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**AN INVESTIGATION INTO RUGBY UNIONS PLAYERS'
KNOWLEDGE AND UNDERSTANDING OF CONCUSSION**

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Thesis submitted for the Degree of MSc by Research

2021

Abstract

Concussion amongst rugby union players' is one of the highest and most common injuries that has been happening in the modern game. However, recently, previous rugby players have come forward with the physical effect that concussion has had on them from their early playing days, reducing their quality of life with everlasting effects. This means the uncertainty of players knowledge and understanding was at large, and wondering whether if players did know this information, would they take encountering a concussion more seriously.

Therefore, this research study aims to investigate current rugby union players' knowledge and understanding of concussion. The sample size consisted of 62 participants, including both males and females from both a university and a club setting, to get a comparison on their current knowledge. This research used a mixed methods approach by carrying out semi structured interviews and questionnaires to collect data. A process of coding a thematic analysis revealed key themes such as education players have had regarding concussion, what they believed were common signs and symptoms of concussion and their current knowledge to returning to play.

The findings from this research indicated that males and females both from a university and a club setting had a large gap of knowledge regarding concussion including 62 responses in the questionnaires believed that headguards, mouth guards or shoulder pads prevent concussion. Other gaps included identifying incorrect signs and symptoms of concussion, such as neck pain, knocked out and ear discharge, as well as not having knowledge regarding the correct return to play protocol. There were also 4 participants who were unsure or did not believe players needed to be removed from play after sustaining a concussion. This study has shown the need to implement more concussion prevention strategies for both male and female's players that can be disturbed to captains within a team as well as different settings such as club and university.

Acknowledgments

I would like to thank my thesis supervisor, Dr Kristy Howells, Director of Physical Education within the Faculty of Education at Canterbury Christ Church University. Throughout my master's experience, Kristy has constantly given me positive feedback, as well as guiding and supporting me and always keeping up to date with recent new information regarding the topic. I have overall had an amazing experience working alongside her this year and I hope we will be able to work together again in the future.

I would also like to give my thanks to the rugby members from the university team and the local team for being to help me conduct my research within this project. They all were openly active in participating whenever they needed to and put 100% into helping me. Thank you for the time, effort and commitment you have put into this project.

Finally, I would like to thank all of my family for their constant support and motivation throughout this experience, by motivating and encouraging me to do the best possible. My parents have always known my enthusiasm with rugby and have helped me along the way with helpful advice.

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Total Word Count – 28,362.

Introduction

1.1 Researcher Background Sport and Rugby

From a very young age, sport has been a very important factor in my life. My enthusiasm for sport has come from my Mum and Dad who, even though they are not sporting people themselves, have acknowledged my passion for sport, and have encouraged me to continue with it. I first started Taekwondo at the age of four. My Mum brought me along to join as she believed I was a very shy child and wanted to help me build my confidence. I remember when I went to my first lesson, and I was too shy to join in so I sat with my Mum refusing to join in. Then a separate instructor asked if I wanted to practice punching newspaper sheets on my own. After I finished that lesson, I was so excited to go back. I have always believed that Taekwondo has made me into the person I am today as it has helped me develop my confidence as well as my social skills. Nineteen years later and Taekwondo is still a massive part of my life, with my accomplishments including a 2nd degree black belt as well as earning medals in both English and British Championships.

Since beginning Taekwondo at the age of four, I have also been involved in several other sports such as rugby, badminton and table tennis, which were all competed at to a relatively high standard. Reminiscing back to primary school, when I was seven, I remember my friend coming up to me in the playground saying to me that I should join rugby, as he played for the local rugby club and thought that I would enjoy it. At the time I was very apprehensive and nervous about joining as I saw rugby as a 'big people sport' and at that age I was not big at all. After some encouragement from my mum, I plucked up the courage to go. Because I did not have any boots, I borrowed a pair from the lost property box, which were two sizes too big for me. However, I still loved part of that training session and just like the Taekwondo lesson I went to, I was very eager and excited to go back to the next session.

From starting to play for my local club at the age of seven, I continued to play up until 11 when attending secondary school and playing for the school team. Most of the players at my club team went on to attending grammar schools, where rugby was their main sport within the school. In comparison to my comprehensive school where football was the popular sport, and rugby wasn't a very big deal. One positive was that there were also several students who went to the school who played for different clubs, meaning that we had a very good team for my year group. I had the privilege of captaining my team from the start of our secondary school experience until we left at 18 in year 13, making rugby more of a popular sport in our school due to the success we brought. This

also meant that the school continued to promote rugby as one of their main sports as it was clear to see how successful the school could be.

When my local Gravesend rugby club team did not have 'age specific' teams anymore, I went on to play for the adult team that was available at the club. This was a big step up and it was clear that the physicality was a lot higher than I had previously played. However, playing at this level from the age of 17 up until now gave me the confidence in my ability and led me to believe that I was fully capable of playing to this level.

After completing my time at secondary school, I went on to study an undergraduate degree at Canterbury Christchurch University, where I studied Physical Education & Sport and Exercise Science. I chose to study this topic as I had a lot of influential teachers whilst being at school, who encouraged me within my studies, my sports and any personal matters I had. This motivated me to gain a degree in sport so that I could do the same for students after I completed my degree. Studying a sports degree within university meant that I was studying with people who had similar interests to me as they were all very sport orientated as well.

As well as studying my degree, I was also a part of the men's rugby union team whilst playing for my local club team at the same time. I was a member of this team from my entirety of university and loved every minute of it. I met friends from life through this society and had the privilege of captaining the team in my 2nd year of university. Just like stepping up to adult rugby, it was also clear that the physicality would be high, as everyone was determined to win by representing their university.

Through my rugby playing career, I have sustained 5 concussions, but this number could be higher due to being unaware of what concussion is. This is a high reason for completing this research project. It is important for other players (especially those at an amateur level) to have a full understanding and knowledge of concussion to prevent any future long-term illnesses or injuries. Many of the players who I have played with over my rugby career were unaware of the impact repeated concussion and mistreated concussion can have later in life, so it was important me to investigate this further.

1.2 Section Research Background and Rationale

As of recent times (high level media coverage of the recent lawsuits) the importance that either untreated concussion or repeated concussion has been significant due to former rugby players forming law suits due to the impact concussion has had on them later in life. Therefore, there is an importance for players to have a strong knowledge and understanding of concussion. Previous research that has been conducted regarding players knowledge and understanding of concussion (O'Connell & Molloy, 2015; Walker, 2015; Fraas et al., 2014) has focused solely on other nationalities knowledge and understanding (Sye et al., 2005). As well as this, most research regarding players' knowledge has been focused on elite athletes rather than amateurs.

The focus of this study will be focusing on rugby union players knowledge and understand of the signs and symptoms and functional disturbances of one concussion as well as their understanding of repetitive head impact. This will also be looked at further within the literature review.

Most research that has been conducted has primarily focused on male athletes. Knowledge and understanding of females regarding concussion is largely understudied. There is little research (Tsushima, Lum & Geling, 2009) exploring female players' experiences of concussion, medical care provided to female players and the knowledge and understanding that female rugby players have on concussion. This is an important research deficit given that studies (Tsushima, Lum and Geling, 2009) have shown that female players respond less favourably to concussion than male players.

Role players (captains) have an important effect on the rest of the team. As Walker (2015) has suggested that the mind-set of players is largely influenced by coaches, fellow teammates and the importance of the match. As studies have also shown (O'Connell & Molloy, 2015) that 75% of participants have suggested that they would continue to play when being concussed in important rugby matches or because they do not want to let their teammates down. This mind-set from players can be easily associated with a lack of knowledge of concussion and the effect under-reported or mistreating the injury can have.

At a university level, rugby union can be classed as a 'social league' whereby players follow a less strenuous training regime in comparison to elite professional and international players, (Barret, 2015). The lack of the physical conditioning for rugby puts those players at risk of injury during training and matches. These high injury risks could be due to factors such as the level of the players ability and current academic obligations. University students do not have sufficient time to be able to attend a gym, technical and field conditioning sessions apart from the games that are played during the week (Barret, 2015). This is a reason as to why this research aims to investigate both

university student's knowledge as well as a local rugby club's knowledge of concussion, to see if there were any significant differences.

Central to my experiences of playing rugby, rugby player's knowledge and understanding of concussion both in a university setting as well as a local club setting was explored and current literature, the following aims and questions were devised:

1.3 Research aims and Questions

This study used a mixed methods approach to identify players current knowledge and understanding of concussion. Both qualitative and quantitative data were collected. The questionnaires had a positivist focus where participants had to tick their opinions on their knowledge and understanding. The qualitative data came from the interviews, which was then thematically coded.

Research Aim:

- To investigate rugby players current knowledge and understanding of concussion

Research Questions:

- Is there a difference in knowledge of concussion between males and females?
- Is there a difference in knowledge of concussion between university player's and club players?
- Does number of years of playing and position impact players knowledge of concussion?
- How much current knowledge of concussion do rugby players at an amateur level have?

Literature Review

2.1 Introduction

The purpose of this literature is to review, outline and critique the topic areas that are relevant to investigating concussion amongst rugby union players as well as analysing their current knowledge and understanding of the topic area. This research project is investigating adult's knowledge; therefore, the literature will focus predominantly on adults. The review of this literature begins by examining what is concussion and its relationship it has within rugby union, with also reference to the effect that wearing protective headgear has on preventing concussions. From there, factors such as the important signs and symptoms and the correct return to play protocol are discussed, as well as a comparison to males and females and the Head Injury Assessment (HIA) which is included in the elite game. Finally, this chapter discusses the large media attention that has been brought to light as of recent sports related concussions and the current resources that are available in rugby for understanding the effects concussion can have.

2.2 Concussion

Meeuwisse et al's. (2017) summary of the International Conference on Concussion in Sport (CISG) meeting outlines who was involved within the panel for this conference and how they were selected. He begins by explaining that the panel involves chief medicals officers who are from each international organisational sporting bodies that provide financial support for the consensus group (FIFA, International Ice Hockey Federation, World Rugby, IOC and Fédération Equestre Internationale). The panel was created by the scientific committee, which involved individuals who are known to be experts in the field of concussion from all across the world, as well as individuals who had been actively researching and publishing within sport concussion during the previous four years. Meeuwisse et al. (2017) also stated that the panel was broadened to include additional healthcare professionals, organisation and professionals in the field who both come from the sport concussion area as well as other areas outside of sport, and international brain injury consortia. Finally, their review of the meeting involved a variety of healthcare professionals and researchers that had expertise within concussion, which involved individuals who are physiotherapists, athletic trainers, sport medicine physicians, epidemiologists, neurologists and neurosurgeons and imaging scientists. **The consensus group's consensus statement was designed to expand on previous statements, and to improve further conceptual understanding of sports related concussion using an expert consensus-based approach.** As defined by the Berlin expert panel at the International

Conference on Concussion in Sport (CISG) McCrory et al., (2017), sport-related concussion (SRC) is defined as a TBI (traumatic brain injury) induced by biochemical forces that are accompanied by several common features.

The cause of concussions are commonly by accelerations or decelerations of the head involving a linear and/or rotational forces, as Eckner (2014) has stated that there is a large interest in trying to gain a greater understanding of the biomechanics of this injury. The reason for a larger interest in understanding the biomechanics of concussion is because as many as 10% to 25% of concussed athletes commonly go on to develop prolonged symptoms (Collins et al., 2006), and there is a growing concern surrounding the long-term effects of concussion on athletes' neurocognitive health (Gavett et al., 2010). The England Rugby's module 'Don't be a Headcase' (2013) states that concussions are a traumatic brain injury that affects its function. All concussions need to be taken seriously, as failing to do so can have serious consequences, including in extremely rare cases, death.

Concussion has been recognised as the most common recorded injury players receive in professional rugby union within England in both the male and female game and is significantly increasing (Gardner et al., 2014). Sustaining a concussion is a high risk in many sports but is more of a concern in full contact sports such as rugby union, ice hockey and American football as the accelerations and decelerations that occur within tackles can cause the head to have changes in linear and rotational forces. In terms of competing level, Prien et al., (2018) research aiming to summarise recent evidence on the incidence of concussion in soccer, rugby union, ice hockey and American football found that rugby union has a higher incidence of concussion than any other contact/collision sports. **Incidence of concussion is defined as a new event which occurs over a specified period of time (Prién et al., 2018).** Rugby union is known to be the most popular full contact team sport in the world, played both in a 15-a-side or a 7-a-side format. Kemp (2008) has found that 5-9% of match injuries that occur in men's elite rugby 15's rugby union are concussion, and Fuller et al., (2010) found that 25% of match injuries are in rugby union 7's. Due to these studies only looking at male athletes, it was an important factor as to why this research aimed at looking at women as well. Therefore, over the years, the incidence rates of concussion within rugby union have risen due to this increase in participation levels. McIntosh et al., (2010) has found that there are unambiguous head injuries and neck injuries in rugby, as head injuries account for between 15% and 30%, with 15% of injury cases being concussion. However, this data comes from studies of elite adults (Brooks et al., 2005; McIntosh, 2005). There is little data to suggest that those players at an amateur level sustain the equivalent number of concussions, therefore, this is why the focus of this study will also include the amateur level. Research from Gardner et al., (2014) found that incidence levels of concussion in men's rugby union have been reported at 4.73 per 1000 match hours at the elite level. **However, it is critical to evaluate that if there is an**

increase in participation levels, does this mean the incidence levels of concussion has risen, or does this fluctuate due to the same due to the level of activity? As of 2015, the UK has the highest rugby union participation levels in the world with approximately 2.7 million children and adults playing the sport (Freitag, Kirkwood & Pollock, 2015). Yeomans et al., (2018) found that a review of amateur rugby concussion injuries indicated an incidence of 47 per 1000 match hours. Although both studies evaluated available evidence on concussion in Rugby Union and conducting a meta-analysis of findings regarding incidence rates, Gardner et al., (2014) searched for articles published in England up to May 2014 whereas Yeomans et al., (2018), searched for articles published in England from January 1995 to October 2016. This could be due to the Headcase module being introduced in 2013, so has this developed knowledge has this changed the definition of concussion, or has there been more reporting due to being aware of risks.

2.3 Signs and Symptoms of Concussion

Signs and symptoms of concussion are discussed first as it is important to know what these are before a Head Injury Assessment can be undertaken.

Recognising and evaluating sports related concussion especially in adult athletes can be challenging for coaches and even fellow players as Khurana & Haye (2012) have suggested that this is due to the spectrum of concussion ranging from a player feeling dazed without a loss of consciousness, to an unconscious player who has had a seizure. Meehan, d'Hemecourt & Comstock (2010) have found that a loss of consciousness only occurs in about 10% of concussions, meaning that it is not surprising that this topic area can be regarded as difficult to understand. Guskiewicz et al., (2000) and McCrory et al., (2013) found similarly low levels of loss of consciousness as Meehan, d'Hemecourt & Comstock (2010) suggest that this is rare within sports related concussion. Marar et al. (2012,) was able to find that less 5% of sustained concussions involved a loss of consciousness, which was around half the number of the reported other studies. This could be due to different factors including the level of the athletes, age or gender. Harmon et al., (2013) have suggested that there are four domains that are recognised as the main signs and symptoms of a sports related concussion which are sleep, cognitive, emotional and physical (See table 1). In the cognitive domain, Harmon et al., have suggested the difficulty with being able to retain memory and confusion are the most common signs regarding concussion. They then explain that the emotional signs usually include irritability and showing sadness towards others, whereas the sleep signs and symptoms include drowsiness or trouble falling asleep. The table below shows the many signs and symptoms that can be observed within concussion. Research conducted within American high school athletes (173 participants, with an average age of 15.8) has shown that

the most commonly reported concussions symptoms include headaches and dizziness (Cantu, 2009) which both are within the physical domain (Meehan et al., 2011). Although the previous study had a larger sample size with younger athletes, it still shows the side-effects all athletes can have from concussion.

Table 1. Signs and Symptoms of Sports related Concussion: Harmon et al., (2013)

	Signs	Symptoms
Physical	Balance Problems Dazed Stunned Vomiting Sensitivity to noise Sensitivity to light	Fatigue Dizziness Nausea Headache Visual Problems Numbness/tingling
Cognitive	Confused about recent events Answers questions slowly Forgetful of recent information and conversations Repeat Questions	Difficulty remembering Feeling slowed down Feeling mentally 'foggy' Difficulty concentrating
Sleep	Sleeping less than usual Sleeping more than usual	Drowsiness Difficulty falling asleep
Emotional	-	Irritable Sadness Nervousness More emotional

McCrea et al., (2005) and Meehan et al., (2010) have found that between 7-10 days after encountering a concussion, between 80-90% of symptoms commonly clear, however, Donovan et al., (2014) have suggested that factors such as history of any previous concussions, self-reported fatigue and number of and duration of post-concussion symptoms could result in delayed recovery. Therefore, questions regarding how many symptoms they have had and to describe the incident that led to their most previous concussion were included questions, in this research study. Therefore, the participants current knowledge and understanding of the signs and symptoms of concussion could differ from one another due to their previous history. Covassin, Crutcher & Wallace (2012) have also suggested that athletes who are participating in high level of cognitive and physical activity following the injury could lead to more severe symptoms. McCrea et al., (2004) also suggests that even tough young athletes usually underreport concussions as the rate of reported concussions are showing an increase. This may mean that due to some athletes underreporting concussion, the rate of reported concussions could be higher than originally thought. The National Federations of State High School Associations

(2015) have suggested that this increase in sports related concussions could be due to a true increase of concussions within sport or an increase in the awareness of concussion, the severity of ignoring signs and symptoms, or the effect it could have on an individual if not correctly monitored. Within amateur rugby, the lack of team doctors available at training or games could mean that concussions are not fully or correctly monitored.

2.3.1 Signs, Symptoms and Concussion effect: Male Vs Female

While most research into concussion has been performed on males, Dick (2009) has suggested that due to the increasing participation of females in sport around the world, it is important for an analysis of their risk and response to concussion as well. He has also claimed that there is a limited amount of evidence that sex differences exist in traumatic brain injuries and concussions. Therefore, analysing both female and male participants in their knowledge and understanding of concussion can allow for further research as to whether they have a greater/less understanding of concussion and reasons behind why their knowledge of concussion may differ.

Data has suggested that in sports where there are similar, if not the same rules for males and females, females sustain more concussions than their male counterparts (Dick, 2009; Lincoln et al., 2009; Marar et al., 2012). Tierney et al., (2005) has supported this as they have suggested that differences in head-neck dynamic stabilisation could be the reason why female athletes may potentially be at greater risk for concussion in comparison to males. They have also stated that the decreased head-neck segment mass of females in comparison to male athletes has the potential to contribute to greater angular acceleration of the head after impact as a more severe injury. Colvin et al., (2009) has also suggested that oestrogen and a differential cerebral blood flow could also play a factor in influencing concussion severity and outcome. From a recent podcast (Female Athlete Podcast, 2020), Women's Scottish Rugby Union captain Rachel Malcom was told by team doctors that women are commonly exposed to a longer recovery period due to hormonal influences (such as menstrual cycle) and it is important for female athletes to know about it as it is not fully known. This has been supported as Esposito et al., (1996) have stated that females experience or report a higher number and severity of symptoms, as well as longer duration of recovery than males. Females may also have a greater incidence rate of reported concussions due to increase in blood flow (Esposito., 1996), neuroanatomical differences (greater area of unmyelinated neuronal processes) (Cheng et al., (2009) or potentially the female sex hormone estrogen (Roof et al., 2000). Dick (2009) has stated that the explanations for increased concussion-symptoms reporting for females in comparison with males are unclear. This is why Daneshvar et al., (2011) suggests further research is important to be able to understand if sex is a risk

factor for concussion, and if so, what mechanisms may account for it, or if sex is merely a predictor of symptom recording due to social constructions. Therefore, it is vital to identify potential sex related differences between male and female concussion, so that appropriate guidelines can be given for diagnosis and treatment of concussion in both male and female athletes.

2.3.2. Signs and Symptoms of Concussion Effect: Forwards Vs Backs

Playing position (forwards vs backs) could also have an influence on the risk for concussion. Gabbett, (2005) have suggested that forwards (who typically possess a larger physique and are involved in more contact/tackles) might be at a greater risk for injury than backs. Research has found that forwards are at a greater risk for injury than backs (Gissane, et al., 1997) and that the ball carriers appear to be statistically more likely to get injured than the tackling player. Although research has found that forwards sustain high injury rates than backs (Gabbett, 2003), no study has investigated the site, nature and cause of injuries sustained by specific playing positions. However, Hinton-Bayre et al., (2004) found the incidence rates of concussion in forwards were not greater than backs.

