if asymptomatic following each step and can only start once a player is asymptomatic (McCroy, Meeuwisse, Aubry, et al., 2013). However, 68% of the total population did mention return to play after a period of rest. This is hard to interpret as rest could mean something different to each player. This could be two days or could be upward of three weeks. This in future could be changed to 10-18 days to see if a player is following the mandated amount of days of sport post-concussion injury. Participants were aware that they should rest after a concussion but did not seem to know that there is a specific protocol that needs to be followed. According to BokSmart, a South African initiative that aims to provide coaches, referees, players and administrators with the correct knowledge, skills and leadership abilities to make sure that safety and best practice principles are incorporated into all aspects of contact rugby in South Africa (Coaches And Referees, 2012), and World Rugby.

The minimum time that a player under the age of eighteen must rest is nineteen days, which includes the six-step graded return to play protocol (World Rugby Concussion Management, 2017). So, for players to say rest this needs to be more than nineteen days, minimum, from date of injury. Players who rest anything less than the minimum amount of days and then go back and play sport, put themselves in danger for second impact syndrome and even death. The return to play protocols need to be educated in a way that highlights the risks of playing sport without allowing the first concussion to heal properly. The education needs to be relevant to the sport and the age group. Players need to be told that even though they feel fine they must follow the graded return to play protocols. In the qualitative data a participant mentioned not following the graded return to play by saying “I went to the Grant Khomo trials last year and got a knock and they told me I got a concussion I carried on playing that weekend and I didn’t go to the doctor because I felt fine”. This statement shows either poor knowledge of the risks or failure to follow the protocols if he knew the protocol.

6.5.2 Reasons for not adhering to return to play protocols

6.5.2.1 Not thinking injury is serious enough

Some explanation became clear from qualitative data as to why the participants do not adhere to the graded return to play guidelines. These explanations or themes included not thinking that the injury is that serious. FG3 P4 *"I somewhat do it depending on the extension of the injury if it's not that serious and they say maybe recovery time is less than a week or week maybe it's not that important to rest that week."*. Not thinking it is that important or serious enough to be a concussion is similar to studies which also mention that non-reporting of concussions is due to the participants not thinking the injury is a concussion injury (Fraas, Coughlan, Hart, & McCarthy, 2014). If players think that their injuries are not serious enough players can then risk playing with possible concussions and risk the complications of getting a second concussion in short space.

Some participants will take concussion seriously only when they think the concussion is serious enough from experience as one participant mentioned that: *"the first time I got concussed it wasn't that bad it was in grade 9 and it wasn't like bad I was only out for three weeks or two weeks and but it literally wasn't that bad but I didn't take it seriously because of that and then the second time I got concussed it was really bad and I had to stay in hospital overnight so that made me take it more seriously kind of, but yeah just made realise how serious it can be"*. Experience then has an impact on how serious a concussion is to the participants, if they have a bad experience and need to be hospitalized they will think that future concussions need to be taken more seriously even if not as bad as first concussion. If player do not think that all concussions are serious and do not follow the graded return to play they then put themselves at risk for possible complications.

6.5.2.2 Not wanting to be excluded from the game

Self-reporting of concussions is very important for concussion management and what is stopping players from reporting concussions is that players do not want to be excluded from games or the team. One participant in the focus group discussion mentioned *"the fear of not being able to play the next week if you do have a concussion and you can't play the next week would make you not want to go make sure you that you ok."*. Another also mentioned *"well if you know you concussed the only thing that might stop you from reporting it (concussion) is that you know you won't be allowed to play so for me it's the only thing I can think of right now"*.

These statements are similar to those of a study which found that forty percent of a study participants mentioned that not wanting to be pulled out of the game was a contributing factor to not wanting to report a concussion (Fraas, Coughlan, Hart, & McCarthy, 2014). Another study suggests that almost 30% of the participants are worried about losing their spot in the team as a contributing factor to non-reporting of concussions and 20% mentioned that they will be held out of upcoming games even if it is not a concussion (if they reported concussion) (Kroshus, Baugh, Daneshvar, & Viswanath, 2014).

This is supported by another study which suggests that boys have a lower reported prevalence rate for concussion due to the fear of not being allowed to play (Laker, 2011). Not wanting to be excluded from the game is one that the coach/medical professionals cannot control as this is the players personal feelings. It is hard to try and convince a player to not play if they feel they are good enough to carry on. That is why we need to focus on the risks of playing with a concussion. We need to ensure that all players of all sports are advised of the detrimental risks they are placing on themselves should they take another concussive knock. If players knew the severe risks in detail rather than just a quick sentence on the subject, they would make more informed decisions regarding playing or not.

6.5.2.3 Not wanting to let the team down

Participants do not want to let their team down when it comes to non-adherence or non-reporting of concussions. One participant mentioned that "*I remember it was a process like four weeks or something I returned like a little bit earlier I think it was to the fact that maybe it was just like pressure on the team or peer pressure or something like that.".* Another participant mentioned that some external pressures that are keeping him from reporting a concussion *"I think maybe sometimes it could be your team mate as I was saying that they need you this weekend or something in that regard".* This is similar to that of a study where 70% of the participants indicated that not wanting to let the team down was the reason for the non-reporting of concussion (Fraas, Coughlan, Hart, & McCarthy, 2014).

Another study only found that 27% of the participants indicated that not wanting to let the team down was a contributing factor to not reporting a concussion (Register-Mihalik, et al., 2013). These differences could be the population used in these particular studies that causes such a big difference. Change of thinking needs to happen from not wanting to let the team down to thinking of a player's own wellbeing. Players need to think of the risks of possible future complications which are associated with multiple concussions when thinking of either to report a concussion or not. The team members and coaches need to change the stigma that is associated with having a concussion which is that of being weak. If players do not think that they are going to be judged when reporting a concussion, then they will be more inclined to report concussions.

6.5.3 Being cleared by a medical professional

From the qualitative data it was clear that most of the participants felt it was important to get cleared by a medical professional and from the total population 71% mentioned that one should be cleared by a medical professional before returning to sport. The adherence of this was once again poor when of those who suffered a concussion only 54% of them reported being medically cleared before playing sport again. Although not directly asked in the surveys or qualitative data, some themes did come up as to why some participants did not adhere to the guidelines that are in place. One theme was wanting to carry on playing and not being excluded from the game. Another was fear of being dropped to a lower team. This was also the case in another particular study which identified that players did not want to leave the game and that players did not want to let the team down as part of their reasons for not reporting concussions (Fraas, Coughlan, Hart, & McCarthy, 2014; Broglio et al., 2010; McCrea et al., 2004) therefore the reasoning for not adhering to the protocols are similar amongst the population of the study and literature.

In the qualitative data, when asked when do you think you are ready to go back and play sport after you have suffered a concussion a player mentions "*personally depends on how bad it is...I think i can go back maybe after resting on the weekend maybe two days if you feel fine"*. The participant then decides when they are ready to go back to play and takes the responsibility of that decision. If the player has poor knowledge of the risks of concussions he then places himself at risk for further injury. I think the availability of medical professional help and the financial burden of this medical professional clearance could also be a factor leading to poor compliance with being cleared before returning to sport. Players that are not medically cleared before playing sport again put themselves at risk for potential harm. Medical professional help could be made accessible at schools for concussions

specifically or schools could subsidise a concussion insurance that is available for school boys.

6.5.4 Playing with a concussion or suspected concussion

Eighteen percent of the total population mentioned that they would carry on playing a competitive game if they feel they have suffered a concussion. This is a similar finding to a study which reported that a percentage of the participants in that study mentioned that in a hypothetical situation if they were suffering with concussion symptoms after a collision they would carry on in the same game (Chrisman, Quitiquit, & Rivara, 2013). Roughly 30% of the population mentioned that if the coach told them to carry on playing they would carry on even though they are suffering from concussion symptoms. Playing with concussion symptoms could be due to not wanting to let the coach down or not wanting to be judged by the coach. In the qualitative data a participant mentioned *"coaches know if you injured they won't let you play"*.

Not wanting to let the coach down is similar to a study which found that even though the coaches say if you injured come off, but then the participants feel like they are being judged by the coach also some coaches say to players that they *"must not be a wuss"* (Chrisman, Quitiquit, & Rivara, 2013). Another study suggests that reducing the pressure a player feels from coaches, teammates and parents this could lead to increase in symptom reporting of the players (Kroshus, Garnett, Hawrilenko, Baugh, & Calzo, 2015). There seems to be a bad stigma associated with concussion as not a serious injury especially by the older generation coaches.

Coaches need to buy into the concussion programme and start implementing concussion education pre-season and correct techniques on how one could avoid a concussion in the specific sports for example good tackle technique for rugby. Coaches also need to be

approachable and players need to know that they will not be judged for approaching a coach with a suspected concussion injury. A study has stated that there is need to focus on the coaches and parents regarding how they communicate with injured athletes, and whether these interactions are causing an unintended consequence of encouraging unsafe concussion reporting behaviours (Kroshus, Garnett, Hawrilenko, Baugh, & Calzo, 2015). As most schools do not have medical facilities on the premises the coach then becomes the first point of contact for the players with suspected concussions. Education needs to be directed to coaches not just on concussion management but also child psychology with regard to being approachable for the young players. If a player feels they can approach the coach, they would be more willing to report injuries no matter how big or small. This is similar to a study also found that players are more willing to report to coaches if the coach is more approachable and explains to the players the protocol for reporting an injury "I think that from previous incidents that I've known what our coach expects of us. I'd tell him right away because I know what he wants us to do with injuries, because I've been out for a long time." (Chrisman, Quitiquit, & Rivara, 2013).