Gabbett (2005), found that the forward position of the hooker was the player most at risk of sustaining a concussion. They also found that this was four times more likely than a player in the 2nd row position. The role of the hookers has a very offensive and defensive role, as they are positioned in the middle of the defensive ruck. Meir (2001), has found that hookers are at a higher risk of falling and stumbling injuries. This may explain why the hooker is at a larger increase of sustaining concussions, as they are exposed to physical contact at head height by larger, heavier opponents.

2.4 Head Injury Assessment (HIA)

World Rugby's (WR) concussion management system is known as the Head Injury Assessment (HIA) process. Due to not having a universal agreement on an operational protocol for evaluating concussion (Carney et al., 2014), WR introduced a pitch side protocol specifically for elite rugby in 2012. Fuller, Kemp & Decq (2015) suggested that during this evolution, the process of an operational definition of concussion was developed and successfully implemented. This was due to Helmy, Agarwal & Hutchinson (2013) presenting that the English Rugby Football Union had reported that between 2002 and 2006, there were 58% of confirmed concussion cases that were not removed from the field of play, despite medical practitioner education. This protocol was then subsequently developed further from 2013-2015, with the focus on the need to recognise and remove players

suspected of sustaining a concussion (Raferty et al., 2016). These progresses in development led World Rugby (2015) to integrate the match-day concussion management, referred to as the HIA process, which was introduced into the laws of the game in 2015. In 2017, World Rugby (2017) brought forward a new mandatory HIA review process to support unions and competition owners with HIA process management and compliance. The mechanism proposed is an education, training and compliance process developed by World Rugby and independent expert advisors, which is designed to enhance the promotion of player welfare by reducing the risk of incorrect application of the process. It also consists of a post-game video review process which is delivered by the union, competition or world rugby, and the HIA review process will involve a group that will formally investigate the incident and make recommendations which could include further education and training for the club or team medical personnel (World Rugby, 2017). However, this is only the case at the elite level and could be why there are still such high numbers of concussion rates within the amateur level as this process does not occur there. World Rugby has acknowledged that the contents of the HIA tools will continue to be modified as evidence around concussion diagnosis evolves. Need to find new HIA PROTOCOLS

The HIA test was introduced to recognise that concussion is a fast-evolving serious head injury with fluctuating, delayed and evolving signs and symptoms. World Rugby (2015) introduced three stages for the HIA test. These included: 1) an assessment immediately post injury (HIA 1), 2) repeat assessment within three hours of the injury (HIA 2), and 3) a follow up assessment at 36-48 hours post-injury (HIA 3). The World Rugby's HIA 1, contains a criterion set, which are indications for immediate and permanent removal from further participation within the game. The aim for the criteria set will confirm whether a concussion has been sustained, unless proven otherwise. The HIA 1 also consists of a 10-minute off field assessment tool used when a player has sustained a head injury where the diagnosis is not clear immediately. However, during the 2019 Rugby World Cup (RWC), World Rugby's (2019) executive committee amended Law 3 with immediate effect to make the HIA 1 assessments last 12 minutes instead of 10 (RugbyReferee.net, 2019). This was because during the RWC 2019, there were logistical issues regarding when the clock began, as in some stadiums, the distance from the HIA rooms were further away. Therefore, the amendment meant the 10 minutes would start from when they entered the relevant room, rather than when they left the field of play.

As of July 2022 (World Rugby, 2022), World Rugby issued a statement to help fans gain a better understanding of the process of identifying and managing concussions in rugby. The HIA 1 test combines the use of video review and off field medical observations. This test suggests whether a player should sit out for the rest of the game as precaution, it does not confirm a concussion. If the player is able to pass the HIA 2 test after the game and HIA 3 test 36 hours after the game, the results

will show the player does not have a confirmed concussion. If a player does not pass either the HIA 2 or HIA 3 test, a concussion is confirmed, and the player will be unable to play the next match.

Although this advancement in HIA is benefiting the elite men's game, World Rugby (n.d) state that there is NO (HIA) process in the amateur game. This also includes the women's premiership 15's. As Rachel Malcom (Scottish Women's' Rugby Union captain) has said from a recent podcast (Female Athlete Podcast, 2020),

'The use of HIA exists in the women's international game, as there is more than one team doctor at an international match whereas at a premier game, you only have a team doctor of the home team and they need to be pitch side, meaning that the HIA can't be done during games. I believe that the process is a very good protocol as when I sustained a concussion in an international game, if the availability of HIA wasn't there then I would have played on, but after reviewing footage, it showed my discomfort after making a tackle poorly. The lack of footage could have kept me on the pitch, but by being taken off, it allowed for a swift recovery'
Rachel Malcom - (Female Athlete Podcast, 2020).

It is important that for the reduced numbers and severity of repeated concussions that the use of medical personnel is available at the Women's premiership level (in comparison to the men's premiership level that do have medical personnel available), as well as having medical personnel available for grassroots and an amateur level.

2.5 Return to Play (RTP)

The American Academy of Orthopaedic Surgeons (AAOS, 2012) defined the return to play protocol (RTP) as a decision-making process of a returning injured athlete to practice or competition. This commonly leads to medical clearance of an athlete before full participation back into sport (Herring, Kibler & Putukian, 2012). Clear guidance on acute management and return to play following encountering a concussion within rugby, alongside with the 2012 consensus statement on concussion in sport (McCrory et al., 2012) are provided by the International Rugby Federation ('World Rugby'). England Rugby Football Union (ERFU) (2013) proposed the principles of concussion management in English rugby can be summarised by the 4 R's:

- Recognise
- Remove

- Recover
- Return

According to Particios et al., (2017) those athletes who are at a lower level of competition with limited medical staff should follow the standard procedure (as outlined by ERFU) of recognise and remove any player with a suspected concussion. Therefore, (in this study) it was important to analyse current rugby union players knowledge and understanding of concussion to see if they were aware of the 4 steps to follow when encountering a concussion. Players being unaware of these steps could be a reason as to why there are a high number of concussion incidences in amateur levels in comparison to the elite level.

Although there is existing evidence in terms of risks of concussion, there is little research that has investigated into the time period that is sufficient during the recovery protocol. Brown et al., (2014) have suggested that for a player to get the full benefits of resting after encountering a concussion, a full rest period of 24-48 hours is required. Below is a graduated return to play protocol by McCrory et al., (2013) highlighting the key steps into introducing individuals back into full participation following the 4 steps outlined by ERFU (See table 2).

Table 2. Graduated Return to Play Protocol: McCrory et al., (2013)

Rehabilitation Stage	Functional exercise at each stage of rehabilitation	Objective of each stage
No activity	Symptoms limited physical and cognitive rest	Recovery
Light aerobic exercise	Walking, swimming or stationary cycling keeping intensity <70% maximum permitted heart rate (No resistance training)	Add Movement
Sport specific exercise	Skating drills in ice hockey/running drills in soccer (No head impact activities)	Add Movement
Non-Contact training drills	Progression to more complex training drills May start progressive resistance training	Exercise, coordination and cognitive load
Full contact practice	Following medical clearance participate in normal training activities	Restore confidence and assess functional skills by coaching staff
Return to play	Normal game play	-

Delahunty et al., (2015) has previously stated that as concussion is a large factor in contact sport, there is a growing need to educate players, coaches and administrators regarding the recognition of concussion, the immediate management protocol, signs and symptoms and recommended RTP (Return to play) protocols. Griffin et al., (2017) investigated the knowledge of players, coaches and referees RTP, however, the RTP process can be influenced by other role players. Role players such as captains are important in a team sport as they are the individual who is in control of the team during game time. Therefore, analysing captains' experience of concussion (in this study) as well as their current knowledge and understanding will give an indication into how much information from these role players is being implemented by the rest of the team. Sabini et al., (2014) has suggested that after a player has sustained a concussion, the consensus guidelines advise a thorough physical and cognitive assessment by a member of the medical team, as well as guiding the player through an RTP protocol. World Rugby (2014) has emphasised the use of neuropsychological testing, an examination by a health care professional and memory and balance tests. However, the use of these tests within the amateur level is very uncommon. The decision regarding RTP is usually the responsibility of a member of medical staff or support team, and is based on clinical assessments or field tests (Menta & D'Angelo, 2016). Kemp et al., (2016) have found that athletes also have a greater risk of suffering with musculoskeletal injuries following their RTP protocols, which could be due to some RTP protocols not focusing on re-training of neuromuscular control, but rather just rest.

However, King et al., (2014) has suggested that due to lower standard clubs not having a member of medical staff available at the time of concussion, it becomes problematic to assess players as it relies heavily on subjective self-reporting of symptoms. This could be due to the 'drive' to want to play for the team, as individuals feel like they are letting the team down by coming off the field of play, even though they do not fully understand the consequences of remaining on the field with a concussion. A big factor still remains the reliance on self-reported symptom recognition from players, which rests on behaviour (Hendricks et al., 2012), as well as knowledge of the injury (Meier et al., 2015; Cusimano et al., 2017). A study completed by Sye, Sullivan & McCrory (2006) found that when examining concussion in American high school rugby union players, out of the 62% of those who sustained a concussion, 20% did not report their injury. As Broglio et al., (2010) has found in both adults and high school level, the common reasons for failing to report a concussion may include: not thinking it was serious enough; believing that concussions are just part of the game; not realising it was a concussion, not wanting to leave the game; and not wanting to let their teammates down.

The implementation of the return to play guidelines and protocols should follow an individualised approach to protect players (Melander & Moen, 2014), because not all symptoms will present in the

same way for different players. Delahunty et al., (2015) has stated that under legal and medical guidelines, no suspected concussion can RTP on the same day as occurrence of encountering the concussion. Mathema et al., (2016) have reported that World Rugby's (WR) guidelines regarding post-concussion state that any player who is displaying signs of concussion should be immediately and permanently removed from play and not be permitted to re-join that specific match. This is why McCrory et al., (2017) has suggested that the presence of delayed onset signs and symptoms of concussion is an important factor that needs to be considered. Due to the increased awareness of concussion over the years, it is clear as to why athletes/medicals may be confused with current protocols as it is forever changing due to variants for different age phases. Table 3 below shows the Post-Concussion RTP stand down times that are required by World Rugby.

Table 3. World Rugby (2014) 'Concussion Guidance for General Public'

TABLE 2.5: THE POST-CONCUSSION RTP STAND DOWN TIMES AS REQUIRED BY WORLD RUGBY

Age group	Minimum asymptomatic rest period from day of injury (days)	Minimum asymptomatic time between RTP steps	Minimum days missed
Children & adolescents (<19 years)	14	1(x5)	19
Adults (>19 years)	7	1(x5)	12

2.6: Protective Headgear

Protective head equipment in rugby is commonplace but is not mandatory to wear in rugby union. Firepower (2020) has reported that the first scrum cap worn was in the 1980's from the very first French championship deciding game between Racing 92 and Stade Francais. A large focus as to why amateurs may choose to wear headguards could be due to believing that it does prevent concussion or elite players who wear them also encourage amateurs to wear them. Finch, Donohue & Garnham (2002) have suggested that superficial head injuries (known as a mild head injury) are amongst the most common injury, accounting for 14-29% of all injuries and at an occurring rate of 21.2 per 1000 games. Both Hollis et al., (2009) and Kemp et al., (2008) state that players who regularly wear protective headgear are less likely to sustain a concussion compared with those who never wore it. Research from McIntosh et al., (2009) has found that there is no difference in concussion rates between players who did and did not wear headgear in senior rugby. **This has been proven by Archbold et al., (2015) as they found similar concussion rates from those who did wear headguards in**

comparison to those who did not. However, a recent systematic review of concussion prevention strategies by Schneider et al., (2016) contradicts this by suggesting that they found the use of headgear may prevent superficial head injuries but does not prevent concussion. This difference in results could be due to one study being a systematic review, looking at a large body of research in the area and drawing conclusions from that. McCrory et al., (2013) has suggested that it is important to remember that there has been no hard evidence to suggest that the use of protective equipment will prevent the occurrences of a concussion occurring. However, research from Menger, Menger and Nanda (2016) has suggested that a significant proportion of players (up to 60%) believe that the use of wearing protective headgear prevents severe head injuries, including concussions. This shows the significant mismatch that rugby union players have on their own knowledge and understanding of concussion, hence why this research aims to investigate players knowledge further. Therefore, by asking participants what protective equipment they deem to prevent concussions, it will give a clear understanding whether those players believe that the use of wearing a headgear will reduce the likelihood of sustaining a concussion.

2.7 Media Attention

2.7.1 Will Smith Film ‘Concussion’

The large importance in the effects concussion can have on sporting individuals during or after their playing careers came from the 2015 film ‘Concussion’ (Concussion, 2015), where Will Smith played Dr Bennet Omalu, a forensic pathologist and neuropathologist. The film (based on true events) begins with former Pittsburgh Steelers Centre Mike Webster suddenly passing away of a ‘heart attack’, leading to Dr Omalu being assigned to conduct an autopsy on him. Quoting the words from Dr Omalu, Mike Webster autopsy showed ‘Regular fold of grey matter, no obvious contusions, and no shrinkage from Alzheimer’s (Concussion, 2015). After reviewing a CT scan from six months old, Dr Omalu suggested that the brain should be a mess, but in turn looked completely normal. Records however had shown that Mike Webster had previously recorded severe headaches, double vision, hearing voices in his head, no documented concussions and had complained of dizziness once in 18 years of professional football. Further research from Dr Omalu stated that ‘a human being will get concussed at 60g’s, whereas a common head-to-head contact for NFL players will get concussed at 100g’s’

‘Due to Mike Webster playing the most violent position on the field, it was likely that he sustained more than 70,000 blows to the head which suggests that playing football killed Mike Webster’ (Concussion, 2015).

This is when Dr Omalu discovered that Mike Webster was suffering with a disease now known as Chronic Traumatic Encephalopathy (CTE), which was unknown at the time of his passing. CTE is a progressive neurodegenerative syndrome, which is caused by single or repetitive blunt force impacts to the head and transfer of acceleration and deceleration forces to the brain (Omalu et al., 2014). However, at the time, the National Football League (NFL) was not interested as they were suggesting that 'the helmets are preventing concussion' (Concussion, 2015) and were concerned that the information collated by Dr Omalu would ruin the fun of the game. As this information was continuously being proposed to the former NFL, a significant number of players were tragically passing away such as the likes of Justin Strelzyk, Andre Waters, Dave Duerson and Junior Seau. These players were still at a young age and were unable to control the effects that the unknown CTE was having on them, causing self-inflicting pain on themselves which led to them ending their own lives.

In 2011, retired NFL players began to sue the league for concealing the dangers of concussions. Over 5000 of these ultimately brought suit. The NFL settled on the condition that it would not have to disclose what it knew, and about the effect that concussion was having on these football players. Actuaries hired by the NFL had concluded that 28% of all professional football players will at some point suffer from serious cognitive impairment, which includes CTE. Dyer (2020) has suggested that in 2015 more than 4500 former American football players sued the National Football League in a group action, claiming that it hid the dangers of repeated head trauma, and won a \$1bn (£0.75bn) settlement. After the film, Will Smith who plays Dr Omalu has quoted:

'In the film, we use the illustration of an onion inside of a jar, you cannot stop the onion from (being hit). That's the human brain' (Will Smith - The brain that changed a sport, n.d.).

After the story being told on cinema screens around the world, Dr Omalu has been full of praise for his development into CTE, by giving sports athletes more of a knowledge as the effect treatment or repetitive concussions can have either during their current playing career or later down the line.

George Attallah (NFL Players Association) has suggested:

'We are encouraging players to see it, as a teaching tool for them about the not-so-ancient history of how the league mismanaged a serious health and safety issue, and why it's crucial for the union to be aggressive on these issues' (George Attallah - The brain that changed a sport, n.d.).

This quote is important to relate to Rugby Union as concussion within the sport is becoming an epidemic with the lack of treatment for players, therefore, it is important for all players to have a strong understanding of the effect repeated concussion can have, as well as coaches/physios having a strong understanding on how to treat concussions when they occur.

2.7.2 Scotland's Women's Rugby Union Captain – Rachel Malcom

In a recent podcast by Female Athlete Podcast (2020), Rachel Malcom who is the captain of the Scottish national rugby team talks about her encounters with concussion as well as talking about what more can be done to prevent these effects. In her playing career, she describes that she has sustained a few concussions which had an impact both on her life and her playing career. Rachel has suggested that data from recent seasons shows concussion is the most common injury in the premier 15 (Women's Premiership) as this knowledge has been informed by practices about how they train with more emphasis on neck strength. As Gilmore (2020) has reported, Women's Rugby is one of the fastest growing sports in the UK and concussion has accounted for a fifth of all injuries in the 2017-2018 premiership season. Gilmore (2020) continues that the higher rate of concussion in the women's game could be attributed to the whiplash effect, given that women have comparatively weaker neck muscles than men. Malcom (2020) goes on to say how after sustaining a concussion in a preseason game, she was picked back up and told to carry on playing by a team mate, even though she did not feel 100%. This is the impact of having team mates on your team who have a lack of understanding/knowledge of concussion, and why it is important to look at within this study.

'5 mins after I made the tackle that led to me feeling dazed, people on the side-line were saying that I did not look great, so the team doctor decided to ask on pitch questions as it was only a club game. These questions included 'what was the score', 'who are you playing' and 'who scored last'. After answering these questions correctly, I was given the all clear to continue playing' (Female Athlete Podcast) (2020)

However, later that evening, she described how she had severe headaches and was concerned, so spoke to her physio which then led onto having SCATS tests completed (which consists of balance, memory and cognitive function tests). Although she had passed these tests, she then explained how she believed there was controversy as she was still experiencing these symptoms (as can be seen in table 1). Due to being given the all clear, Rachel continued to play for another week, even though she stated that she was still encountering these headaches, which then resulted in six months of having constant headaches, and was unable to do anything without getting agitated. This is also very similar to Hannah al Khaldi (Women's Rugby Premiership player) who experienced a knock to the head, but showed no immediate signs of head injury or concussion. However, days later, she experienced terrifying stroke like symptoms. *'The right side of my face and body went numb, I lost the ability to use my right arm, I couldn't speak. The pain was blinding, I couldn't function' Hannah al Khaldi (2020)*

After an MRI scan four weeks later, they found a cerebrospinal fluid leak from the brain. After a month of intensive recovery, including an epidural blood patch through her spinal cord, Khaldi was cleared to play rugby again by a neurologist. After feeling stressed with the whole process, Khaldi's mental health eventually suffered, which led to her choosing not to play in the premiership. Although Hannah was fortunately cleared to be able to play rugby again, there are some who aren't as lucky to be able to play.

2.7.3 Stevie Ward

England and Leeds Rhino's second row Stevie Ward has confirmed his retirement from rugby league (difference between league compared to union is that there are contested scrums in league) in January 2021 at the age of 27 as a result of concussion related injuries. Written from Total Rugby League, Shaw (2021) states that Ward, a two-time super league champion, was forced into spending the 2020 season on the side-lines, after suffering with major symptoms of a delayed concussion following an encounter which happened in the first game of the season. Although Ward has seen a number of specialists in an attempt to overcome this issue, he had decided to hang his boots up for good. Ward has talked about the effect that concussion has had on his life.

"I have come to the conclusion, after over 11 months of severe symptoms, that I need to give this injury the respect and time it deserves and cannot put my health and brain to any further risk and detriment. On a daily basis, I struggle with migraines, dizziness, motion sickness, sensitivity to light and screens, short-term memory issues, slurred speech, and an inability to exercise or do daily tasks without irritating my symptoms" Stevie Ward – Total Rugby League (2021)

These are just a few examples of elite level experiences both in males and females that concussion is being shown in the media limelight, therefore, it is important to examine what is happening in the amateur game.