CHAPTER SEVEN: CONCLUSION

7.1 Introduction

This chapter summarises what the main findings of the study were and explains the limitations that were encountered during the process of obtaining data. The aim is to present the conclusions made from the quantitative and qualitative results and this will be followed up with recommendations for future research opportunities.

7.2 Overview of study and summary of main findings

This study aimed at gaining knowledge of high school rugby and hockey players' knowledge regarding concussion and the return to play guidelines that are in place. The study was based at a high school in Durban, South Africa and utilised both quantitative data and qualitative data. The study used high school rugby and hockey players from Grades 8 to 11, no Grade 12 learners were allowed to be involved due to government national policy. The study's main objectives were to obtain knowledge regarding the point prevalence of concussion among the population, determine the population's knowledge regarding concussion and the return to play guidelines, and determine the adherence to the return to play guidelines.

The point prevalence of concussions in this sample was 31.4% of the total population. More concussions were suffered by rugby players when compared to hockey players and more multiple concussions were suffered by rugby players when compared to hockey players. Due to the nature of the different sports the fact that more rugby players sustained most of the concussions was expected.

Knowledge of concussion was poor amongst the total population. Most of the symptoms and causes of concussion were not identified by the majority of the population. Those who had suffered a concussion felt they understand the symptoms of concussion better than those who

had not suffered a concussion. However, when tested, the knowledge between those who had suffered a concussion and those who had not showed no difference in the knowledge. The symptoms of concussion, causes of concussion and return to play guidelines after a concussion injury are not well understood by the total population with minimal difference between those who suffered a concussion and those who had not suffered a concussion.

The return to play guidelines were not well adhered to by the population. Only 30.4% of the sample who sustained a concussion indicated that they had followed a graded return to play as part of the treatment for the concussion. Of the total population, 48% indicated that graded return to play is part of a safe return to play post-concussion injury. More than half of the participants therefore do not know about the graded return to play protocols that are in place. However, of those that have had a concussion the adherence of these graded return to play protocols were poor. The poor adherence can be attributed by the players' unwillingness to let the team down, not wanting to disappoint the coach or ignorance of the possible risks that are involved with playing with a concussion injury.

7.3 Study limitations

One of the limitations that were encountered were that no matric (Grade 12) learners were allowed to participate in the study. This limits the generalisability of the findings to Grade 8-11 rugby and hockey players at this school. The response rate from the initial randomly selected sample of participants were poor and therefore it was decided to change to convenience sampling in order to include a bigger sample size. The change from random to convenience now might introduce a sampling bias.

7.4 Clinical recommendations and recommendations for future research

7.4.1 Education of young athlete

From the findings of the study it was evident that there was a lack of knowledge in the field of concussion, the symptoms, causes, safe return to play policies and the long-term effects of concussion. Education from professionals in the field of concussion or medical professionals need to educate young athletes on the seriousness of concussion and the why it is important to adhere to the graded return to play protocols. The medical professionals will then ensure that facts are given to the young athletes. The medical professionals will need to address all aspects of concussion which includes symptom identification, causes of concussion and the graded return to play protocols. Long-term and short complications need to be addressed to the players who play with concussions and the possible risks associated with this playing with a concussion as some of the participants indicated not knowing there are long-term complications of concussion.

7.4.2 Education of support staff

As a few participants mentioned that knowledge of concussion was obtained from coaches and parents. Coaches, parents and all support staff who are involved with concussed athletes need to be educated on the topic of concussion. As these people will be the ones who may potentially give concussion information to young athletes, as this may be the case they then need to be well educated on the topic of concussion. The topics include symptom identification, causes of concussion, return to play protocols and the risks associated with allowing a participant to play with a concussion. The support staff also need to be well taught how to handle and effectively deal with an athlete who is suspected of having a concussion. As some participants mentioned not wanting to report concussion due to possible negative consequences, being dropped from a team. Players and coaches need to be positively enforce that reporting of concussion is a positive action rather than a negative as some players might

not report a concussion injury due to not wanting to let the coach/team down. Coaches and parents need to place less pressure on playing the game and more emphasis on a player's wellbeing.

7.4.3 Concussion history tool

A concussion history tool can be developed to accurately document and monitor past and present concussions in athletes of all skill levels. This tool will be used to monitor athletes' concussion history and the steps that an athlete still needs to follow in order to safely return to sport via the graded return to play protocols that are in place. The concussion tool will be a standardised tool that medical professionals can use to accurately and safely clear a player to return to sport. As some players have mentioned returning to sport before being medically cleared, for various reasons, this tool will help in ensuring all players have been through the correct return to play protocols. Coaches and medical professionals will be able to objectively make better decisions rather than uninformed ones. This concussion tool will be able to assess symptoms daily and once asymptomatic will be able to then focus on the return to play guidelines. In order for the concussion tool to be effective athletes will do a baseline test on the application and this will be able to be used as an objective measure to ensure that players do not start the return to play protocols to early. The concussion tool will also be personalised and will ensure that the stand down period is calculated from day of injury and only after the mandatory stand down will players be allowed to continue in the graded return to play.

7.5 Conclusion of study findings

It is evident in this study that the participants in this study are aware of concussions and have a basic knowledge of the injury. The knowledge is still below par with regards to knowledge of symptoms of concussion, causes of concussion and the return to play guidelines. The recommended treatment of concussion is not well recognised and not adhered to by the

participants which is concerning as puts the participants at risk for further and more serious complications. Confidence and self-perceived knowledge of concussion seems to be greater in those that have suffered a concussion when compared to those who have not suffered a concussion there was not difference in actual knowledge of concussion between the two groups. Education on the prevention, causes, symptoms of concussion and return to play guidelines should be compulsory for all high-school rugby and hockey players in South Africa.

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APPENDIX A: QUESTIONNAIRE AND FOCUS GROUP DISCUSSION INFORMATION SHEET

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959 2542 Fax: 27 21-959 1217

QUESTIONNAIRE AND FOCUS GROUP DISCUSSION INFORMATION SHEET

Project Title: High school rugby and hockey players' knowledge of concussion and the return to play guidelines.

What is this study about?

This is a research project being conducted by St. John Taft pursuing a Master degree in physiotherapy (MSc. Physiotherapy) at the University of the Western Cape. We are inviting you to participate in this research project because you are partaking in either rugby or hockey at Westville boys' high school. We are trying to figure out the knowledge of concussion and the return to play guidelines of the hockey and rugby players at Westville boys' high school.

What will I be asked to do if I agree to participate?

We will ask you some questions regarding your personal knowledge of concussion and the return to play guidelines. If this is ok with you, you will fill out a survey which should not take more than 10 minutes.

Would my participation in this study be kept confidential?

We will do everything in our power to keep your name and identity confidential however; if you participate in the FGD anonymity cannot be assured. The surveys will be kept in locked cupboards and only the researcher shall have access to these files.

What are the risks of this research?

There are no personal risks to partaking in the survey, but if you feel discomfort or uncomfortable at any time during the completing of the survey, you may leave at any time or I will refer you to the appropriate professional if you are at any time traumatized.

What are the benefits of this research?

This research could potentially raise your personal awareness of concussion and the return to play guidelines. It could also potentially identify that you have sustained a concussion previously. The research will be used for further health promotion of concussion and return to play guidelines.

Do I have to be in this research and may I stop participating at any time?

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time.

What if I have questions?

St. John Taft, Master's student at the University of the Western Cape is conducting this research. If you have any questions about the research study itself, please contact;

St. John Taft,

Westville boys' high school medical centre,

Wandsbeck road

Westville, Kwazulu-Natal

Tel. +27 31 266 4080 email: 3113572@myuwc.ac.za or stjohntaft@gmail.com or his supervisor Dr Liezel Ennion at liezel.ennion@gmail.com. Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Head of Department:

Dr. Nondwe Mlenzana

University of the Western Cape

Private bag X17

Bellville 7535

nmlenzana@uwc.ac.za

Dean of the Faculty of Community and Health Sciences:

Prof José Frantz

University of the Western Cape

Private Bag X17

Bellville 7535

chs-deansoffice@uwc.ac.za

APPENDIX B: ASSENT FORM FOR SURVEY AND FOCUS GROUP DISCUSSION

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959 2542 Fax: 27 21-959 1217

Email: stjohntaft@gmail.com or 3113572@myuwc.ac.za

Assent form for survey and focus group discussion

Title of Research Project: High school rugby and hockey players' knowledge of concussion and return to play guidelines.

Your son has been randomly selected to take part in either the survey or the focus group discussion or both aspects of the Masters' research project.

This is to agree that your son is allowed to participate in a study being conducted by St. John Taft, a M.Sc physiotherapy student at University of the Western Cape. This entails filling out of a survey and possibly being involved in a focus group discussion.