2.8 What can be done differently?

Concussions have come under scrutiny in contact sports such as rugby because of links between repetitive head trauma and long term neurological sequelae (Sellgren, 2016), with doctors urging schools to ban tackling in rugby. Former England World Cup winners Ben Kay and Lewis Moody have said that the amount of contact in training should be limited while research into a possible link between rugby and brain injuries

continues (BBC Sport, 2020). Kay and Moody's former team mate Steve Thompson and seven other former English and Welsh players claim the sport has left them with permanent brain damage. As Squires (2020) reported sport is bracing itself for an 'epidemic' of potentially ruinous lawsuits on the back of the early onset dementia claims led by England World Cup winner Steve Thompson. According to the former England Hooker, he has no recollection of the 2003 World Cup win because of the damage done by repeated head impacts. Lawyer Richard Boardman who is representing the group of seven ex player says:

'Up to 50% of former professional rugby players could end up with neurological complications in retirement. That's an epidemic. Whether you believe the governing bodies and world rugby are liable or not, something has to be done to improve the game going forward. We've got a lot of guys in their early 40's and by the time they get into their 50's a lot of them will be unable to work and will require a lot of healthcare' Richard Boardman – Daily Express (2020)

The NFL have previously adapted its tackling and training rules as a result of these concussions. Although rugby union has done the same, there was no concussion protocol in Thompson's era and more contact work was done in training. Neuropathologist and concussion expert Dr Willie Steward (The Daily Express, 2020) has said:

'American football had a painful route towards change which brought around rule changes that they have continued to review. Rugby saw what was coming and decided to make changes and adapt. It took a long and slow process but it has got to a place where it is far from perfect but an awful lot better than it had been' Dr Willie Steward – Daily Express (2020)

2.8.1 What is being done?

Due to the severity that repeated concussions are having on sports athletes, families of football and rugby stars stricken by dementia have helped to launch a charity to make sport safer. "Head for Change' has enlisted as ambassadors the family of England World Cup winner Nobby Stiles, who had Alzheimer's and passed away in October 2020. Riches (2021) reported that the 'Head for Change' campaign will aim to promote research and suggest changes to football and rugby. It also wants to challenge scientists who insist that only decades of further research can prove the link between dementia and sport. NHS surgeon Dr Tucker of London has said *'Dementia is something people usually associate with the elderly but that's not the reality. Some players in impact such as sports like rugby are developing symptoms far younger'*. Dr Tucker (2021).

The charity aims to set up local support groups for those who are affected at the moment and support independent research into dementia in sport. Dr Tucker also describes that this is not about blame, it's about the medical world and sport's governing bodies working together to make the sport safe. Also backing the charity for change is former Manchester United manager Sir Alex Ferguson, ex-Liverpool manager Sir Kenny Dalglish, England Football coach Gareth Southgate and Liverpool manager Jurgen Klopp. The football community is getting involved due to the effect that players are having from heading the ball.

2.9 Current Knowledge

Knowledge regarding the recognition and management of concussion has been investigated (Lin et al., 2015) in a variety of different role players such as athletes, coaches, medical staff and parents. In the amateur play setting where there is usually no/little qualified medical supervision, athletes, coaches and parents all have the important role to play in player welfare (Fraas et al., 2014a), and therefore, should require sufficient knowledge in regard to recognition and management of concussion (Sullivan et al., 2009). Both investigations (Baker et al., 2013; Fraas et al., 2014a) have found that rugby athletes commonly fail to report concussions. Other research (Broglia et al., 2010) has suggested that the failure of athletes to report their injuries is due to a lack of relevant knowledge about concussions, and the risks that are associated with incorrect treatment. This therefore, has a major effect in detection and effectively managing concussion. Both Providenza et al., (2013) and Provizenda and Johnston (2009) have suggested that knowledge of concussion (education) is vital in preventing injuries, and impact knowledge of attitudes and beliefs about concussion.

Delaney et al., (1997) found that players commonly stated that a player had to be 'knocked out' in order to be concussed, which suggests large scale underreporting/lack of recognition of concussion. From Sye, Sullivan and McCrory's (2001) research, they found that more players identified that the responsibility for checking a concussion was solely based on the individual player or the coach, rather than a doctor or a sports medic. This could reflect the fact that many lower-level teams (amateurs) will not have any immediate medical support, or a general risk taking similar to wearing of a headgear in a similar group of young rugby players (Finch, McIntosh & McCrory, 2001). Baker et al., (2013) and Fraas et al., (2014b) have found that a sufficient lack of knowledge has been found to be a problem not only with athletes but also with parents, coaches, medical personnel and trainers. In order to increase players, coaches and parents' knowledge of concussion and the severity it can have if not

treated correctly, rugby injury prevention programmes have been developed in several countries. This is why role players need to have a stronger knowledge/understanding of concussion to be able to pass on the knowledge they have.

2.10 Available Resources

The lack of knowledge/understanding of concussion is a worldwide issue including countries like New Zealand, South Africa and England. In 2001, the RugbySmart programme was implemented in New Zealand as joint effort between the New Zealand Rugby Union and the Accident Compensation Corporation (ACC), a rehabilitation and accident compensation scheme that provides injury knowledge to all citizens of New Zealand (Gianotti & Humme). The aim of the RugbySmart programme is to try to reduce the number and severity of injuries within community rugby by providing helpful and relevant resources and education to coaches and referees on the injury risks and injury prevention strategies (Quarrie et al., 2007). Chalmers, Simpson & Depree., (2004) have stated, all coaches and referees that attend the annual compulsory RugbySmart workshop be presented with video view and internet resources that address injury prevention issues, including physical conditioning, tackling, scrummaging techniques and injury management. Previous investigations from Quarrie et al., (2007) have found that the programme is effective in improving athletes' injury-preventing behaviours and reducing scrum-related spinal injuries, and as Gianottie, Quarrie & Hume, (2009) have suggested, reducing overall injury claims.

In 2009, South African Rugby union launched the BokSmart National Rugby Safety programme. Adapted from the RugbySmart format, BokSmart includes four key components: 1) biennial compulsory safety workshops for coaches and referees; 2) first aid training aimed at underprivileged rugby communities; 3) a toll-free hotline to assist with management of head, neck and spine injuries; 4) online evidence based educational resources addressing numerous rugby-related issues (Viljoen & Patricios, 2012). Research from Brown et al., (2015) and Quarrie et al., (2007) have supported the effectiveness of these programmes in reducing neck and spine injuries. This was proven as Patricios., (2014) found that serious head, neck and spine injuries within South Africa are reported to have declined by 14.6% at the amateur club level and 23.9% at school level. This drop in numbers could be due to a more informed knowledge of concussion as well as a better understanding of how to treat a concussion when encountered.

'Don't be a Headcase' (2013), is recognised as one of the UK's leading concussion awareness and education resources. The Rugby Football Union's (RFU) Headcase programme aims to increase

understanding and provide important information on concussion and other relevant topics, such as how to prevent and manage suspected concussions. This course can be completed for free on the RFU website for anyone, including players, parents and coaches, which also gives individuals a chance to fully understand important information regarding concussion rates in rugby union, potential short/medium and long-term problems as well as the effects of second impact syndrome. **However, Fraas and Burchiel's (2016) systematic review of the Headcase programme found limited evidence for the effectiveness. Hill et al. (2020) later found through interviews that even though teachers had completed the training course, they still had a very limited knowledge of employing the correct course of action. This was down to finding the course 'useless', 'boring' and 'pointless.' Teachers also described that if you got a question wrong, you were able to restart it, meaning they would not be learning from it. This suggests that even though teachers/coaches have taken the course, how much knowledge have they really understood?**

As well as 'Don't be a Headcase' (2013), the University of Bath and England rugby developed 'ACTIVATE' (2019), a preventive exercise programme with proven results across community youth and adult rugby. This was launched by World Rugby as a major new injury prevention programme ahead of the Rugby World Cup 2019, with the aim to raise awareness and accelerate its use globally. Research co-led by England Rugby and University of Bath in England (Activate, 2019) has found that the Activate programme can reduce concussion risk by 29% in youth and 60% in adult rugby players. World Rugby Chairman Bill Beaumont has stated:

'As the game's global governing body, we continually strive to ensure that the game is simple, enjoyable and as safe to play as possible. Activate is an example of a research-led, proven injury prevention programme that can be implemented at any level of the game, anywhere in the world. It has the potential to be a game-changer' (World Rugby, World Rugby launches ground-breaking preventive exercise programme designed to reduce injuries, 2019).

With a large scale of innovated resources being available to players, coaches, parents and medical staff with a greater knowledge and understanding of concussion, it has the impact to help reduce the number of concussion incidences, as individuals will be made more aware of the important factors to look out for, which is a step in the right direction. Hence why this study will be aiming to investigate players current knowledge/understanding of concussion as well as analysing where they can find any available resources.

Research Methodology

3.1 Introduction

Having analysed and reviewed previous literature and findings from concussion within rugby studies in chapter two, this chapter will advance to addressing the research methodology that was used within this study. The following chapter will explore the ontological and epistemological stances that were used within this research, the data collection methods that were used and how these findings were analysed. It will also include information regarding the participants and the settings within the study. This chapter will include how these methodological considerations were acceptable in exploring concussion knowledge in rugby union, as stated by the research aims. The research that was conducted in this study was a mixed methods approach, which is the reason as to why there was both qualitative and quantitative data.

3.2 Mixed Method

Within this study, the use of a mixed method approach was used. A mixed method approach is a strategy where the researcher combines both quantitative and qualitative research, concepts, techniques and methods within one single study. This research used an explanatory sequential form of mixed method design which Shorten & Smith (2017) describe as when quantitative data is collected and analysed first, then the qualitative data is collected and analysed to help find factors within the quantitative data. Smith (2010) suggests that there are four main reasons as to why using a mixed- research approach brings value to sport. These are expansion, triangulation, complementarity and development. His definitions include expansion, as it relates to the growth of knowledge by applying different research approaches to be able to assess the sporting phenomenon to advance the scope and range of the research study. He continues this by his triangulation reference which refers to the way in which the researcher is able to apply different strategies to explore the same sporting phenomena, therefore, increasing confidence in the conclusion reached, hence why the use of questionnaires was used to investigate players knowledge/understanding of concussion and interviews were conducted with captains to gauge information from important role players of the teams. Smith (2010) also refers complementarity to strategies, which are often used to investigate wider aspects of the same sporting phenomena, in order to broaden the interpretation from a study. This is why questionnaires aimed to discover players current knowledge and understanding whereas the interviews aimed to gain their experience of concussion either from

their own or others experiences, as well as gaining information about their current knowledge. Finally, development refers to how the results from one research approach can be used to show the development of the other (Smith, 2010).

Smith (2010) has also suggested that by adding qualitative interviews to what he refers as experiments as a way to discuss directly the issues around the investigation and gauge into participants perspectives, it can enrich the study and can allow for more meaningful answers. Research from Tashakkori and Teddlie (2003) has considered that reported dualism between qualitative and quantitative research approaches are artificial, and therefore should be put aside. By using the questionnaires to collect quantitative data and interviews to collect qualitative data in this study, the researcher is able to gain information regarding players knowledge of concussion through questionnaires whilst also gauging knowledge of the players experience through qualitative data from the interviews. The use of a mixed method approach goes beyond the initial goal of triangulation, which relies on methodological approaches to gain a better understanding of results, discover new perspectives, or develop new measurement tools (Tashakkori and Teddlie, 1998, p.43) where the use of mixed methods will rely on a combination of qualitative and quantitative data strategies. Using a mixed method approach to investigate rugby players knowledge and understanding of concussion, it will go beyond the initial goal of investigating their current knowledge as to how they have acquired this knowledge and how can further information be passed on. Another important goal of a mixed methods approach which Morse (2003) has suggested is comprehension, which brings qualitative and quantitative research approaches together to provide greater comprehensive and detailed understanding of the phenomenon under study or identify particular anomalies in data.

3.3 Quantitative Research

Bryman (2012) defined quantitative research as *'a research strategy that puts emphasis on quantification in the collection and analysis of data, meaning that quantitative research denotes amounting something'*. (2012, p.35). The questionnaires within this study will be able to give quantitative data regarding players knowledge/understanding of concussion based on factors such as the number of years being involved within the sport and the number of concussions they may have sustained. Furthermore, Thomas (2017) suggests that data from quantitative research can be triangulated together to form structure with a clear design of analysis. The answers given by participants based on their current knowledge/understanding of concussion will be able to answer the research questions and aims (See Chapter 1) of this study. These involved questions where the

participant had to tick the boxes that they felt were appropriate to the question being asked. Multiple Choice Questions (MCQ's) have been suggested by Downing (2002) to be a valid method of competence testing, as cognitive knowledge is best assessed using written forms. Case and Swanson (2001) have found that MCQs are designed to assess knowledge. Well-constructed MCQs can also assess higher cognitive processing such as interpretation and application of knowledge rather than testing recall of facts. Therefore, using a variety of MCQs within the questionnaire allowed the researcher to investigate participants' current knowledge of concussion and how they have gained this knowledge. A main purpose for MCQ's being used is to measure knowledge as an end point in research and education, usually in the context of testing an educational intervention (Considine, Botti and Thomas, 2005). Haladyna (1994) and Haladyna (1999) have supported the use of MCQs as they suggest that they have a high degree of reliability due to them having an objective scoring process.

The use of quantitative data can be used as proposed by Creswell and Plano (2007) as a primary source of information for examination and analysis, as well as use features of qualitative data in a supportive capacity. The positive effect of the use of quantitative data is that findings are likely to be generalised to a sub-population or a whole population, because it involves the larger sample which is selected (Carr, 1994). Research from Sye, Sullivan and McCory (2006) have administered questionnaires to investigate players' knowledge and understanding of concussion, therefore, conducting interviews as well will allow a broader range of data collection, resulting in a significant answer as to why do players know a little/a lot about the topic.

Due to the fact that a large sample of participants were needed to investigate player's knowledge and understanding of concussion, using questionnaires to collect quantitative data was important. Therefore, the way a research questionnaire is administered is critically important to the overall findings of the study (Bowling, 2005). Bell, Bryman and Harley (2018) have suggested that this is because the answers are coming from the participants own pre-conceived ideas and not influenced by anyone else. Participants own opinions and ideas on symptoms of concussion would be coming from their own beliefs on it, whether that be from experience of encountering concussion themselves or accessing resources available on concussion.

The use of using quantitative data as well as qualitative data makes the study more reliable and trustworthy (Pitney, 2004) as there are two ways of collecting data, from interviews and questionnaires. Quantitative research data carried out by Powers and Powers (2015) has found that their study sample can reflect a larger target population, therefore, helping make the study more trust-worthy. Various formats of questions were asked throughout the questionnaire to ensure the

best form of answers. Cohen, Manion and Morrison (2018) states that using a selection of open-ended questions can allow for a broad range of responses from the participants, therefore, allowing them to answer how they feel best suits rather than choosing from a range of answers. This is why the research method investigated answers to the questions starting with how many, how much and to what extent (Rasinger, 2013). Research conducted by Thomas (2017) has suggested that the process of using a selection of open questions allows for qualitative research to fundamentally become quantitative, and this in turn benefits from both fields of data collection. This allows for responses from the questionnaire to give more detail into their understanding of signs and symptoms of concussion, instead of answering from a selection of options, therefore, gaining valuable qualitative information from a quantitative source. **These will be examined in the questionnaire (3.4).**

3.4 Questionnaires

The use of questionnaires offers benefits of a standardized and open responses to a range of topics from a larger sample of population (Cohen, Manion and Morrison, 2018). The questionnaires aimed to gain around 60 responses. **Purposeful sampling was used to collect participants, as this number is a similar number to 4 full teams of 15. However, due to the online nature of the sampling, the response rate was actually over the target sample size and 62 participants took part in the research. The advantages of using purposeful sampling are that it is time effective, cost effective, and is the best way to collect participants when completing research online (Cohen, Manion and Morrison, 2018).** To begin the creation of the research question, the use of planning research (Biddix, 2017) was utilised to give the researcher the opportunity to ask the most poignant questions that could relate most effectively to the research aims. Because questions were based on individuals' own knowledge and understanding of concussion, it was a priority to avoid putting too much strain on the respondents, in relying on their recall (Champagne, 2014), the sensitivity of the topic and time taken to complete the questionnaire, as well as understanding the questionnaire. Denscombe (2014) notes that completing a questionnaire can be mentally demanding, and it is important for the researcher to consider the burden of effort and demand it can put on respondents. By including too much, arises the possibility of participants not taking part, withdrawing during the process or giving responses which are not accurate to what they may perceive. It is important that the appearance of the questionnaire is not overwhelming (Diaz de Rada, 2005), as Dillman et al., (2014) has previously stated that it must look easy, attractive and interesting rather than being complicated, unclear or boring.

From the questionnaires (Appendix 6), the way in that these questions were formatted was via Biddix's (2017) framework of important characteristics of a good research question. Although the framework aligns itself towards a research question in a broader wider sense, it can also be used to format individual questionnaire queries. For example, question 4 'How many years have you participated within rugby union/rugby league?' The framework states that a question must be clear, significant and ethical. The questionnaire also included various styles of questions such as multiple choice and open-ended questions. Cohen, Manion and Morrison (2018) suggest that allowing participants to have the option of picking an answer is useful to allow for a definitive response from the respondent. In questions such as 7, 10 and 11, the research consisted of closed multiple choice questions that allowed the respondents to demonstrate their knowledge of symptoms related to concussion and the return to play protocol they believe should be enforced after sustaining a concussion.

As mentioned, a selection of open-ended questions and closed ended questions were utilised, rather than just solely evaluating the participants current knowledge and understanding of concussion. The use of open-ended questions is beneficial if the possible answers are unknown to the respondents or if the questionnaire is exploratory (Bailey, 1994). Cohen, Manion and Morrison, (2018) state that open questions give participants the opportunity to write a free account in their own terms, to explain and qualify their responses and avoid the limitations of pre-set categories. For example, question 6 'Describe the incident that led to your most recent concussion?', allows the participant to further describe how the concussion was sustained rather than a short, fixed answer or choosing from a list of options. Krosnick and Presser (2010) note that open items can often provide more of a valid and reliable response compared to closed items, but respondents are more likely to opt for a 'don't know' response rather than take the time to complete an open question. This is why in questions such as 8 and 9, the researcher gave the options 'yes, no or don't know', and allowed for a more elaborate answer if they felt necessary. These questions were limited as too many of these questions could result in respondents answering 'don't know' for a large majority of the questions, therefore, not gaining the sufficient information required. The use of a variety of closed questions are useful as they can generate frequencies of response to statistical treatment and analysis (Cohen, Manion and Morrison, 2018). Oppenheim (2009) states that closed questions can also enable comparisons to be made across groups in the sample. This is the reason that four subgroups were used for data collection.

Originally, questionnaires were to be handed out at each training session in which participants attended for each subgroup. However, due to the current COVID 19 pandemic, these questionnaires had to be moved online and completed through google forms, and put into each subgroup's group

chat as the government guidelines included not mixing with any individual who was not in your household and for everyone to stay at home. Confidentiality was still kept as at no point did the questionnaires ask for any personal information, and included a consent form on the first page.

3.5 Qualitative Research

Due to the aims of this research (Chapter 1, Section 3), both a qualitative and quantitative approach towards the research deemed the most suitable in collecting a wide variety of data as according to Flick (2014), who suggests that qualitative research looks into analysing subjective meaning or the social production of issues, events and or practices, by collecting non-standardised data, and analysing the texts and images rather than using number and statistics. While Rahman (2017) adds to this that it can refer to research about peoples' lives, behaviours, feelings and emotions as well as organisational social movements and functioning, cultural phenomena and interactions between nations. By exploring qualitative data by looking into individuals experience of concussion and their history, it will give a wider range of information regarding how people believe the effect concussion can have on individuals whilst analysing how they felt as well at the time. Qualitative research is referred to by Van Maanen (1979, p.520) as 'an umbrella term covering an array of interpretive techniques which seek to describe, decode, translate, and otherwise come to terms with the meaning, not the frequency, of certain more or less naturally occurring phenomena in the social world'. Although the previous reference is from 41 years ago, it still fits purpose to research as it still relates to how analysing qualitative data can be completed, and is still being used today. By conducting interviews with participants based on their experience on concussion will allow the researcher to understand their own personal experience with concussion and analysing information as to why they may feel the way they do, meaning that players will need more information and education regarding concussion, hence why this study is being conducted. Straus and Corbin (1990) have previously stated, '*By the term 'qualitative research', we mean any type of research that produces findings not arrived at by statistical procedures or other means of quantification' (1990, p.11)*

Qualitative research can be used to look into an area where there may be a lack of theory or if an existing theory fails to accurately explain a phenomenon. Due to the current situations that are occurring within former rugby union players coming forward to discuss the effect concussion has had on them now they have retired, it is a topic of interest that needs to be looked into further (Chapter 2.8). As reported by Squires (2020) sport is bracing itself for an 'epidemic' as a large number of lawsuits are being brought forward on the back of the original early onset dementia

claims from ex England World Cup winner Steve Thompson (Ex England hooker). Marriam and Grenier, (2019) suggest that an important characteristic of qualitative research is that the process is inductive, and that the researcher can collect data to build concepts and theories. The inductive process will help build concepts on players knowledge/understanding of concussion as well as how they may have acquired this information. Due to individuals talking about their concussion experience from playing rugby, it was important to collect qualitative data from interviews. This is because qualitative researchers are interested in understanding what those interpretations are at a particular point in time, and in a particular context. Therefore, understanding how players have gained their knowledge/understanding through experience will help to bring conclusions as to whether enough is taught on the topic. Learning how individuals experience and interact within their social world, the meaning it has to them, is considered an interpretive qualitative approach (Merriam and Grenier, 2019).