I agree for my son to be **[**audiotaped**]** during the participation in this study. I understand what the participation involves and I agree to allow my son to participate at his own choice and free will. I understand that my son's identity will not be disclosed to anyone. I understand that my son may

withdraw or I can withdraw my son from the study at any time without giving a reason and without fear of negative consequences.

Participant's parent's name……..

Participant's name……..

Participant's parent's signature…….

Date……

APPENDIX C: CONSENT FORM FOR SURVEY AND FOCUS GROUP DISCUSSION

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959 2542 Fax: 27 21-959 1217

Email: stjohntaft@gmail.com or 3113572@myuwc.ac.za

Consent form for survey and focus group discussion

Title of Research Project: High school rugby and hockey players' knowledge of concussion and return to play guidelines.

You have been randomly selected to take part in the survey, focus group discussion or both aspects of the Masters' research project.

This is to agree that I give permission to participate in a study being conducted by St. John Taft, a M.Sc physiotherapy student at University of the Western Cape. This entails filling out of a survey and possibly being involved in a focus group discussion.

The study has been described to me in language that I understand. My questions about the study have been answered.

I agree to be **[**audiotaped**]** during my participation in this study. I understand what my participation will involve and I agree to participate of my own choice and free will. I understand that my identity

will not be disclosed to anyone. I understand that I may withdraw from the study at any time without giving a reason and without fear of negative consequences.

Participant's name……..

Participant's signature…….

Date……

APPENDIX D: SELF-DEVELOPED SURVEY

Questionnaire

Demographics

Name _____ Age_____

In which grade are you presently? Please tick the appropriate box.

	Grade 8		Grade 9		Grade 10		Grade 11

What sport do you play? Please circle Rugby or Hockey

In which position do you play? Tick the box

	Rugby backline		Rugby forward		Hockey goalkeeper		Hockey forward		Hockey back

A. Point prevalence of concussion

1) Have you ever suffered a concussion? Please circle YES or NO (*If No, please continue with question section B question 1)*
2) How many concussions have you suffered? _____
3) Who diagnosed your concussion? Tick the box

	GP (house doctor)		Physiotherapist		Sports doctor
	Other players		Coach		Parent

	Self-diagnosed		Other

If "other", please describe_____

4) How long ago was your most recent concussion? Tick the box

	0 - 6 months		6 – 12 months		More than 12 months

5) For how long did you not play sport during your most recent concussion? Tick the box

	0 -10 days		10 – 21 days		More than 3 weeks

6) What did the treatment of your concussion include? Tick all of the appropriate boxes.

	Nothing		Medication		Physical rest
	Cognitive rest		Graded return to play protocols		Further investigations (x-ray, CT scan, MRI)

7) Before you returned to sport were you cleared by a medical professional? Please circle YES or NO

B. Understanding of concussion

1) Please choose from the list below one or more features that best define concussion to you? Tick the boxes

	Loss of consciousness ("knocked out")
	Confusion after the incident
	Direct blow to the head

	Indirect blow to the head
	Presence of concussion symptoms
	Slight change in normal behaviour
	Trouble falling asleep or waking up

2) Do you know what the symptoms of a concussion are? Please circle YES or NO

3) Choose from the list below the symptoms that you think may be present with concussion. You can tick more than one box.

	Headache		Feeling of "pressure in the head"
	Nausea and vomiting		Dizziness
	Blurred vision		Sensitivity to light
	Sensitivity to noise		Poor balance
	Feeling "mentally slow"		Feeling like you're "in a fog"
	Fatigue		Drowsiness
	Poor concentration		Poor memory
	Confusion		Sad or depressed
	More emotional than usual		Irritable
	Nervous or anxious		Sleeping more than usual
	Sleeping less than usual		Difficulty falling asleep

4) Are there any long-term complications of having a concussion? Please circle YES or NO

5) If you had suffered a possible concussion during a game, would you carry on playing in the same game? Please circle YES or NO

6) If you had a headache after a knock to the head from a game would you tell someone? Please circle YES or NO

7) If yes, who would you tell?

	Coach		Physio or doctor
	Parent		Other players

8) If you had a headache **while** watching television or reading, a day or two after a game where you took a knock to the head, would you be concerned enough to seek help? Please circle YES or NO

9) How confident are you in identifying a concussion in yourself or in a fellow player? Tick the box

	Not confident		Slightly confident		Confident

10) From where does your knowledge of concussion come? Tick the box/es

	Parent		Sport coach
	Internet/books		Teacher
	Medical professional		Other

C. Adherence to the return to play guidelines

1) What are the features that you think are part of a safe return to play process after a concussion. Tick the box/es.