Denzin (1989) suggested that qualitative approach produces thick, detailed description of participants' feelings, opinions, and experiences, and can interpret the meanings of their actions. Although this reference is dated, it still suggests that the use of conducting interviews to collect qualitative data can gain a deeper understanding of how participants feel on concussion, whether that's their experience of it or how they feel about it now. Denzin & Lincoln (2017) have suggested that qualitative research aims to describe and discover narratively what particular people do in their everyday lives and what their actions may mean to them. By completing interviews with the captains from each team (Chapter 3.1), it allowed them to openly talk about their previous encounters with concussion, whether it was either them who had experienced them or somebody who they know. Lastly, qualitative research design has a very flexible structure, due to the fact that the design can be constructed and reconstructed to a greater extent if needed to (Maxwell, 2012). Therefore, within the interviews, questions can be modified to gain a larger scale of information if needed based on the answers given, **and this will be discussed in the interviews (3.7).**

3.5 Constructionist Ontology

Cohen, Manion and Morrison (2018) suggest that for a researcher to understand the core facts of research methodologies, there needs to be an understanding as to why these approaches exist. They continue to explain that there are two key underlying paradigms within research which are ontology and epistemology. The implication of an ontological assumption is linked with the paradigm that things exist 'out there' which can be found through doing rigorous research (Bailey, 2018). A constructionist ontological approach was used for this research to understand rugby union player's

knowledge and understanding of concussion. From this position, we can assume that the knowledge and meanings of individuals are constructed as we engage with the world that we interpret (Crotty, 1998). Thomas (2016) supports this by suggesting that individuals construct meanings from the social situations they find themselves in, and then use this to understand the social world. Therefore, within this research, the rugby player's concussion knowledge was constructed through their experience of either encountering a concussion or knowing somebody who has experienced one. Knowledge from players would have been socially constructed, as opposed to a universal fact/truth being uncovered. The experience and perceptions which are being investigated will rely on social constructed knowledge, relating to experience and different perceptions, not on the investigation or discovery of the existence of a generalisable law.

There are two broad and contrasting positions: objectivism that believes there is an independent reality, and constructionism that assumes that reality is the product of social processes (Neuman, 2003). Crotty (1998) suggests that constructionism is the social generation and transmission. This is supported both by Doyle (2013) and Sparkes & Smith (2014) who explain that constructionism refers to a shared generation of knowledge and meaning. A reflexive stance allows us to maintain a position of self-awareness, and therefore acknowledge our subjectivity when constructing knowledge. Where an objectivist stance would see the meaning of objects as fixed and independent of social realities, a constructionist stance would construct their own meaning through their experience with the object (Crotty, 1998). An example would be an object such as a tree can construct different meanings for different people dependant on whether they are a lumberjack, a poet or a gardener (Blumer, 1969). Blumer continues to state '*the meaning of objects for a person arises fundamentally out of the way they are defined to him or her by other with who they may interact with*' (p.11).

This means that different people are able to construct different meanings of an object in different ways in relation to the same phenomenon.

3.6 Interpretivist Epistemology

Epistemology is concerned with the nature and forms of knowledge. It is suggested by Cohen, Manion and Morrison (2014) that epistemological assumptions are concerned with how knowledge can be created, acquired and communicated. In simpler terms, what it means to know. Guba and Lincoln (1994, p.108) explain that epistemology solely asks the question, what is the nature of the relationship between the would-be-knower and what can be known? As Scotland (2012) has

previously suggested, epistemology is fundamentally the discourse of how knowledge that we already know is accrued and formed throughout life. Central to interpretivism is the understanding of the subjective world of human experience (Cohen, Manion and Morrison, 2014). Therefore, interpretivist epistemology was used within this research as it gives a clearer understanding of the experiences that individuals associated with concussion. The use of interpretive research can allow for the approach that assumes an in-depth understanding into the environment of the subject (Thomas, 2016). This allows the researcher to reveal personal, subjective and unique knowledge and the participants experiences (Cohen, Manion and Morrison, 2014), which can therefore uncover what Thomas (2013) refers to as 'situated knowledge' (p.144)) where knowledge can be situated in relations between people. Due to the nature of the research, it made participants feel more comfortable knowing that they could speak to someone about their history of concussion if the researcher shares their own experiences as well.

Interpretive epistemology is one of subjectivism which is based on real life phenomena. The world does not exist independently though our knowledge (Grix, 2004, p.83). Similarly, to Blumer's (1969) example of trees from an ontological standpoint, Crotty (1998) elaborates with epistemology that

'We need to remind ourselves here that it is human beings who have constructed is as a tree, given it the name, and attributed to it the associations we make with trees. A tree is not a tree without someone calling it a tree. Meaning is not discovered; it is constructed through the interaction between consciousness and the world (p.43).

Regarding the same phenomenon, different people may construct different meanings in a wide variety of ways (Crotty, 1998, p.9) but the truth is that a consensus is formed by co-constructors (Pring, 2000, p.51). Each participant may perceive concussion in a different way, as some may believe sustaining a concussion requires an individual to be fully unconscious, whereas others may believe that even feeling slightly dizzy from a knock to the head can be classed as concussion. Knowledge and meaningful reality are constructed though interactions between humans and their world and can be developed and transmitted in a social context (Crotty, 1998, p.42). Thus, the social world can only be understood from the viewpoint of individuals who are participating within it (Cohen, Manion and Morrison, 2007, p.19). This is how interpretivism aims to bring in consciousness hidden social forces and structures.

3.7 Interviews

Semi-structured interviews were used as a form of collecting important data about the participants' own experiences and perceptions of the impact concussions can have within rugby union, as it gave them the chance to express their own thoughts and feelings (Sparkes & Smith, 2014). Due to concussion potentially being a different definition to each individual involved, it allows for the chance for participants to expand on their own understanding of the matter as interviews are an effective qualitative tool. Etzler (2016) described interviews as 'a licensed experienced psychotherapist, building rapport, built on asking open-ended questions, and following the cues from a client's given mindset.' Due to concussion being a traumatic brain injury, it allows the participant to open up and expand on their concussion experience. As McLeod, Wagner & Bacon (2017) have suggested, studies that are based using a qualitative approach can provide a better insight into the influence of a sport-related concussion on the psychosocial experiences with health-related quality of life (HRQOL) as an analytic framework. Whilst Kumar, (2014) explains that interviews are an effective research method that can verbally communicate the thoughts of an individual who provides relevant information concerning a topical discussion related to the chosen research field. McGrath, Arar and Pugh (2007) have also suggested that interviews can also give effective non-verbal communication based on how the participants may answer the questions (tone of voice) and how their phrase may change (pauses and stutters). Through the transcripts from the interviews (See appendix 4) the use of different colours was used for pausing moments and responses were put in bold when participants changed their tone, to be able to clearly see tone and verbal communication. Each interview used a pre-planned interview guide comprising of a series of open-ended, in-depth questions which included the following areas: 1) length of rugby playing career and what position they currently play; 2) their history of encountering concussions whilst playing rugby; 3) their knowledge of common signs and symptoms linked to concussion; 4) their understanding on how to deal with a fellow player sustaining a concussion.

Before the initial interviews were carried out, the format was piloted to test the effectiveness of the questions and to increase confidence to the researcher (Jones, 2015). This was conducted with two current rugby union players who had no connection with this research. This was to measure how effective the researcher's questions were and if they needed to be modified. The participant who was involved within the pilot study had no influence on the final research, did not have connections with any of the teams involved so they were unable to tell them what it was about but it was still

important that they were a current player. Pilot studies can be useful procedures to fully prepare for a full-scale study, regardless of the paradigm (Tashakkori & Teddlie, 2003). The use of piloting the interview questions can address potential practical issues that may arise in following research procedures (Van Teijlingen & Hundley, 2002) and trying out the questions, shown in Castillo-Montoya's (2016) pilot study who found that interview protocols have the potential to be strengthened through piloting the interviews. Before the actual interviews were carried out, two pilot studies were carried out. After completing the first pilot study, it was clear to see that there were changes that need to be made which included changing the phrasing of some of the questions asked. This was due to them not being in the correct order when asking them or re-wording some of the questions so the participants could fully understand the questions being asked to gain full effectiveness (BERA, 2018). The correct order consisted of grouping the topic areas of the questions, to ensure that it flowed in a chronological order.

The interview type that was used for my research were semi structured interviews. These consisted of face-to-face communication, which allows the specificity of the research objectives to be addressed whilst also allowing opportunity for the interviewee to add additional meaning (Galletta, 2013). An important advantage of the use of semi structured interviews is the opportunity for previously unknown knowledge to emerge. Different individuals are likely to have different opinions on concussion, which means that participants may have a different opinion on concussion based upon their own perception of what it is. By carrying out semi structured interviews opposed to structured, it allowed the researcher to ask further questions to the participants based on the reply given to the original question, in contrast to structured interviews where the questions that are set need to be stuck to throughout. O'Keefe et al., (2016) has suggested that participants can be regarded as experts by their experience as there is an unlimited amount of opportunity to speak freely, new and novel information can emerge. As Cohen (2018) has also suggested, by using semi structured interviews, the topics and questions are given, but the questions are open ended, and the wording and sequencing will be tailored to each individual interviewee and the response given.

As well as the semi-structured questions created before administering the interview process, the use of probes were used to encourage the participants to provide more relevant information and expand upon their answers. Patton (1980, p.238) stated that the use of probes can allow the interviewer to ask respondents to elaborate or add to their existing answer. Whereas Wellington (2015) showed that it extends or clarifies their responses which are hallmarks of successful interviewing, therefore, enabling the researcher to gauge more of an understanding of the thought processes of the interviewee (Priede et al., 2014). Probing was beneficial to expand on personal reflection and this was demonstrated with questions beginning with 'do you...'

Before the interviews were conducted, I described the reasoning and purpose behind my research which was recorded through zoom video call and ensured that participants who were involved had read the information sheet about the research project (See Appendix 1). These were recorded so that a transcript of the discussions could be written (See Appendix 4). When the participant had agreed to be interviewed, they signed a consent form. This was vital as it was important that the participant was aware of their rights including that they had the right to withdraw at any given moment and that they are not required to answer any questions that they may not feel comfortable answering. Following GDPR, the study did not involve any risk of harm or injury to participants and the data would remain confidential and raw data will remain safely stored and destroyed after completion of the project.

These interviews were originally meant to take place within a quiet group study zone within the University library, to ensure that there were no distractions or disturbances as Bell (2010) has suggested that no-one other than the researcher could hear or influence the participants responses. However, due to the current COVID 19 pandemic, these interviews had to be completed virtually online through zoom, as the government guidelines restricted individuals mixing within other households. All four participants took part in virtual face-to-face interviews that lasted between 30 and 60 minutes. By conducting these interviews in a neutral yet familiar setting for both myself and the interviewees, I had hoped that the interviewee felt the suitability of the environment and that it helped them relax to produce productive answers. This approach was used within the pilot study to gauge an understanding of how appropriate it would be to use when actual interviews were conducted. Due to the fact that this study involves gender analysis, it is important to clearly distinguish in the data analysis which are males and which are females (Given, 2015). I ensured that all the appropriate measures to keep the questionnaires and interview recordings were in a pin protected computer/phone to main confidentiality of all the individuals involved.

3.8 Access

Due to the researcher being involved within the club rugby team since a young age and being involved within the university men's rugby team (Chapter 1) gave them great advantage when building relationships with the gatekeepers. Hammersley and Atkinson (2007), previously suggest that familiarity with particular establishments can enhance the likelihood of initially entering research environments. Therefore, this can create a more enriched research project because the gatekeepers from each club are more likely to trust the legitimacy of the research. The gatekeepers for each sub-group were the captains of each team, so these were the individuals who gave

permission for the questionnaires to be handed out to their team and for the captains themselves to be involved with the interviews. These were individuals who had an insider status within a social or cultural group of interest (Creswell, 1998), thus, acted as the first point of the contact for the researcher for each subgroup (Hammersley and Atkinson, 1995).

Engagement with each gatekeeper was vital for the development of relationships with the other team members. Due to previously playing for both the men's university team and the men's club team, I was able to form an easy connection with these associations. Regarding the women's teams, I had a very strong friendship with the captain of the university team which formed through school, and I was able to gain easy access from a former player who was the coach of the women's club team. Colonnesi et al., (2017) has suggested that building a rapport with research participants involved can assist with the undertaking of research, as this allows the participants to feel more comfortable and at ease, therefore, can potentially return more accurate results. The positive connections that were gained encouraged a smooth running of the research for other participants to be involved within the questionnaire process. To ensure participants involvement within the research project, the gatekeepers were given a clear indication and insight of what the study would be involving and the purpose of why the study was being investigated. By keeping regular communications with the gatekeepers, it ensured that they were motivated and willing to continue with the process of data collection. This was more important when moving to virtual data collection as I had no means of having physical contact with others, therefore, I needed to make sure that they were still fully interested and willing to take part.

Before the interview process, it was important to gain a strong rapport with the captains. Due to having a very strong connection to the establishments, it gave confidence in addressing the participants involved. Due to the captains being the gatekeepers for this research project, it meant that there was a sturdy platform to develop conversations and relationships with the other members of the team. This allowed for captains to pass information on to the other members of the team to help assistance with completing questionnaires for the research project as well as allow me access to communicate with them through social connection platforms. Due to the current COVID 19 pandemic, the process of how the research was going to be carried out was either going to be virtually or either face to face. Therefore, it was important to build a rapport with the captains involved over social connections as they would not be seeing the researcher in person. This involved keeping in regular contact with them by asking how they were and if they were still willing to participate in the study. This in turn created a strong rapport with the captains, which made them feel comfortable with the researcher. Sands (2002) states that by building a reliable rapport with

gatekeepers helps uncover new potential participants and allows for the researcher to understand the social and cultural phenomena.

The strong relationships that were formed with the gatekeepers allowed for a smooth process when asking participants to complete questionnaires. Captains from each team were more than happy to pass the questionnaires onto the other team members and were enthusiastic in getting them to complete it for the researcher. The individuals who participated from each subgroup were very helpful and open to taking part within the study. Some of the participants involved were interested about what the research would involve and what the researcher was hoping to gain from it, so these questions were answered.

3.9 Participant and Setting Design

The following section will provide understanding of the participants and setting design that was used within this research study. The research focused on four sub-groups of rugby union players from a Men's & Women's university team and a Men's & Women's club team. These clubs were associated with the researcher due to previous playing time with both university and club teams (therefore, I was familiar with both the men's and the women's teams). Hammersley and Atkinson (2007) have previously suggested that a familiarity with certain establishments can improve the likelihood of entering the research environments. This in turn can create a more successful research project because the gatekeepers from each club are more likely to trust the effectiveness and legitimacy for the research being conducted. Participants that took part in the questionnaires were identified using a selective method, using purposive sampling as suggested by Patton (2002). Participants were selected if they coincided with the classification in the following criteria:

- A member of either the Men's/Women's University Rugby team
- A member of either the Men's/Women's Club Rugby team

Like the questionnaires, a purposive sampling method was used to gather the participants for the interviews. Etikan (2016), has suggested that purposive sampling (also known as 'Heterogenous Sampling'), involves selecting candidates across a broad spectrum relating to the topic of the study. The participants that were involved within the research were purposively selected.

The captains were each selected as part of the subgroups involved. This was done as it was believed the captains are the most influential players on each team. Although all participants involved were part of a rugby union team, it did not mean that they had sustained concussions themselves, as

questions involved how they have had to assist somebody who has encountered a concussion before. This is what makes them the target group for the interviews regarding concussion, as the research wanted to evaluate their understanding of concussion as a whole. Neuman (2011) has suggested that purposive sampling is appropriate to select unique cases that are especially informative. Purposive sampling is most effective when the researcher has the access to a sample of knowledge that can bring the most information concerning the research intentions (Guarte and Barrios, 2006). By using a smaller sample size for the interviews over the questionnaires, it allowed the researcher to gauge deeper understanding of important insight into the lives of others. This was vital as those who were involved within the interviews would be discussing their history of concussion, and some individuals may have felt concerned discussing these areas. A smaller sample size can be effective when the participants have the opportunity to elucidate the aims of the research project (Malterud et al., 2016). This will therefore generate focused information surrounding the inquiry of the research. Clearly et al., (2014) has suggested that the personal experience of participants will create useful data which can then be thematically analysed to gain credible research findings and conclusions. Due to confidentiality purposes, the names of the participants involved within the interviews were modified. The figure below shows their names, playing positions and which setting they played for.

Name	Uni / Club	Position	Gender
Michael	Club Male Captain	Centre	Male
Sasha	University Female Captain	Flanker	Female
David	University Male Captain	Number 8 / centre	Male
Amy	Club Female Captain	Front row / Number 8	Female

3.10 Ethics

A vital part of any research project that involves participants must consider the ethical issues that may arise to prevent the risk of harm to others. Within research that involves human subjects, participants need to be protected as far as possible against harm associated with participation during the research programme (Swedish Research Council, 2017). Singh (2012) states that there are multiple ethical principles that must be taken into consideration prior to researching in the specific field, such as honesty of intended methods and the integrity of dealing with personal thoughts and emotions. Due to participants talking about their concussion history or answering relative questions

towards concussion, it was important to deal with the matter with care and consideration, as it had the potential to bring about sensitive areas for them to discuss. This supports Darlington & Scott (2003) as they describe that qualitative research (mainly in humans) offers the opportunity for challenges to arise associated with the ethical considerations, such as in-depth interviews that can be intrusive due to highly personal matters of the people being discussed. Overall, Singh (2012) explains retrieving fully informed consents from all participants, accepting and confining the conclusions based on evidence, and the ethics of authorship make up the basic fundamentals that demonstrate the importance of ethics.

Before the questionnaire and interview process, I introduced my research verbally to encourage personal contact and avoid any communication processes that can be deemed administrative such as emails. The captains of each subgroup of teams read and signed the consent form (Appendix 2) before the handing out process of questionnaires was completed to ensure their understanding of my research intentions (Bell, 2010). The captains of each subgroup who were going to be interviewed read and signed a consent form to give permission for the conversation to be recorded and that all information will only be reviewed by the main researcher and the main tutor.

The Ethical Guidelines for Educational Research (BERA, 2018) form the emphasis of British ethical principles that act as a main guideline for research projects. Therefore, I aimed to follow the protocols of the British Educational Research Association (BERA, 2018) throughout the entirety of my research, from the commencement to the completion submission of the thesis. My official ethics forms that were completed were submitted through to the University's Ethical Committee that involved information such as the nature of the study, the number of participants that would be required, methodology and a risk assessment form. Due to the current COVID 19 pandemic, information regarding an alternative method of data collection was included dependant on the government restrictions. When the University's Ethics committee approved my proposal, I started the process of putting my questionnaires online with a consent form (Appendix 6) attached to the front, to club coaches explaining the intentions of my research and asked permission to allow players to complete questionnaires based on their knowledge and understanding of concussion, as well as participant consent form (Appendix 2) for their permission to take part within the study. BERA (2018) states that having voluntary informed consent allows the researcher to begin researching because the participations are at the stage where they have agreed and understood how the research affects themselves and others involved. Berg and Latin (2008) suggested that informed consent is not just seen as a paper exercise, but the participants are given, and understand all the necessary details to give them the option to make a fully informed decision to participate or not. The consent form for both the questionnaires and the interviews both clearly state that

participants have the right to withdraw from the study whenever they feel like they need to. BERA (2018) states that the participants who agreed to be involved within the study do not have to provide a reason as to why they may wish to withdraw. However, it is important as the researcher to investigate and reflect on the actions to determine if they influenced the decision to withdraw. As Hack (1997, p.37 in Blaxter, Hughes, & Tight, 2001) emphasises 'it is worth standing back for a moment and considering what effect your actions might have on others as the result can be quite damaging to yourself'.