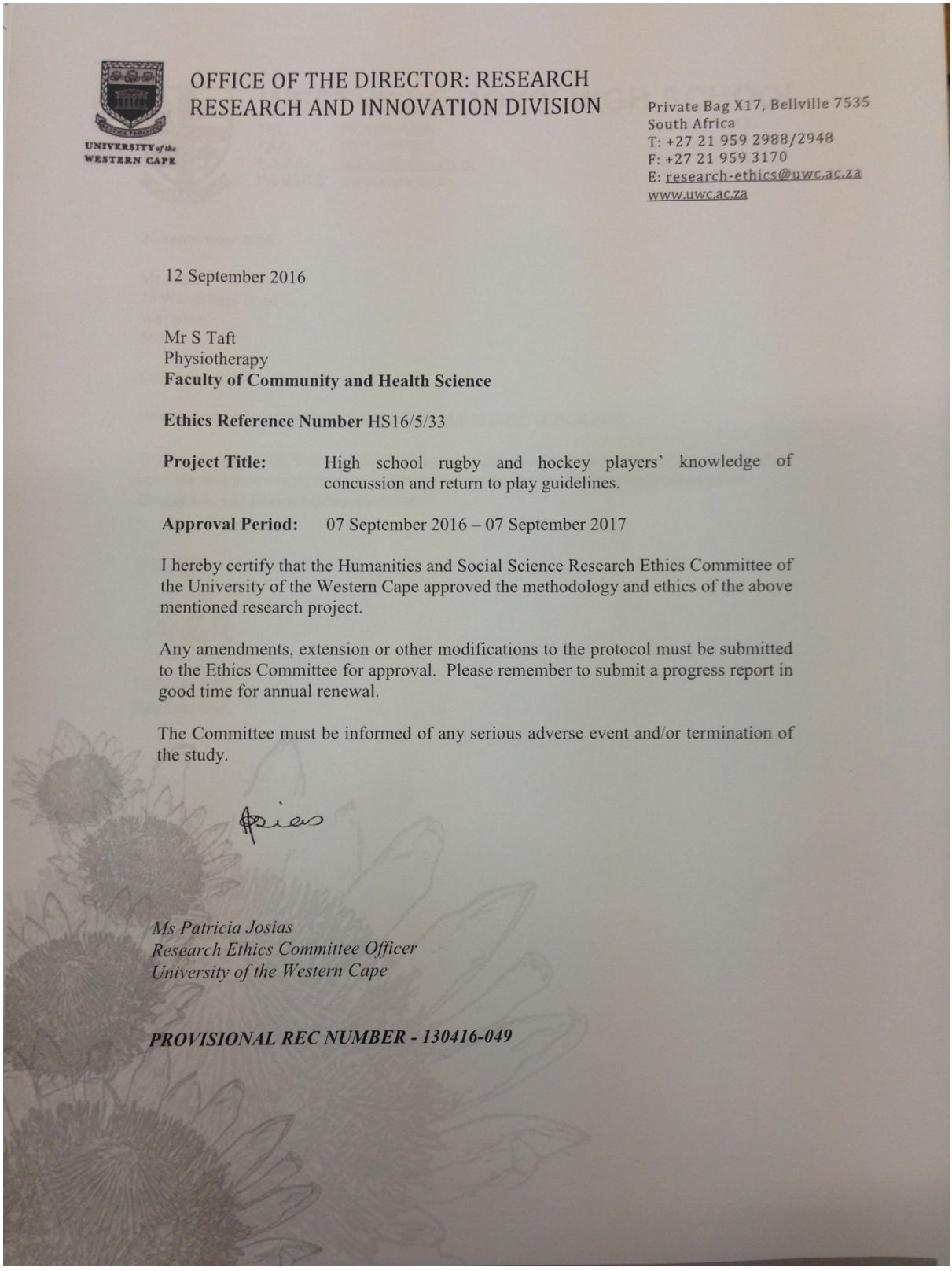
	Play sport the same day		Return to play after a period of rest
	Gradual return to sport activity once		Play the next day

	symptom free		
	Start contact as soon as you feel ok		Return to playing sport as soon as symptom free
	Start light jogging or cycling only when symptom free		Stay away from contact for a set period of time, even if you have no symptoms