Throughout the entirety of the research project, I ensured that there was no exaggeration of deception and ensured that my aims and motives for completing the research were clearly stated in all of the consent forms handed out and also verbally explained them to the individuals who took part and those who wanted to ask general questions about my research. It was also important to make sure that there was no offensive or discriminatory language used both in the written consent forms and verbally. This prevented any emotional harm that could occur through participants who I made contact with and ensured that there was no misleading information. The American Psychological Association (APA) (2017) suggests that conducting research requires following well-established ethical guidelines, principles and codes of conduct. Therefore, within these guidelines, important ethical approaches are established (e.g., causing no harm, informed consent and confidentiality) that researchers need to ensure take place before, during and after the collection of their data (Tracy, 2010). Thus, the ethical guidelines that were used within this research followed BERA (2018) protocols and participants were given a broad depth and had a strong understanding concerning the research that was being carried out.

Before the research project was carried out, communication was mainly going to be face to face, regarding handing out and returning questionnaires and the arrangement and completion of interviews. However, due to the current COVID 19 pandemic, organising the handing out of questionnaires and discussing the schedule of completing interviews were conducted through social connection platforms. My ethics forms that were submitted did state that the collection of my data may have to change dependent on the current government restrictions put in place.

Under ethical agreement from the Ethics Committee, false names were created for the participants that are discussed within the research. It is important for false names to be used instead of their names to maintain both the participants' confidentiality and anonymity. The google form will collect the results from questionnaires and can categorise sections such as gender and age, which will make it easier to represent each participant as a unique number. Due to the fact that this study involves gender analysis, it is important to clearly distinguish in the data analysis which are males and which

are females (Given, 2015). I ensured that all the appropriate measures to keep the questionnaires, interview recordings and transcripts were in a pin protected computer/phone to main confidentiality of all the individuals involved.

3.11 Data Analysis

Data analysis has previously been described by Thorne (2000) as the most complex and mysterious of all phases of a qualitative project, and one that receives the least thoughtful discussion within literature. It is an ongoing and elaborate process. Dickie (2003) has suggested that data analysis in qualitative research has been deemed more favourable than quantitative data analysis as it can help perceive a given situation in a new stance. On the other hand, previous qualitative research papers have lacked a clear description of the methods used when analysing data, or, when included, the terms that have been used to describe data analytic methods are often used incorrectly, or are mislabelled entirely (Sandelowski 2010). Certain terms describing qualitative data analysis have either carried a variety of definitions or lacked clear definitions. Nowell et al., (2017) has proposed that this leads to a lack of clarity, making it harder for readers to understand how the use of data analysis was performed, as well as how to interpret findings. It also gives the perception that qualitative research is less rigorous than quantitative research (Clarke and Braun, 2013). Therefore, for the researcher to create new and undiscovered knowledge from the data, they must engage in a form on analytical process.

3.11.1 Questionnaire Data Analysis

The first stage was descriptive statistics, as this is how it has been presented within the results section as well as analysing statistic differences (see Chapter 4). To analyse the data that was collected through questionnaires, the Statistical Package for the Social Science 26 (SPSS) was used. As well, Levene's (1961) test for quality variance was used to examine areas of statistical significance ($p < 0.05$). This is where a series of univariate analysis of tests were carried out to establish if any independent variables (gender, setting, playing position) had any impact on the player's knowledge and understanding of signs and symptoms and return to play protocol of concussion. To be able to investigate the effectiveness of independent variables on dependent variables, tests can be used to determine whether there is a statistical significance value of below $p < 0.05$, as this suggests that there is a 95% chance of the findings representing a larger population (Field, 2017). He also suggests that this figure is universally known within academics, determining whether a fixed factor has an impression of a dependant variable.

This research also used MANOVAs to explore data by coding each form, response and variable into a number, e.g., males were identified as 1 and females were identified as 2. As well as that, each subgroup was labelled from 1-4. From here, the researcher was able to process the data through SPSS with a variety of independent variables, to investigate whether particular factors had a statistically significant effect ($p < 0.05$). As well as this, the Bonferroni Post-hoc test was utilised after MANOVAs, as Field (2017) has suggested that this test is a useful tool to reduce any possibility of MANOVAs accumulating false statistical significance ($p < 0.05$), therefore, increasing the validity of the research. After this, the researcher was able to return to the original data to be able to create visuals graphs and charts to clearly show results from questionnaires. This data as a whole was then able to be analysed, where the statistics coincided with each other alongside the literature which followed on with a discussion. This gave the researcher the conclusions of participants' current knowledge and understanding of concussion, which ranged from the signs and symptoms of acknowledging a concussion, the return to play protocol involved after sustaining a concussion and useful information currently available on the topic.

3.11.2 Interview Data Analysis

Through the interviews, the use of thematic analysis (TA) was employed to analyse qualitative data that entails searching across sets of data to identify, analyse and report repeated patterns (Braun & Clarke 2006). TA is a method for describing data, but also involves interpretation in the processes of selecting codes and constructing themes. A distinguishable feature of TA is its flexibility to be used within a wide range of theoretical and epistemological frameworks, and can also be applied to a variety of study questions, designs and sample sizes. Sparkes & Smith (2014) suggest that thematic analysis:

'Is a relatively straightforward and flexible form of qualitative analysis. A strength is that it highlights similarities and differences across the data set. It summarises key features of a large body of data. With a strong emphasis on interpretation, it has the potential to push the researcher toward deep, freewheeling aesthetically satisfying interpretation of the data' (Sparkes & Smith, 2014, p.124).

By analysing differences between gender and age within concussion knowledge/understanding, using thematic analysis will help identify these key features and gaps in the knowledge of one subgroup in comparison to another.

Braun and Clarke (2006) argue that the use of TA can be used as an analytic method, and can be seen as foundational for other qualitative research methods. In a number of interpretivist orientations (e.g., constructivism) TA can put emphasis on social, cultural, and structural contexts that influence individual experiences. This allows for the development of knowledge that can be constructed through interactions between the researcher and participants, revealing the meanings that are socially constructed (Braun and Clarke, 2006). Joffe (2011) has suggested that the use of TA is well-suited to constructivism because, through the process of analysing a wide sample of data, it can create a picture of how a certain social construct develops. Constructivist thematic analysis will search for deeper themes within data. Social constructs that will be looked for within the data will include if they have had any prior information regarding concussion as well as the current knowledge/understanding of concussion that they have acquired. With the use of thematic analysis, it will be able to highlight social factors into players' knowledge and understanding of concussion such as how long they have been involved in the sport or how many concussions they have encountered in their rugby career. Eighteen themes were first identified when reviewing the transcripts and these were reduced down into which were highlighted as more important, leaving eight themes to identify.

To ensure that a successful process of thematic analysis was used, the researcher followed Braun and Clarke (2006) guide.

Steps	Why?
1. Familiarizing yourself with the data	<ul style="list-style-type: none"> Understand what data has been collected and why it's important
2. Generating Initial Codes	<ul style="list-style-type: none"> To make analysing the questionnaires easier
3. Searching for themes	<ul style="list-style-type: none"> Finding themes that are relevant to the project title
4. Reviewing themes	<ul style="list-style-type: none"> Were there clear themes intended to look for or were some more apparent from seeing the results of questionnaire?
5. Defining and naming themes	<ul style="list-style-type: none"> Makes converting the answers from questionnaires into results when clear themes are identified
6. Producing the final report	-

3.12 Conclusion

Throughout this chapter, the fundamental methodological and epistemological discussions have been outlined and applied to the research project. By addressing these, it should allow for a successful investigation into evaluating rugby union players' knowledge and understanding of concussion as well as gaining a deeper understanding of how participants perceive concussion. The methods that have been used within this research project will identify players' knowledge and understanding of the impact of concussion. The chapter described the importance that using a mixed method approach can have on research, by being able to analyse both the qualitative and the quantitative data throughout the study. The next chapter of the discussion will give the reader a clear understanding of the research findings.

4.0 Results

The following chapter will present **quantitative data through** the questionnaire which will be shown by comparisons by gender, setting and position. The qualitative data will be presented through thematic analysis within the discussion. The following will also present the findings in the form of bar graphs and pie charts. **The following results consisted of 18 male university players, 16 male club players, 9 female university players and 19 female club players.**

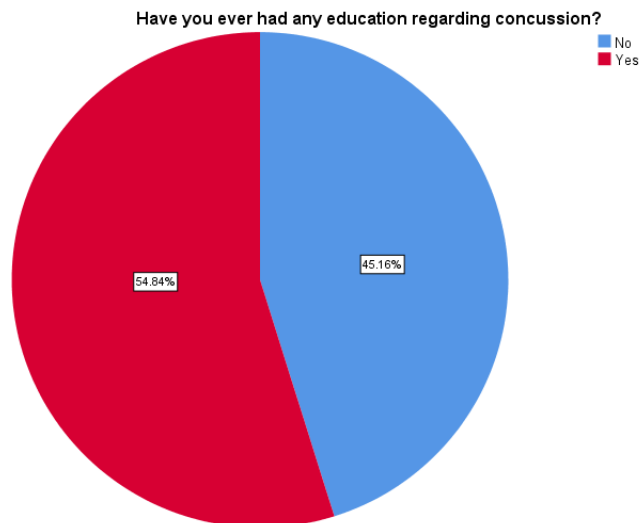


Figure 1 shows that overall, 54.84% (n = 34) of people have had information regarding concussion. Participants from club settings had more education with 61.8% (n = 21) than those from university settings with 38.2% (n = 13). The data tells us that those participants who were at a university setting responded mainly no and that there was a small number of yeses. There was no significant difference for setting ($F = 1.445, p = 0.234$) or for gender ($F = 0.562, p = 0.458$).

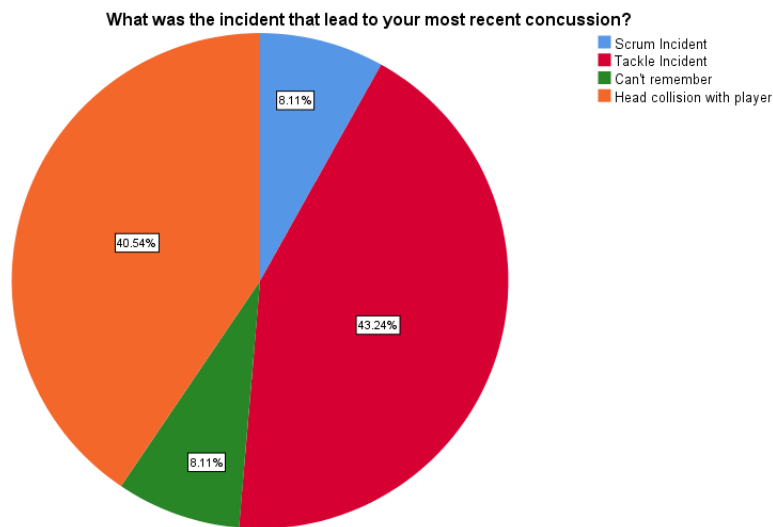


Figure 2 shows 25 participants did not have a recent concussion and therefore the data focuses on those who have had an incident due to the nature of the question, to prevent the data being misleading by those who have not had a concussion.

In regards to gender, there was a significant difference ($F = 4.131, p = 0.047$). Out of the 43.24% of participants who answered that tackle incident was their most recent cause of concussion, 9 were men and 6 of these were men from a club setting.

There was no significant different in terms of incident and playing position ($F = 1.262, p = 0.280$). From the 40.54% ($n = 15$) of participants who said that head collision with another player was the incident that led to their most recent concussion, 9 of these were forwards, and 5 of these were men.

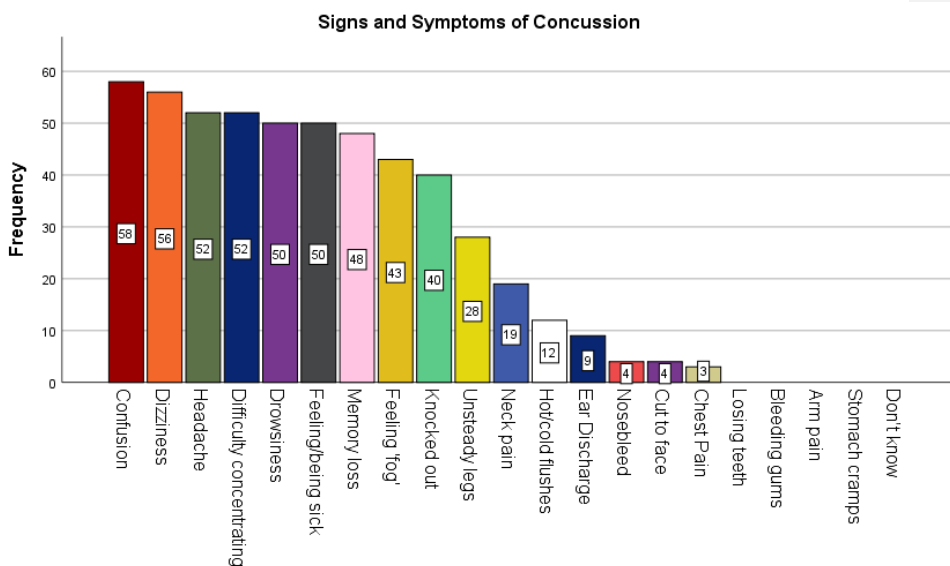


Figure 3 above shows the overall frequencies from the multiple response open question that asked participants what they believe are the most common signs and symptoms of concussion. The figure illustrates that the signs and symptoms most commonly associated with concussion was that of confusion, with 58 responses. When further analysing the setting, similar responses were reported, but for confusion more reports came from the club setting (n = 33) than from university setting.

From the table, we can also see that the second most common answer was dizziness with 56 respondents selecting that answer. Out of these respondents, 32 of these were from a club setting and 24 being from a university setting, meaning there is no difference identifying the specific system between settings.

The figure also shows 19 participants answered that neck pain was a common sign and symptom of concussion. From those 19 participants that responded with neck pain, 10 were males and 9 were females. Neck pain, ear discharge, nosebleed, cut to face and chest pain are not signs and symptoms of concussion, which shows that they do not have the full knowledge and understanding of concussion.

Do you think a player who has shown signs of concussion be allowed to remain on the field of play if they feel fine and have no signs of concussion?

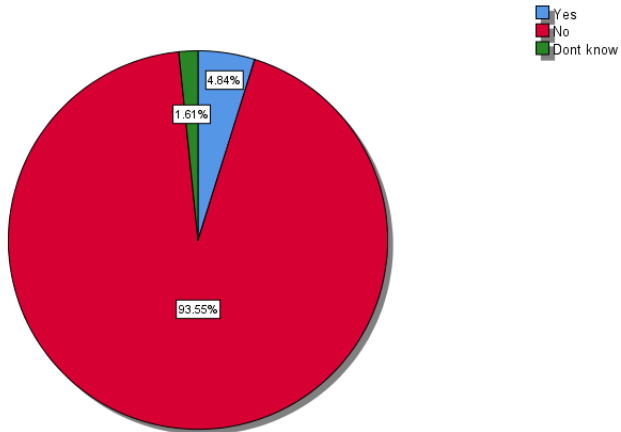


Figure 4 (above) shows that 93.55% ($n = 58$) of participants believe that a player who has shown signs of concussion should not be allowed to remain on the field of play even if they feel fine. 4.84% ($n=3$) of participants believe that they should still remain on the field with 1.61% ($n = 1$) unsure. There was no significant difference in terms of gender, setting and position ($F = 2.299$, $p = 0.076$).

Although only a few participants would allow a player with signs of concussion to remain on the field of play, those participants who did suggest this, were mainly male and from a university setting ($n = 2$).

Which of the following do you think is the next step for a player who has sustained a concussion and has been symptom free for 24 hours?

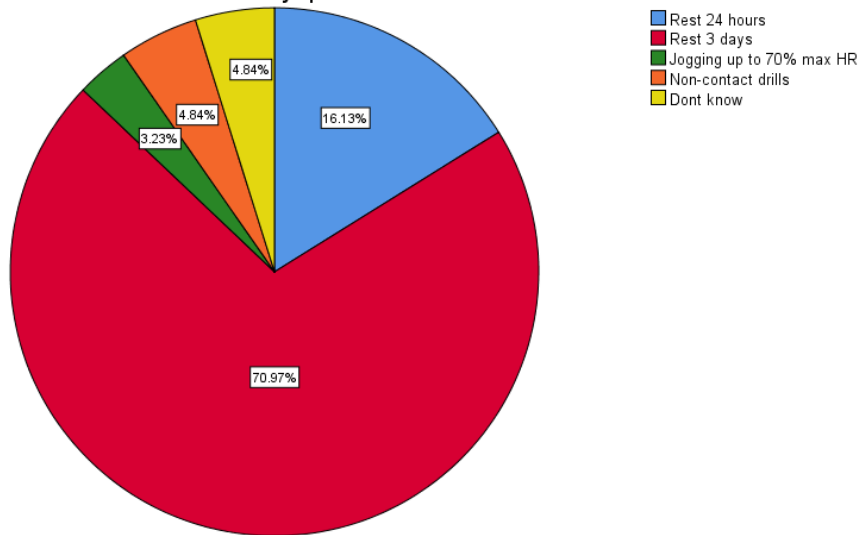


Figure 5 shows responses regarding what participants believe is the next step for a player who has sustained a concussion and has been symptom free for 24 hours. There was no significant difference in terms of gender ($F = 0.045$, $p = 0.830$). 70.97% ($n = 44$) of participants believe players should rest for 3 days. The data showed that 18 (out of 44) participants were females, and 26 participants were males.

In terms of setting, there was no significant difference ($F = 0.136$, $p = 0.715$). Overall, 56.8% ($n = 25$) of respondents who answered rest for 3 days were from club setting, with 52% ($n = 13$) of those from club setting being females.

In terms of position, there was no significant difference ($F = 1.367$, $p = 0.258$). Out of the 16.13% ($n = 10$) of participants who responded with rest for 24 hours, 50% ($n = 5$) were both forwards and backs.

12.9% ($n = 7$) responded saying no rest was required, with answers including jogging for up to 70% max HR, non-contact drills or don't know. Out of these 7 participants, 4 participants were men and 3 were women, showing that there is no difference between gender. There was also 4 from club and 3 from university, also showing there is no difference in setting.

What do you think is the minimum time a player should have off EXERCISING once all symptoms of concussion have resolved

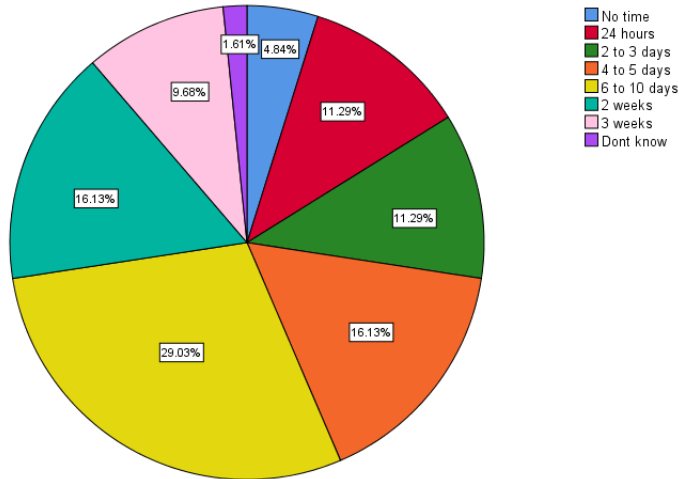
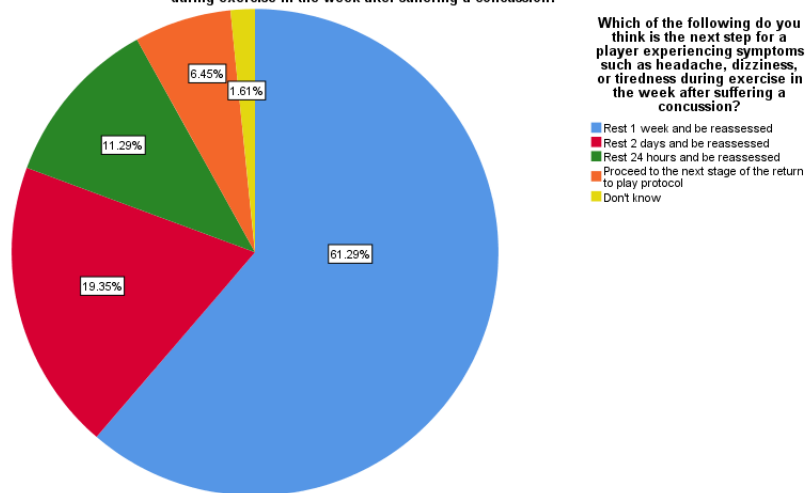


Figure 6 above shows that there was no significant difference for position ($F = 1.404$, $p = 0.244$). From the data, there is much confusion as to what is the minimum time off from exercise and the variance went from 24 hours, to 3 weeks as to being unaware. Out of the respondents 29.03% ($n = 18$) said that players should rest for 6 to 10 days. Out of these, 12 (out of 17) participants were forwards and 8 of those forwards were men. The figure shows that the most common response (6 to 10 days) is a lot longer than the recommended amount (2 to 3 days).