2) If you think you have suffered a concussion and your COACH says you must carry on playing, would you? Please circle YES or NO
3) If you think you have suffered a concussion and your PARENT says you must carry on playing, would you? Please circle YES or NO
4) If you think you have suffered a concussion and your TEAM MATE says you must carry on playing, would you? Please circle YES or NO
5) If you think you have suffered a concussion and your TEAM PHYSIO says you must carry on playing, would you? Please circle YES or NO
6) If you had symptoms of a concussion a day or two after a game/practice where you took a knock, would you play a game/practice before telling a COACH? Please circle YES or NO
7) If you had symptoms of a concussion a day or two after a game/practice where you took a knock, would you play a game/practice before telling a PARENT? Please circle YES or NO
8) If you had symptoms of a concussion a day or two after a game/practice where you took a knock, would you play a game/practice before telling a PHYSIO/DOCTOR? Please circle YES or NO
9) Who should clear you to play sport after a concussion? Tick the box/es

	Doctor		Sport doctor		Physiotherapist
	Coach		Neurologist		parent
	Other				

APPENDIX E: PERMISSION FROM THE UNIVERSITY OF THE WESTERN CAPE'S HIGHER DEGREES COMMITTEE



UNIVERSITY of the WESTERN CAPE

OFFICE OF THE DIRECTOR: RESEARCH
RESEARCH AND INNOVATION DIVISION

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12 September 2016

Mr S Taft
Physiotherapy
Faculty of Community and Health Science

Ethics Reference Number HS16/5/33

Project Title: High school rugby and hockey players' knowledge of concussion and return to play guidelines.

Approval Period: 07 September 2016 – 07 September 2017

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval. Please remember to submit a progress report in good time for annual renewal.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

PROVISIONAL REC NUMBER - 130416-049

APPENDIX F: PERMISSION FROM THE DEPARTMENT OF EDUCATION, PROVINCE OF KWAZULU-NATAL

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Enquiries: Phindile Duma Tel: 033 392 1004 Ref.:2/4/8/911

Mr. St. J Taft
26 Wandsbeck Road
Westville
3629

Dear Mr Taft

PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **"HIGH SCHOOL RUGBY AND HOCKEY PLAYERS KNOWLEDGE OF CONCUSSION AND RETURN TO PLAY GUIDELINES"**, in the KwaZulu-Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the Intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from 20 September 2016 to 26 March 2018.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Learners are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Miss Connie Kehologile at the contact numbers below
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report/dissertation/thesis must be submitted to the research office of the Department. Please address it to The Office of the HOD, Private Bag X9137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu-Natal Department of Education.

Westville Boys High School

Adv. MB Masuku
Acting Head of Department: Education
Date: 22 September 2016

...Championing Quality Education - Creating and Securing a Brighter Future

KWAZULU-NATAL DEPARTMENT OF EDUCATION
Postal Address: Private Bag X9137 • Pietermaritzburg • 3200 • Republic of South Africa
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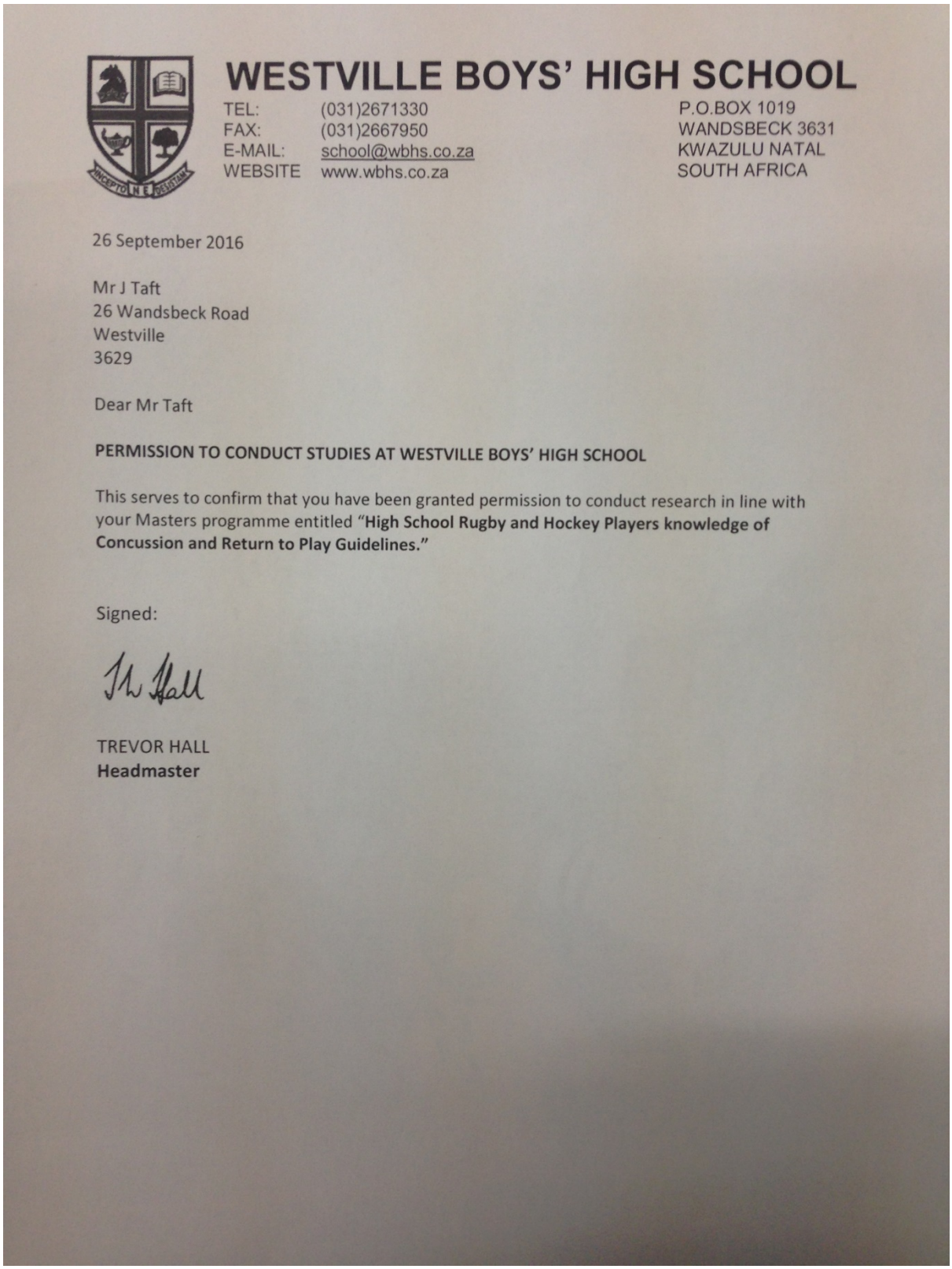
Facebook: KZNDOE....Twitter: @DBE_KZN....Instagram: kzn_education....Youtube:kzndoe