In terms of gender, there was no significant difference ($F = 0.006$, $p = 0.938$). Overall, 88.7% ($n = 44$) of participants responded with either too short of a resting period or too long of a resting period. 31 (out of 44) participants who suggested these answers were males with 13 being females, suggesting that males are more unaware of the length of time from recovery.

In regards to setting, there was not a significant difference ($F = 0.170$, $p = 0.683$). The data shows that 6.5% ($n = 4$) participants believe that players do not have to rest by either suggesting that they either spend no time recovering or do not know. Out of these 4 participants, all of them were from a university setting, suggesting that those at university do not have a full knowledge and understanding of concussion.

Which of the following do you think is the next step for a player experiencing symptoms such as headache, dizziness, or tiredness during exercise in the week after suffering a concussion?



Which of the following do you think is the next step for a player experiencing symptoms such as headache, dizziness, or tiredness during exercise in the week after suffering a concussion?

- Rest 1 week and be reassessed
- Rest 2 days and be reassessed
- Rest 24 hours and be reassessed
- Proceed to the next stage of the return to play protocol
- Don't know

Figure 7 above shows what participants believe is the next step for a player experiencing concussion symptoms in the week after encountering the concussion. There was no significant difference between genders ($F = 0.621$, $p = 0.436$). From the data, we can see that 61.29% ($n = 38$) of participants believe that players should rest for a week and be reassessed. Out of those 61.29%, 63.2% ($n = 24$) of participants were males and 50% ($n = 12$) were split between university and a club setting.

The pie chart also shows that 38.7% ($n = 24$) of participants were either incorrect of what to do if signs and symptoms are still occurring or are unsure of what to do. Out of these 38.7%, 13 were from a club setting and 11 (out of 24) were from a university setting, suggesting that there is no difference in the misunderstanding of knowledge for either university or club setting participants. The data also tells us 8% ($n = 5$) of participants have a misunderstanding of what concussion is as they believe that no rest is required as they suggested either proceed to the next stage of the return to play protocol or were unsure. There was no significant difference between setting ($F = 0.021$, $p = 0.844$). Out of that 8%, 60% ($n = 3$) of those were from a club setting and 66.7% ($n = 2$) were females.

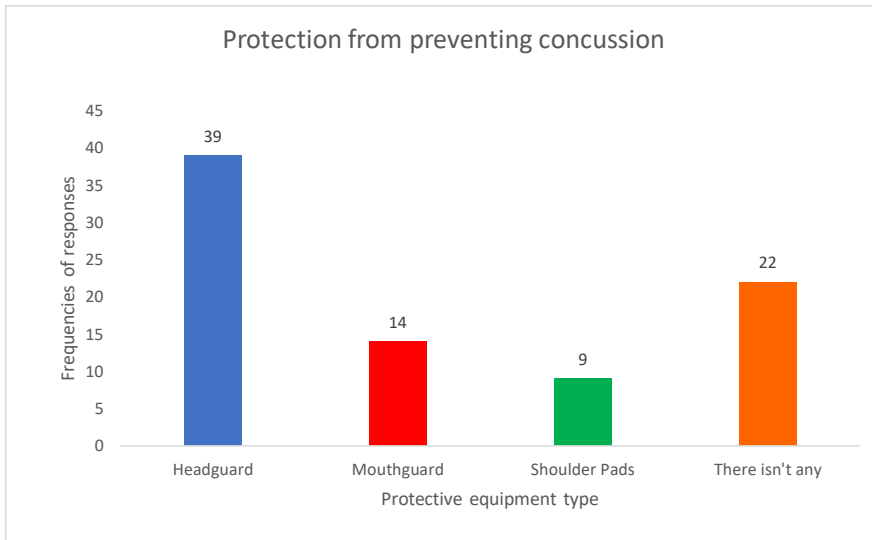


Figure 8 above shows the overall frequencies from the multiple response open question that asked what protective equipment participants believed prevent concussions. The most common answer was headguards, meaning that shoulder pads and mouthguards will not be analysed. The pie chart above shows that 39 participants believe that headguards are a form of equipment that prevent concussion. In regards to position, 24 (out of 39) who responded headguard, 22 of those were forwards, with university and club settings being split. Yet this response is misunderstood information about preventative equipment as headguards, mouthguards and shoulder pads are not designed to prevent concussion.

The data also shows that 35.5% (n = 22) believed that there is no protective equipment that can prevent concussion. Out of those participants 50% (n = 11) were split from a university and club setting, with 54.5% (n = 6) being males from a club setting.

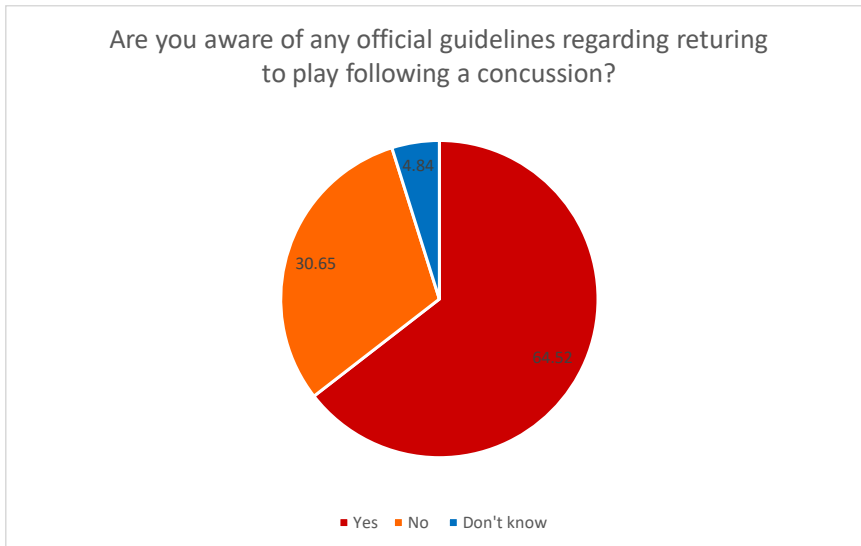


Figure 9 shows that 64.5% (n = 40) of participants were aware of any official guidelines regarding returning to play following a concussion, yet 30.64% (n =19) had no awareness of the guidelines and 4.6% (n = 3) unsure of any official guidelines.

When playing position is considered there were no significant differences in terms of position and levels of awareness of official guidelines (F=0.722, p = 0.611). The data showed that there were more forwards (22) who were aware of the guidelines, in comparison to the backs where 18 (out of 40) were aware. However, from those that were not aware of any official guidelines, 10 participants were men and 8 out of those 10 were forwards.

When setting is considered, out of the 40 participants who responded with yes, 62.5% (n = 25) of those were from a club setting and 37.5% (n = 15) of those were from a university setting meaning that there were no significant differences (F = 2.377, p = 0.131). The data did show that those within a club setting were more aware of the official guidelines (n = 25) compared to those in the university setting (n = 15).

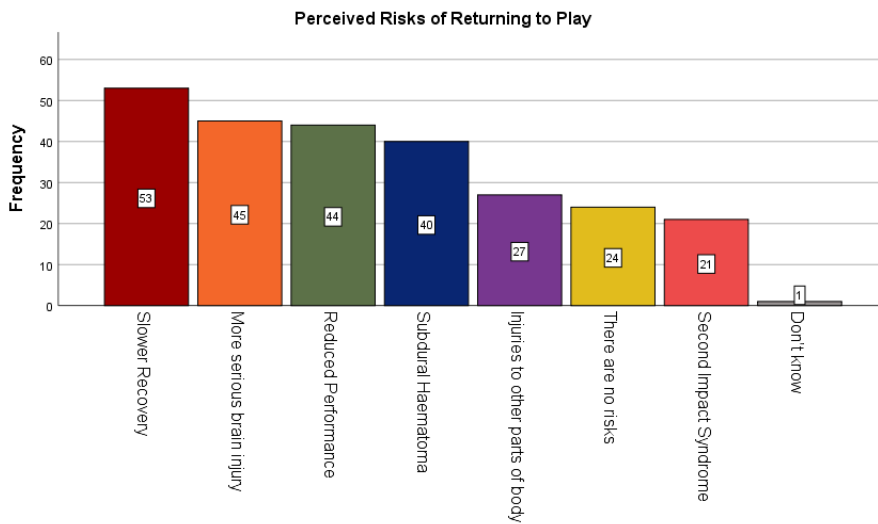


Figure 10 above shows the overall frequencies from the multiple response open question that asked what are the potential risks of returning to play when concussed. The chart shows that the most common risk believed by participants was a slower recovery from existing concussion with 53 participants responding with this answer. Out of these responses, 28 were men.

The second most common answer was more serious brain injury which was answered by 45 participants. There was no difference with position, as 25 of these participants were forwards and 20 were backs.

However, from the chart, we can see that 24 participants believed that there were no potential risks when it comes to returning to play when concussed. Those who thought that there were no risks, showed a higher percentage from a club setting with 70.8% (n = 17) than a university setting with 29.2% (n = 7), meaning those from a university setting are more worried about there being risks in comparison to those from a club setting.

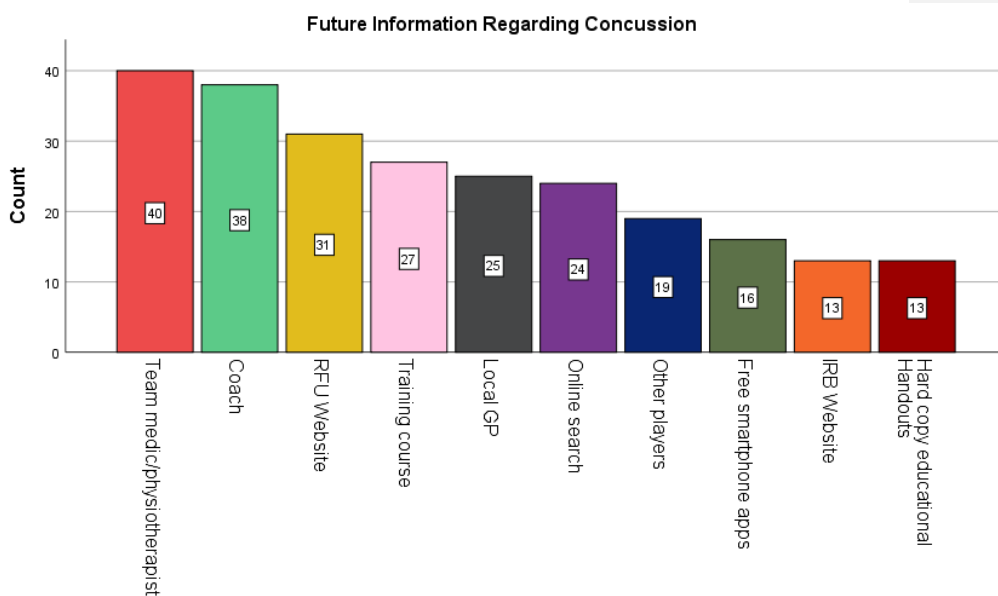


Figure 11 above shows the overall frequencies from the multiple response open question that asked participants how they think future information regarding concussion should be published. The most common answer on the bar chart shows that participants would prefer to obtain future information from a team medic/ physiotherapist with 40 responses. Out of these respondents, 22 were from a club setting, and 8 of those club responses were males.

The data also shows that the second highest response from participants was through a coach. Out of the 38 participants who responded that they would prefer future information through a coach 20 of these were females. 11 (out of 20) of the females who responded preferred a coach as future information regarding concussion were forwards.

The data also tells us that the least common answers given by participants were hard copy handouts and the IRB website. These options were selected 26 times and out of these, 18 of these were selected by males.

Discussion

4.1 Introduction

The purpose of this chapter is to present and discuss the data collected both from the questionnaires and the semi-structured interviews (of just the captains). This reveals new insights and opinions on rugby union's players' knowledge and understanding of concussion, comparisons will be made within the discussions linked to the player's gender, setting and position. For clarification the focused areas for this will be as follows

- The current knowledge and understanding of concussion
- The current knowledge and understanding of the signs and symptoms of concussion and prolonged concussion
- The current understanding of the use of protective equipment in preventing concussion
- The current understanding of return to play action following a concussion
- The difference between grassroots and professionals

4.2 Current Knowledge and Understanding of Concussion

The data from the questionnaires and the interview transcripts suggests that there was a 50% (see figure 1) mix regarding current knowledge that participants had of concussion, including the available educational resources. Due to the increased risk of injury that comes with playing sports, especially in contact sports such as rugby, Sarmiento, Donnell & Hoffman (2017) has suggested that there is need for improvement of concussion education programs, which should increase concussion knowledge amongst individuals who are likely to sustain a concussion. This is also a cause for concern as players should be given access to the available resources after sustaining a concussion, when seeking medical care because they are at an increased risk of encountering future concussions. Due to the 50% mix in this research, this indicates that there is great variation and misunderstanding, therefore, more information is required. Recommendations could include an educational induction regarding concussion when joining the game to outline the severity that concussion can have and how this information will look after you. This could also include an educational A4 handout in a mandatory first aid kit including what signs and symptoms to look for when a player has taken a knock to the head, the correct return to play protocol following a

concussion and information regarding protective equipment. This handout should be mandatory for all training sessions and matches, where it is the captains/ designated concussion specialist players' responsibility to make it available at all games.

As captain of the men's club team, Michael, stated that he has gained his current knowledge and understanding of concussion through coaching the younger age groups. He explained

'Part of being a coach involves doing the Headcase stuff from the RFU, so I'm quite aware of it all, but when I'm playing in the men's team, as a captain, its really difficult because you're playing, and we don't have a coach on the side-line and is something that should be looked at'. (Michael, Club Captain, Centre).

As Parsons (2014) has claimed, within the United States, all active NCAA (National Collegiate Athletic Association) members are required to have a concussion management plan on record, as well as providing athletes with educational material. This could be a reason as to why there is a gap in player's knowledge, which is a recommendation that rugby players should also have. Therefore, if this was to be implemented for rugby within the UK, the knowledge of concussion will be increased, resulting in more caution when an injury occurs. Michael was the only participant from the interviews who was able to identify any educational available resources regarding concussion, such as the *Don't be a Headcase* program. The other three captains did not talk about any educational resources, which questions whether they knew about them meaning that they are not sharing this knowledge with their teams as a captain's responsibility, therefore, you cannot expect the players of them teams to know it. Therefore, a recommendation should include that these resources should be talked about more by including monthly or seasonal interventions which outline what these programs are and how they can be accessed, and this should be integrated into the club and university setting.

Amy, Sasha and David all identified that there are available resources regarding concussion but could not identify specific programs. This vagueness in these resources would indicate that they are not accessing them regularly themselves or sharing them with their players, something as a captain it might be recommended that they do more in the future. This is illustrated by David who stated,

'I know there's a lot that's getting out now, and I think a lot more studies are getting done now'

And, with Sasha stating,

‘I think there’s enough information out there, but you’ve just got to go and find it’.

This suggests that if individuals want to broaden their knowledge of concussion, they must find out the information themselves, as no information is given out. This allows for future recommendation that it should be the norm that there is an A4 educational handout within a first aid kit which should be mandatory at all games for both university and club setting. This would allow for easy access for both the captains and players to support the injured player. Our research supports Bramley et al.’s, (2012) idea that greater concussion knowledge has been correlated with improved reporting behaviours in youth athletes, however, there is a lack of evidence supporting the fact that young athletes are sufficiently educated. The players from a university setting may have been at a youth level in 2012, and therefore may have had access to the greater knowledge that Bramley et al., (2012) reported on. This would therefore suggest that those in the club setting who were slightly older and not youth level in 2012, would still need educating as they would have missed out on the targeted youth approach as they may have been forgotten in the educational process and this needs addressing. Anyone who started playing rugby as an adult would need extra support in educating due to missing out on the youth focused education. There were no significant differences between knowledge and understanding according to setting, therefore, the data indicates all could benefit from further education to improve knowledge and understanding.

Both questionnaires and interview transcripts investigated the lack of awareness of concussions that a sample of the participants had. Through analysing the transcripts, it was clear that all the participants had different ideas in which they were unaware of the effects that concussion can have. It is firstly important to point out that the findings from this research should be considered in the management of sports related concussions. Concussions at all levels of sport are considered as a relatively common occurrence.

McCrea et al., (2004) reported that players who fail to report a probable concussion whilst participating in contact or collision sports such as rugby expose themselves to a heightened risk to more serious effects associated with a second injury if they continue to participate while still symptomatic following their initial concussion. Despite all this awareness, and targeted programs for these organisations, it is still evident in rugby that the full understanding of concussion is not there. This is evidence from Amy who suggested that she continued to play on after sustaining a concussion as she responded with

‘I do believe I have but I was a silly first year at Uni and I didn’t listen’.

This may be due to her lack of awareness of the long-term effects of concussion.

This attitude is reflected in the questionnaires as well as there was no difference in behaviour between males and females.

The recommendation from the data is that there is a need for all to have more education links specifically to the most recent research from Beakey, Tiernan and Collins (2021) who found a wide disparity in educational history received by athletes with 46% of their sample claiming previous education on sport related concussion. Again, emphasising there is still a great need to support all in knowing and understanding concussion more.

The effects that concussion can have on individuals is a universal effect, meaning that no matter what region you are in, the effects that concussion can have on an individual will be the same. Despite the fact in America there have increased concussion education of current athletes by state legislatures (NFL, 2012), National Collegiate Athletic Association (NCAA, 2010), and professional sports leagues (NFL, 2010) and an increase in awareness of concussion among the general public as a result of increased media attention, it is still unclear whether this shift in understanding of the definition of concussion can correlate to current and former athletes. Therefore, if these education resources are widely portrayed within the media, it can give players and former players what information is available and how it can be found. Research from Andrikopoulos, Montenegro & Stern (2014) suggested significant decline in the rate of reported concussions relative to studies that were reported in the 1980s, however it has been agreed that published studies are likely to underestimate the overall rate of concussion for athletes participating in contact or collision sport. Therefore, it is interesting to see if 40 years later, underreporting rates are still at the same level or whether these scores have gone down over time.

Shenouda et al., (2012) found that adults who had participated within an education program within the last year reported greater confidence in their knowledge of concussion management and improved familiarity with concussion protocols, this was reflected in Michael's interview.

Michael also suggested that adults who teach kids are more likely to have a better knowledge and understanding of concussion in comparison to those who do not coach. He stated

‘Those who are 30 and over do not take concussion seriously. I think the men who coach adults and kids do get it, I think it's a lack of knowledge and a lack of understanding’.

This suggests that ‘men’ who coach give the assumption to parents who are allowing their children to be coached by that parent coach that they have sufficient knowledge and understanding of concussion, resulting in them feeling more confident. This could allow in the future that all coaches

must go through a mandatory concussion program at the end of each session to ensure the sufficient knowledge is there. This is supported by research studies from Shenouda et al., (2012) who have examined the understanding and knowledge of sport concussion among athletes and parents, coaches, trainers, physiotherapists and medical personnel and have found that there is limited, incomplete or a lack of standardised knowledge, reinforcing the need to provide more knowledge of concussion. This emphasises and compliments the previous recommendation of a mandatory educational A4 handout located in all first aid kits. Therefore, Sarmiento, Donnell & Hoffman (2017) have suggested that given the increased risk of injury especially that comes with playing sport, the trend demonstrates the need for improvement regarding concussion education programs, which should therefore be able to increase knowledge among individuals who are likely to sustain an injury. **Future recommendation to enhance policy and education should include participants having an available A4 handout for players, so they can see the correct signs and symptoms and return to play.**

4.3 Signs and Symptoms of Concussion

The analysis from the transcripts as well as the questionnaires suggests that 75% of participants can identify most of the common signs and symptoms, however some participants were unable to identify these, with some participants choosing answers which were in fact not even signs or symptoms. This shows that some participants are confused and not up to date as to what concussion is, as these answers were put there purposively to see if they ticked every answer or whether they had true knowledge of concussion.