APPENDIX G: PERMISSION FROM WESTVILLE BOYS HIGH SCHOOL



WESTVILLE BOYS' HIGH SCHOOL

TEL: (031)2671330
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WEBSITE www.wbhs.co.za

P.O.BOX 1019
WANDSBECK 3631
KWAZULU NATAL
SOUTH AFRICA

26 September 2016

Mr J Taft
26 Wandsbeck Road
Westville
3629

Dear Mr Taft

PERMISSION TO CONDUCT STUDIES AT WESTVILLE BOYS' HIGH SCHOOL

This serves to confirm that you have been granted permission to conduct research in line with your Masters programme entitled "**High School Rugby and Hockey Players knowledge of Concussion and Return to Play Guidelines.**"

Signed:

TREVOR HALL
Headmaster

APPENDIX H: LETTER FROM THE EDITOR

SAL EDITING AND PROOFREADING SERVICES
SHIRLEY ANNE LEIBBRANDT
BA(HON) RHODES, MLIS UCT
saleibbrandt@hotmail.com

14 November 2017

To Whom It May Concern

I hereby confirm that St.John Taft sent me a corrected version of his Master's thesis for proofreading and editing. I checked his draft version for spelling, punctuation and grammatical errors and made suggestions regarding style, clarity and consistency. I thereafter returned his final draft to him to make the suggested corrections and changes as he saw fit.

Yours sincerely

Shirley Leibbrandt

APPENDIX I: CONFIDENTIALITY BINDING FORM

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa
Tel: +27 21-959 2542 Fax: 27 21-959 1217

E-mail:stjohntaft@gmail.com/3113572@myuwc.ac.za

FOCUS GROUP CONFIDENTIALITY BINDING FORM

Title of Research Project: High school rugby and hockey players' knowledge of concussion and return to play guidelines.

The study has been described to me in a language that I understand. I understand what my participation will involve and I agree to participate in this research study. I understand that my identity will be treated with confidentiality. I am aware that I may withdraw from the study at any time without giving a reason and without fear. I understand that confidentiality is dependent on participants' in the Focus Group maintaining confidentiality. To ensure anonymity, the researchers will do their best to keep personal information confidential with respect to personal identity.

I hereby agree to the following:

- I agree to uphold the confidentiality of the discussions in the focus group by not disclosing the identity of other participants or any aspects of their contributions to members outside of the group. YES / NO
- I agree to be audiotaped. YES / NO

Participant's name…….
Participant's signature……..

Animal/Biomedical/Humanities and Social Sciences Research Ethics Administration

Research Office, New Arts Building,C-Block, Top Floor, Room 28, University *of the* Western Cape, Private Bag X17, 7535