From the questionnaires, confusion, dizziness, headache and difficulty concentrating were the most common answers given when asked what participants believed were the most common signs and symptoms of concussion. The questionnaire data is very similar to Delahunty et al.'s, (2015) study where headaches and dizziness were also the most common symptoms identified by high school rugby players in Ireland. Our results showed that the most common answer was confusion, but the second and third most common answers were dizziness and headaches. These were also shown within the transcripts where all of them were able to answer at least one of the most common answers. This also suggests that the participants had some knowledge, but they did not have full knowledge, which should be mandatory for captains. Future recommendations could include the captains being in charge of the mandatory A4 educational handout as it will strengthen their knowledge and understanding. Griffin et al.'s, (2017) research showed that the concussion symptom

recognition scores revealed players possess a satisfactory level of knowledge in this area. Griffin et al.'s (2017) study also found that both groups of players were better at identifying known signs and symptoms than 'distractors' meaning players may be more proficient in identifying concussion than ruling it out. This shows that there is still confusion regarding identifying signs and symptoms so the educational resources will still be beneficial due to knowledge being underneath the satisfactory level.

Signs and symptom responses have been reported as being slightly different internationally, whilst at the same time being generalised universally. As Salmon et al., (2020) has stated, consistent findings in signs and symptoms of concussion would suggest an international trend and highlights specific symptoms which are universally well recognised following a concussive event. Viljoen et al., (2017) were able to find that New Zealand high school players were able to correctly identify symptoms with 86% in comparison to South African players who were able to report 66% correctly. Both scores reflected our research (see figure 3) regarding identifying signs and symptoms. The most identified signs and symptoms in our research was confusion (94%) and dizziness (90%), in comparison with the New Zealand and South African high school study which had a 77% response rate for confusion and an 84% response rate for dizziness. This also raises the question of are they receiving more education information regarding concussion in comparison to the UK?

When asked what they believed were the most common signs and symptoms of concussion, Amy responded with

'I should do because it's part of my role as a captain, but you've obviously got dizziness, being knocked out for a starter, headaches after a blow to the head, yeah that's about it'.

Like Amy who suggested that getting knocked out was a sign of concussion, Griffin et al.'s (2017) findings showed that only a small minority (5%) incorrectly responded that a loss of consciousness was required to diagnose concussion. This is significantly lower than our research which found that 66% (40 out of 62) recorded that getting knocked out was a common sign of concussion. This emphasises that players believe that they feel the need to be knocked out to be concussed, suggesting that if they encounter other symptoms, they will not take them as seriously. Therefore, it is recommended that the educational handout regarding concussion needs to put emphasis on the other common signs and symptoms that players need to look out for. As well as this, there were also responses to the questionnaires that were not signs and symptoms of concussion such as chest pain, cut to the face or nosebleed (see figure 3). Theadom et al., (2020) supported our research as they found that whilst there was a high awareness of the common signs and symptoms of concussion to support recognition of concussion, there was also a high false positive rate on non-symptoms (such

as pain in the neck and neck weakness). Our research included different non symptoms (see figure 3) as to Theadom et al., (2020) but still showed a high response rate with 14% (9 out of 62) answering with ear discharge and 30% (19 out of 62) responding with neck pain. The results showed that a lot of people are confused regarding the signs and symptoms of concussion, and that the recommendation for the mandatory A4 concussion handout will outline what are the symptoms and what are not. It is important to identify what are not the signs and symptoms as the results showed a high response in distractors. One thing to consider is that when asking common signs and symptoms within concussion in the questionnaires, participants were given a list of answers for them to choose from, where they could select multiple answers. In contrast to the interviews, where the participants had to answer the question with no prompts or answers. This could be a potential limitation of the study (see chapter 5.2).

Sasha reported that she experiences different signs and symptoms of concussion in comparison to her brother who also plays rugby. She stated

‘He gets really confused and doesn’t know where he is, I get hyper emotional where my emotions just sky rocket, I feel slower and feel all dazed like I’m in a fog, if I’m looking at someone else, I would be seeing if they’re stable on their feet and if they’re retaining information, so If I tell them to pass it right 3 times and it’s still going left, I would wonder if they’re okay’.

Although Sasha identified that feeling in a fog and drowsiness were common signs and symptoms of concussion, Chapman (2018) found that the least commonly identified symptoms were ‘feeling slowed down’ or ‘feeling in a fog’ and drowsiness’. This emphasises Carney et al.’s (2014) point that special attention must be given to the influence of aspects such as non-pathological features (e.g., fatigue) and sex (Combs et al., 2019) in tests results and in symptom recording.

Theadom et al., (2020) found that the low specificity of knowledge about the symptoms of concussion could differentiate from broader head injuries, more severe Traumatic Brain Injury (TBI), spinal cord injury and indicators that may make someone check for concussions but may not be direct symptoms such as black eye. Research from Bagley et al., (2012) has found that a 30-minute concussion education program administered to young athletes can help them better recognise the symptoms of concussion. Results from Robbins et al., (2014) have suggested that providing a current definition of concussion to at-risk populations may help increase proper identification of these types of injuries through recognition of concussion symptoms.

Feiss et al., (2020) have suggested that a problem with the educational programs is that many of these programs include little or even no information regarding sleep disturbances, specific details for

youth athletes and emotional symptoms. This gap of knowledge within educational resources suggests that individuals will not have a full understanding of all the signs and symptoms of concussion if some of them are not listed, meaning that the ones that are noted are misleading. This is also why Feiss et al., (2020) have explained that there are gaps regarding specific knowledge in these topic areas and suggested that all programs need to include additional information to reduce the limited specific knowledge gaps. Salmon et al., (2020) have suggested that there needs to be careful use and clarification around the terminology of 'concussion'.

4.4 Protective Equipment

Both the data from the interviews and the questionnaires identified 62% (39 of the participants) believed that headguards are the most common piece of equipment that can prevent concussion. Harmon et al., (2019) have found that headgear in rugby has been shown to lessen transmitted impact and prevent skull trauma, intracranial bleeding and cosmetic damage. However, McIntosh & Patton (2015) have stated its effectiveness in preventing concussion has not been clinically proven. This research shows that there is also confusion in the literature, therefore, it is not a surprise that there is confusion with responses from the answers in the questionnaires. Barnes, Rumbold & Olusoga (2017) in a research study found that 37% of their players believed that headguards were either 'quite' or 'extremely' effective in preventing head injuries, with youth players more likely to hold this view than any other playing groups. This finding was significantly lower than our research findings. Barnes, Rumbold & Olusoga's (2017) research focused on youths, whereas our research combined university students and adults from a club setting. This could lead onto future recommendations within an educational handout that the focus of headgear needs to emphasise the ineffectiveness in preventing concussions. This is supported from Amy's interview transcript who was from a university setting by saying

'I know that headguards can prevent concussion because they soften the blow from hard impacts from either force to the floor or force from another player'.

Barnes, Rumbold & Olusoga (2017) have suggested that at youth level, initiatives should aim to focus on players, parents and coaches to reinforce appropriate attitudes towards headgear use. This is a cause for concern as if players believe that headguards can prevent concussion, they may feel as if they will never encounter a concussion. However, from both males in the interviews (David and Michael) they knew that the use of headguards did not prevent concussions as Michael stated

'I know there's none, I've seen a lot of research where people are proving that they prevent certain head injuries but can't prevent concussion. I think players have the perception that they can prevent concussion which makes them feel more comfortable meaning that they go harder into contact and don't have any fear as they feel indestructible'.

This supports Harmon et al., (2019) as they have raised concern that the use of protective equipment in sport can encourage more aggressive actions which increases potential injuries. Previous research from Hagel & Meeuwisse (2004) has suggested that some players when playing can become overly reckless when wearing protective equipment. The concern with this is that it can heighten the chances of any form of injury as players will have less fear when going into a tackle or any form of physical contact within the game. Research has also found that 67% of youth players felt that when wearing a headguard, they felt more confident and are able to tackle harder (Finch, McIntosh & McCrory, 2001), whilst senior players who believed that headguards prevented concussions were four times more likely to play with an aggressive technique (Menger, Menger & Nanda, 2016). This then suggests that actions may become more reckless and therefore, may lead to more concussions. For the past 20 years, people have been reporting on reckless play linked to headgear and misunderstanding/lack of understanding of concussion, so therefore why is it still being debated?

David believed that there was no form of protective equipment that can prevent concussions.

'I think headguards can protect from head injuries, but I don't think they can prevent concussion as I have still been concussed when wearing them'.

This is reflected in Menger, Menger & Nanda (2016) who found that wearing headgear may facilitate a 'false sense of security' and a 'lead with your head approach' that could end up resulting in an increased risk of injury. This supports Barnes, Rumbold & Olusoga (2017) notion within this group that the association between headgear use and injury prevention gives some players the false confidence regarding head injury.

With regard to the questionnaires, there were 39 (out of 62) responses that participants believed headguards prevent concussions. This is a cause for concern as that means 62% of the participants were incorrect believing headguards can prevent concussion. The graph (figure 8) did show that more forwards wore headguards and felt that headguards could protect them from concussion as out of those responses 22 were forwards, with 11 being from both a university and a club setting. This supports Kahanov et al.'s (2005) study where players who played in the forwards position reported to wearing headguards more often than backs. Therefore, it is a recommendation that

backs need to learn more about the effects that headguards can have. Future research could also investigate why forwards wear protective headgear and investigate whether they believe it prevents concussion.

The lack of knowledge regarding the use of protective equipment could be down to the lack of information through educational strategies. Therefore Marshall et al., (2005) and McIntosh et al., (2009) have both suggested that educational strategies need to accurately specify this misconception, on the basis that there is a lack of evidence that suggests protective equipment will protect rugby union players against concussion. However, this shows that there still is a lack of knowledge into protective headgear as these research studies were conducted in 2005 and 2009. It is a cause for concern that players are still not understanding the full knowledge years on. Therefore, a future recommendation such as an A4 mandatory educational handout which is in first aid kits would be more beneficial than having to go and find the available resources themselves. As well as this, the increased media exposure could have something to do with the limitations of headguard use. An example of this was an article published in the UK media in 2014 (Briggs, 2014) which suggested that the use of headguards could in fact increase the risk of concussions rather than reducing it providing players with a false sense of security, thereby increasing the risk of reckless play. Educational strategies to reduce injury rates have been found effective, particularly in youth populations, noticeably in RugbySmart scheme in New Zealand (Gianotti, Quarrie & Humme, 2009) and BokSmart in South Africa (Brown et al., 2016). This lack of understanding from youth in comparison to adults could be a generational thing, as adults are unaware of the resources that are being published in contrast to youths. Within the youth setting, coaches and parents are available to take the information in so the full responsibility is not on the players. The RFU 'Don't be a Headcase' (2013) launched an initiative with the aim of providing concussion education to all levels of the game, focusing on players and coaches, match officials and parents. This guidance makes specific reference towards the lack of concussion prevention offered by protective headguard and focuses on education of correct tackle technique. Therefore, **recommendations for future policy** should include the initiative being relaunched with more up to date information as this was originally launched eight years ago.

4.5 Return to Play Protocol

The interviews and the questionnaires showed the participants' varying thoughts and opinions regarding return to play protocol. Rivara et al., (2014) have suggested that higher levels of education have been found to correlate with increased adult confidence regarding return to play protocol and

concussion identification, and there is little evidence regarding the effectiveness for programs in understanding concussion from a parent, coach or referee's perspective. This is supported from Sasha's transcript as she said that others around her told her she was fine to continue playing.

'I know that I would have appreciated it more when I was concussed playing as I was told I was okay to play on'.

This goes against the initial stage of the return to play protocol that states players should be removed from the field of play immediately after sustaining a concussion. From Kemp et al.'s (2008) study, half of the players who had sustained a concussion returned to play during the same game with over one third of the players not leaving the field, resulting in twice the proportion found in professional rugby union players (17%) in the UK. This also shows that players are avoiding the first stage of the return to play protocol. Regarding ignoring a potential concussion, David discussed how he himself and other teammates of his have ignored potential concussions as they are unaware that they actually may be concussed.

'I think there has been a couple of times where I didn't think I was concussed but carried on playing'.

Harmon et al., (2013) reported that the current guidelines for preseason management of sports related concussions according to the American Medical Society for Sports Medicine, relied on self-report history of concussion. Kerr et al., (2012) looked into the self-reported concussion history taken from retired National Football League (NFL) players by observing once in 2001 and again in 2010, to assess how reliable they were over time. Cantu (1998) has said that the ultimate concern is the potential for catastrophic events associated with sports-related concussion known as 'second impact syndrome'. A cause for concern is that from the questionnaires only 34% (21) out of the 62 participants had reported that second impact syndrome was a perceived risk of returning to play early. Therefore McCrea (2004) has acknowledged that it is widely accepted that return to play in concussed athletes can lead to prolonged symptoms and increase the risk of both complications and recurring head injuries.

Sasha describes that the reason why players don't seem to report their concussion is being rugby is a tough sport and it's not a 'macho' mentality.

'In my experience of grassroots rugby, you will get 'you will be alright stop being a tart' or 'shake it off' and when it comes to the head, it's something that needs to be treated sensibly'.

McCrea et al.'s (2004) results showed that high school football players often do not report a probable concussion due to the fact they think it is not sufficiently serious based on historical stereotypes. Pearce et al.'s. (2021) longitudinal research found that 143 players who sustained a concussion would return to play after only missing one match. Therefore, it is interesting whether this habit formed in youth with the lack of understanding and severity of concussion is being carried over to a university or club level. It suggests that 10–12-year-olds are not following the correct protocol due to the lack of understanding. This gap of education regarding concussion may not get carried over into a university setting if these players are starting their rugby career as a new sport at university, meaning that there is a constant need for education. Parry et al., (2021) has also suggested that opinions regarding concussion can be misleading through social media sites such as twitter and Facebook. Players not allowing themselves to admit to the fact they are injured opens more opportunities in the future for them to continue to get injured. Robbins et al., (2014) found that high school football players in 2013 were more likely to state they did want to be pulled from a game or practice versus those in 1999 – 2002.

The lack of awareness regarding returning to play after sustaining a concussion is a cause for concern, as players take the risk of encountering further concussions that could lead to serious health issues. When asking Sasha if she knew any of the return to play protocols, she was unaware and could not give an answer but commented 'Not following concussion, I don't'. Returning early to sport, even more so from a contact sport such as rugby can be especially dangerous for lighter and female athletes, as they are often exposed to more blows to the head and for a longer duration in matches, suggested by Follmer et al., (2019). This is since body mass, size and height all play a difference in recovering from concussions. Therefore, those who may be smaller in height and lower in body mass size may be more susceptible to encountering a concussion. This is another useful piece of information that could be found in an educational handout so that players can track their own return to play with regard to their own physical stature and potential gender differences. It has been proven that women also present greater short-term impairment (Covassin, Schatz & Swanik, 2007), as well as more persistent alterations in executive function (Sicard, Moore & Elleberg, 2018), and automatic nervous system disruption (Hutchinson, 2017). Therefore, this is a reason as to why women may need to be specifically targeted in terms of concussion education.

From the questionnaires, it showed that 64.52% of participants were aware of some form of return to play guidelines. However, from other questions regarding how long they should have off after sustaining a concussion or taking part in exercise, 75% answered incorrectly. From Hollis et al.'s (2011) study, they found that 100% of players who had received correct information regarding

return to play advice, still did not comply with the 3-week rest period for returning to competition or intense training. Therefore, it is a recommendation for captains to be able to have a further understanding of concussion as if there is no one else available, they should be the ones in charge to make these big decisions. It could also be important to ensure that a captain is fully educated in concussion before taking on the role of captaining a team. This also applies for a vice captain in case the captain sustains a concussion.

Yard & Comstock (2009) also found that amongst high school rugby union players, 10-12 players did not comply with concussion return to play guidelines even though correct advice was given. What is the point of having a return to play protocol if nobody is going to follow it? This is showing that even though players may be aware of what the return to play guidelines are they will proceed to ignore advice given. Findings from Mathema et al., (2016) showed that the return to play knowledge scores were lower in amateur settings compared to elite level of sport which suggests that the return to play educational message is not reaching the amateur level and that further education is required. Walker (2015) found that almost three quarters of participants indicated that they would to some extent be inclined to participate in a practice despite not having fully recovered from a concussion. This discrepancy between participant's knowledge and their return to play attitudes suggests that knowledge alone still is not sufficient enough to bring any attitudinal and behavioural changes.

Further practice could include an A4 handout which outlines the correct return to play protocol. Further research should investigate why players feel they may not need to rest as much as guidelines recommend.

4.6 Grassroots vs professionals (Physios)

In the interviews, the captains were questioned about whether they thought world rugby could do more regarding concussion both at an amateur level and an elite level. The purpose of this question in the interviews in contrast to the questionnaires was to allow participants to freely discuss their honest opinions. It was easily noticeable that the main issue that all the participants had from the interviews was the lack of physios that are available at the grassroots game. This also refers to captain's responsibility, suggesting that if a physio was available at every grassroots game, they would not have to take control and be mindful of their team as they feel a qualified professional could take on the whole responsibility. The use of a professional medic or physio available at games would have the experience to acknowledge an injury or concussion early and prevent further injuries occurring. As Saffary, Chin & Cantu (2012) have suggested, side-line evaluations are a critical early

measure to identifying a high-risk individual who could be protected from further injury. Cohen, Gioia & Teach (2009) have reported that the side-line identification of concussion has been consistently identified as a challenging aspect of sport-related concussion management because of inconsistencies in side-line protocols and unclear role responsibilities.

Sasha describes how there is a difference with grassroots to professionals regarding HIA.

‘Even having one designated HIA person who can assess anyone who’s taken a knock, not necessarily needing to be linked to a certain club but an independent source that can have a radio and be told where they need to be to offer support to someone who might need it and make sure they’re okay’.

The limited availability of physios or medical personnel at grassroots level creates a dangerous environment knowing that players can play on without a qualified specialist informing them to come off the field of play. This is supported by Clacy et al., (2016) who found that only 1% of athletes and only a quarter of both parent and coach respondents indicated that they felt they had a responsibility to treat concussion. However, Clacy, Sharmon & Lovell, (2013) have suggested that although medical personnel are often the most qualified to make concussion management decisions, the extent of their roles and inconsistent presence in grassroots sport could lead to an increase in injuries. Borich et al., (2013) have stated that this can present a potential gap in the consistency of concussion identification. This is why Donaldson et al., (2014) have said that attitudes and behaviours of physicians, trainers, coaches, parents and athletes on the identification and management of concussion lack both consistency and accuracy. Therefore, it is important for these ‘actors’ (other available people) to have a sufficient knowledge and understanding of what to do when a concussion occurs so that they can act on it when needed to.

David discussed how the lack of physios that are available at grassroots level is ‘unfair’ in comparison to the professional game.

‘In grassroots, you barely get the help you need for concussion whereas professionals get so much support like assessments in comparison to us where it’s just like sit out. The only reason I’ve seen a physio at a game is because the teams I played for play at a relatively high standard, so they had available team doctors or physios there rather than being assigned to our team.’

With Amy wondering

‘This is why I’m confused because there are so many people that want to be physios so why are the grassroots team not seeing any’.

White et al., (2018) has called for structural changes to rugby in UK PE, with most participants declaring the need for some sort of modification to ensure that rugby remain safe. As Kirkwood has suggested, if these modifications to rugby were made in PE, it has the potential to lower the number of head traumas sustained in the sport. Captains of rugby within a sixth form team would not have the responsibility of dealing with concussion, as this would go to the PE teacher in charge. The nominated individual who oversees this needs to ensure that the information that they are providing to the school team can be carried on if they decide to continue to play on for a club or a university team. If athletes coming from youth sports are captains of their team where they are not responsible for concussion, how are they suddenly responsible for everyone? Although these references refer to rugby within PE, the principle still applies that the lack of physios or team doctors available can have an impact on players return to play speed as well as the prolonged effects it can have on their health.

Michael suggested the need for referees and coaches to have more control and should also gather more available information regarding concussion to help reduce player injuries.

‘The entire focus is on elite level, the grassroots level I don’t think they have much interest in really, if they did, they would make sure all referees and coaches are properly trained in concussion protocols and maybe insist that they can’t play again unless there’s a non-playing person who’s trained in the department’.

A future practice could investigate rugby referees’ knowledge and understanding of concussion as well as the appropriate methods in dealing with it if a player sustains one during a game at which they are officiating. Although healthcare professionals should provide guidance on evaluations and return to practice (Harmon et al., 2019), their absence confirms that coaches are often in the position of managing concussions in contact sports (Neidecker et al., 2019). The risk of not having professional advice available when these injuries occur could lead to coaches, referees or even parents having to make important decisions when they are unsure of what the most suitable protocol is. Salmon et al., (2020) found that despite only 7% of coaches reporting that they would not immediately remove a potentially concussed player from the field of play, one of the key findings was that over a quarter of coaches had witnessed other coaches allowing a potentially concussed player to continue playing. This is why Clacy et al., (2016) have suggested that if those

who are in a close proximity to the concussion do not feel they have any responsibility to treat it, it is unlikely that they will demonstrate any reasoned or planned action.

Rasmussen (1997) created the risk management framework which Salmon & Goode (2015) have claimed includes injury prevention in sport and outdoor recreation. The injury framework suggests that decisions and actions of multiple actors at all levels of the system interact with one another to influence the incidence and severity of the injury. This information can also be on an educational handout that all players and coaches can have on them, so they have the full information into how to handle a concussion if they notice a teammate has sustained one. Therefore, Finich et al., (2013) have demonstrated this regarding inconsistencies in concussion treatment, knowledge and the implementation and compliance with graduated return to play protocol. Our findings are of concern considering that concussion protocols are in place for most amateur sports organisations, many of which have been guided by up-to-date recommendations for concussion management and education, the 2016 Berlin Consensus on Concussion in Sport McCrory et al., (2017). The lack of knowledge that has been shown by participants can be easily controlled by a mandatory A4 educational sheet owned by each player that can be accessible through a mandatory first aid kit that is required at all matches.

4.7. Limitations

It is important to note that the research conducted in this study only analysed players from a club setting and from a university setting. One of the largest limitations of this research was the current COVID 19 pandemic. This restricted both face to face interviews where it was harder to be able to observe visual aids and questionnaires could not be handed out in person, meaning the participants could not have a strong relationship with the researcher. This would have meant that the participants would have felt more comfortable meeting the researcher face to face, especially considering that it was a sensitive series of questions being asked throughout.

Also, due to the current COVID 19 pandemic, it resulted in training schedules and matches being postponed until further notice, therefore questionnaires were put into respected group chats rather than physical handing out of the questionnaires. It was completed this way as it was important to maintain social distancing guidelines. This meant that the aimed number of participants from each setting could not be controlled as any of the club members could complete the questionnaire. This did mean though that I was unaware if it was the respondents who actually answered it. Although

this was a weakness, it was also a strength completing this online as it gave better accessibility and gave a larger sample size than originally anticipated.

Another limitation of this study was that some of the questions in the questionnaire gave specific answers for the participants to choose from in contrast to the interviews where the respondents had to answer the questions based on their own opinions. For example, within the questionnaire, the question asking 'what are the most common signs and symptoms of concussion' (figure 3) gave a list of possible answers for participants to choose from in contrast to interviews where the captains had to answer based on their own knowledge without prompts. Therefore, answers from the questionnaires may have been misleading as they could have chosen the most obvious answers unlike the interviews.

Conclusion

5.1 Introduction

The following chapter concludes the difference in knowledge and understanding of concussions between gender, setting and playing position. The limitations of this project will be discussed, followed by suggestive ways to progress this research further. Revisiting the project's research questions will guide the finalising comments to draw sufficient conclusions. The research questions will now be addressed one by one in relation to literature.

5.2 What is the current knowledge and understanding of concussion?

Both data from the questionnaires and interviews suggests that there is still a lack of knowledge and understanding of concussion, especially at a grassroots amateur level. These include not being able to identify the main common signs and symptoms of concussion, unaware of the correct return to play protocols, the protective equipment in preventing concussion and inability in treating a concussion. In terms of identifying signs and symptoms of concussion, the questionnaire data was able to show that a large sample of the participants could correctly identify the main signs to look for. However, it also showed that some participants who answered 'distractor' options have a lack of understanding regarding signs and symptoms of concussion. The return to play protocol also showed that players were unaware of how long they need to rest for after sustaining a concussion or if they were aware, the likelihood of them still ignoring this advice. Although 35% were able to identify that there is no protective equipment that can prevent a concussion, the remaining 65% believed that either headguards, mouthguards or shoulder pads were in fact equipment that can prevent concussions.

5.3 What are the differences in knowledge and understanding of concussion between males and females?

Interview and questionnaire data relating to knowledge and understanding of concussion within rugby union suggests that there is a difference of opinions regarding signs and symptoms, return to play and available information that is available. However, evidence still shows that there is a difference between male and female knowledge. In terms of how long participants believe is the next step for a player who has sustained a concussion and has been symptom free for 24 hours, 31 of the participants that answered incorrectly were males, with the remaining 13 being females,

suggesting that regarding return to play following a concussion, males have a lack of information in comparison to women. This could have been down to different factors such as length of time playing, the ability of the participants, the level of coaching or the setting that they are playing in. In regards to identifying signs and symptoms, there was a 50% mix of gender in answering 'distractors' as common signs and symptoms, suggesting that both genders have a lack of identifying correct symptoms.

5.4 What are the differences in knowledge and understanding of concussion between university players and club players?

When considering the difference in knowledge between university players and club players, there was not a lot of difference. Although neither of them showed sufficient knowledge of concussion, it was clear that those from a university setting had more of an understanding. In regards to identifying signs and symptoms, both club and university players had an equal understanding of correct answers, even though there was still a large mix of club and university players who incorrectly identified common signs and symptoms of concussion. Therefore, it was of interest to see why the knowledge is lacking from the transfer of youth level to adult level. It was also interesting to note that the captains of each respected group were lacking the relevant information to pass onto teammates, which reciprocates to the players knowledge. This shows that both at a club and university setting, the lack of knowledge within concussion from the captains results in their teammates having the same insufficient knowledge. Regarding the questionnaires, there was no difference in the lack of knowledge in all effects of concussion such as the signs and symptoms, correct return to play protocol and the lack of awareness of the prolonged effects of concussion.

What are the differences in knowledge and understanding of concussion according to playing position?

Both the interview and data suggest that there is insufficient knowledge and understanding of concussion regarding forwards and backs. When looking at the protective equipment which prevents concussion, 24 (out of 29) who reported headguards were forwards, with the remaining 5 participants being backs. This brings about questions into whether they wear this as they believe it prevents concussion or just a lack of knowledge portrayed by the media.

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Appendices

Appendix 1 – Participant Information sheet and introductory letter



Participant Information sheet and introductory letter

Introductory letter: To be delivered to either the captain of each subgroup of rugby team or coaches if applicable.

Insert date

Insert whom it may concern

Insert their title

Insert their address

RE: Permission to Conduct a Masters level Research Study

Dear (Captains name)

I am writing to request permission to conduct a research study within your institution. I am currently enrolled in the Physical Education and Physical Activity Masters of Science by research programme at Canterbury Christchurch University, Kent, and in the process of writing my Masters thesis. The study is entitled 'An investigation into the frequency and severity of concussion amongst rugby union players whilst analysing players knowledge and understanding of concussion'.

Due to the nature of the study, I am hoping that you will allow me to recruit between 10-15 participants from your team to conduct questionnaires based upon their knowledge and understanding of concussion and interviews to be carried out for the captains to get a deeper understanding of perceptions and experiences.

Background and aims: Why do I wish to complete this study?

Rugby has been an important aspect of my life since being involved in the sport since the age of 7. From conducting my dissertation on concussion within University rugby union players, I was interested and motivated to delve deeper into investigating both a male and female university team as well as a male and females rugby club team. I believe that the effect of concussion can sometimes be overlooked into the severity of how it can have an impact on players who do not take the injury seriously. I also believe that there are not enough available resources into the correct protocol to follow for those players who do encounter a concussion, and this could be a reflection on a player's understanding and knowledge of concussion itself.

Existing literature surrounding this topic solely focuses on player's knowledge and current understanding of concussion, including factors such as what are key signs and symptoms of noticing a concussion and common ways that a concussion can occur within a rugby union game. This research aims to seek further understanding of the following:

- Does the number of concussions a player encounter have any effect on knowledge and understanding of concussion?
- Does gender, years of experience and ability level have any effect on knowledge and understanding of concussion?
- Do players understand the correct protocol which is in place for those who do encounter a concussion and severity of repetitive concussion?
- Are players aware of available sources that offer information regarding concussion

Consent

If you choose to allow the research, I will seek to gain consent in the following way.

Players who are willing to take part in the study will be given a letter with a participant information sheet and a consent form attached (due to the current COVID 19 pandemic, these forms will be sent out virtually); where the backgrounds, aims and procedures of the study will be outlined. Once participants have given their consent to be a part of the study, participants will be required to return their signed consent form to me on an available training day. The completed consent forms will be stored in a locked box, and then will be scanned onto a password protected computer and will then be destroyed via confidential waste. This process ensures the certainty that participants' identity will remain anonymous and confidential.

Anonymity, Confidentiality, and the Right to withdraw

By following the GDPR guidelines, anonymity and confidentiality of participants will be ensured in the following ways. Once opting into the study, consent forms will be stored in a lockbox, scanned onto a password protected computer and destroyed via confidential waste. During the study, the anonymity of the participants involved will be kept by identifying as a given letter or number, and this process allows for identity to be kept confidential during the recordings.

Although I understand this research to be beneficial for rugby union, the main responsibility is to keep the anonymity of the participants involved and the clubs that are being used. Therefore, the only individuals who will be aware of these clubs and the position it holds in the study will be myself and my supervisor, Kristy Howells. Where it may be necessary to mention your club within the writing of the study, a pseudonym will be used, e.g., 'Institution A, and the geographical location of your club will never be identified as anything narrower than the Southeast of England.

For participants, the process of 'opting in', increases their willingness to participate and their comfort during the research. However, all participants involved in the study will be informed that at any point, they may have access to their questionnaires or interviews recordings, as well as the right to withdraw. If this does occur, then participants will receive their recording/questionnaire with other participants audio blanked out, or if they wish to withdraw, then the questionnaire will be destroyed immediately via confidential waste and the interview audio recording will be erased. Also, it is of importance to note that no other person than myself or my supervisor Kristy Howells will analyse the questionnaires or listen to these recordings and once completion of the study, they will be destroyed to protect those participating. Finally, in the unlikely event that an individual feels too much pressure whilst completing a questionnaire or feel uncomfortable during the interview, the questionnaire does not need to be completed and the recording of the interview will be stopped, and I endeavour to follow the institutions safeguarding guidelines.

I believe that this study has the potential to be a positive effect on players' awareness of knowledge and understanding of concussion, and hopefully change their perspectives on how they treat concussion within the future. If you feel that this research is something that your institution is comfortable to participate in, please RSVP to my email on db59@canterbury.ac.uk, and I will be in touch with further details. I am happy to answer any questions you may have to help with your confidence in this research and am looking forward to the potential of working with you.

Yours sincerely,
Daniel Bromley

Appendix 2 – Consent Forms:
Interviews



Dear X

This letter is to provide you with some information and ask for your consent to participate in a research project that I propose to conduct within the Gravesend rugby football clubs' men's rugby

union team. The data will be used in my thesis for my master's degree in Physical education and Physical Activity at Canterbury Christ Church University.

The project aims to investigate rugby union players' knowledge and understanding of concussion. If you choose to give your consent, I will conduct an interview which will last 30-45 minutes.

This study will not knowingly involve any risk of harm/injury to the participants and does not involve the misinforming or deceiving of participants. When writing up the study, anonymity of participants will be maintained by using pseudonyms in place of real names. Data will remain confidential, and raw data and consent forms will remain safely stored. The raw data will only be used for this research project and will be destroyed after this project has been marked.

If you are happy to participate, please sign the bottom of this letter. I have enclosed a second copy for your records.

Thank you,

Yours sincerely,

Daniel Bromley

I _____ have read the above outlining the nature of the research project and give/do not give my consent to participate.

Consent Form: Questionnaires



Dear X

This letter is to provide you with some information and ask for your consent to participate in a research project that I propose to conduct within the Canterbury Christchurch University men's

rugby union team. The data will be used in my thesis for my master's degree in Physical Education and Physical Activity at Canterbury Christ Church University.

The project aims to investigate the frequency and severity of concussion amongst rugby union players whilst analysing players' knowledge and understanding of concussion. If you choose to give your consent, I will issue a questionnaire for you to complete in your own time and return to me.

This study will not knowingly involve any risk of harm/injury to the participants and does not involve the misinforming or deceiving of participants. When writing up the study, anonymity of participants will be maintained by using pseudonyms in place of real names. Data will remain confidential, and raw data and consent forms will remain safely stored. The raw data will only be used for this research project and will be destroyed after this project has been marked.

If you are happy to participate, please sign the bottom of this letter. I have enclosed a second copy for your records.

Thank you,

Yours sincerely,

Daniel Bromley

I _____ have read the above outlining the nature of the research project, and give/do not give my consent to participate.

Appendix 3 – Ethics clearance from the Faculty of Education Research Ethics committee at Canterbury Christ Church University

Mr Daniel Bromley

Graduate College

Faculty of Social and Applied Sciences

29th January 2021

Dear Daniel

Confirmation of ethics approval: MSc Research Project

Your ethics application complies fully with the requirements for ethical and governance review, as set out in this University's Research Ethics and Governance Procedures, and has been approved.

You are reminded that it is your responsibility to follow, as appropriate, the policies and procedures set out in the [Research Governance Framework](#) and any relevant academic or professional guidelines.

Any significant change in the question, design or conduct of the study over its course will require an amendment application, and may require a new application for ethics approval.

It is a condition of approval that you **must** inform ethics@canterbury.ac.uk once your research has completed.

Wishing you every success with your research.

On behalf of

Faculty of Science, Engineering and Social Sciences Ethics Panel

ping.zheng@canterbury.ac.uk

Appendix 4 – Interview Transcripts

Example 1

Interviewer: First of all, what made you get in to rugby?

Respondent: Errm, I don't know, I started playing when I was about nine

Commented [DB1]: Age started playing

Interviewer: So, you've played for quite a while then

Respondent: Yeah, I played for the primary school football team and then one of my teachers started off a rugby team and told me to come along and give it a go, and I did, and I haven't really looked back since, I think I've had one season off

Commented [DB2]: Role model influence

Interviewer: So, did you play at a local club as well or was it only for your primary school?

Respondent: Yeah so I played from the primary school and the same teacher that started the team up in the primary school started the local rugby club up, erm, it's a bit backwards we started from children and then grew into having an adults side which is quite weird and then through that I met 2 England Women Internationals who were obviously working as full time coaches and they pretty much stayed in contact with me, we done something called the Heathrow games, so its mostly all London Boroughs who come together to play each other in a variety of sports, so they took me to that and still kept in contact and then when I was 14 or 15 I mean I shouldn't have been playing with the boys really but where we were such a small club most teams that we played in the league were like 'oh it's a girl, it's no problem' and then they regret it and at that age I did county trials, then got dragged down to Gravesend while still keeping in contact with these 2 women rugby players and when I hit 18 there was no club at Gravesend anymore so there was no next step and these women asked me to come down to Sarries (Saracens) with us, if not someone will know a club that are looking for people, went down there and played there for about 10 years, 2 neck injuries later decided I'm moving too far away and not getting home till midnight so should knock it on the head, had a season off, then the Gravesend club started back up again so I thought it would be rude not to I'm only 10 minutes down the road

Commented [DB3]: Reason to playing

Commented [DB4]: Role model influence

Commented [DB5]: Mixed gender from a young age

Commented [DB6]: Level of rugby played

Commented [DB7]: Level of rugby played

Commented [DB8]: Injuries occurred

Interviewer: It does sound a lot more convenient when you live only 10 minutes away, so what position do you prefer to play first of all?

Respondent: Errm, I prefer loosehead prop

Commented [DB9]: Current position

Interviewer: Right, and what position do you play?

Respondent: At the minute I'm playing number 8, I think it's because I have a bit more of a knowledge than the rest of the girls, but I've played pretty much everywhere apart from fullback, considering I have been playing for a very long time now

Commented [DB10]: Preferred position

Commented [DB11]: Advanced knowledge of the sport

Interviewer: Is that due to a lack of positions for the teams you've played for?

Respondent: Yeah, it was number issues or they had too many forwards, so when I was younger and I had a bit more pace about me I would get put in centres

Interviewer: Is there a reason that you play 8, is it cause the girls don't have a knowledge of that position or do you have other girls that are more able to play in other positions?

Respondent: I think it's just I can look after the forwards so if there are any issues then I'm there, it has come up in a couple of games where the opposition teams prop hasn't been propping properly so I've swapped to help out my team mates, especially because everyone is learning, not being big headed, but there's no point me dominating the opposition number because then nobody is learning, so as long as they're keeping it clean, I'm more than happy to take a step back

Commented [DB12]: Adopting a captain's responsibility

Commented [DB13]: Inexperience or too experienced/skill level

Interviewer: So, are you aware of any of the main signs and symptoms of concussion?

Respondent: I know that they vary from person to person, mainly because I have a brother who plays rugby as well, and when he shows signs of concussion it's, the complete opposite for me. So he gets really confused and doesn't know where he is, I get hyper emotional where my emotions just sky rocket, so if you see me crying it's probably because I'm concussed, so they're the ones I mainly look for in myself like how am I feeling emotionally, if I was looking at someone else I would be seeing if their stable on their feet and if they're retaining information, so if I tell them to pass it right 3 times and its still going left I would wonder if they're okay, its sort of instinctive cause you see someone not right and you can tell somethings wrong?

Commented [DB14]: Different signs and symptoms for people

Commented [DB15]: Signs and symptoms

Interviewer: Do you think there's enough information whether its spotting signs and symptoms or even just knowing what they are?

Respondent: I think there's enough out there but you've just got to go and find it out, the one I worry about is the secondary impact syndrome, I didn't know enough about it and didn't realise how fatal it can actually be because your brains swelling and you get another whack and it swells more, that's the one I didn't know enough about

Commented [DB16]: Aware of information regarding signs and symptoms

Commented [DB17]: Self-learning

Commented [DB18]: Signs and symptoms

Commented [DB19]: Unaware signs and symptoms

Interviewer: That actually leads on nicely to my next question which is do you have any knowledge of the effect that repetitive concussion can have?

Respondent: I think last February I got a concussion whilst playing rugby and luckily for me I was just recovering from that one and then got another one from work because I work in security as well, that's when I looked it up and realised how dangerous it can be that's the biggest one for me and obviously, you're now hearing all the legal stuff now with Steve Thompson and all that lot with dementia and all the other things that can come with it and it makes you realise that it is scary.

Commented [DB20]: Repetitive concussions from rugby and work

Commented [DB21]: Self-learning repetitive concussion

Commented [DB22]: Current media knowledge

Interviewer: So, in a rugby setting, what incident would you perceive to be the most serious way of getting concussed?

Respondent: Either a hefty tackle in amongst a load of people, so if your getting tackled back into a ruck or something or in the air, if somebody is getting taken out mid-air and lands on their head.

Commented [DB23]: Serious way of getting concussed

Interviewer: Is there a reason you would perceive them to be worse than another way of getting concussed?

Respondent: In the air could lead to spinal injuries, I'm just thinking that's there so many more things that can go wrong from that and within a tight space, people might not notice that someone has gone unconscious or they can't get out to be like I need help cause if you go straight back into a ruck no one is going to be looking at them

Commented [DB24]: Lead to other than concussion injury

Commented [DB25]: Serious way of getting concussed

Commented [DB26]: Limited spacing lead to serious concussion

Interviewer: Yeah, that makes a lot of sense to me, so to your knowledge, how many concussions would you say that you have sustained whilst playing rugby?

Respondent: I was thinking about this the other day, I had one in juniors in U18 and I think I've had 3 since which were all rugby related, and I noticed my ability to bounce back from them have definitely started to slow, so I don't know if that's an age thing or they were a little more severe.

Commented [DB27]: Concussion sustained in juniors

Commented [DB28]: Concussion sustained in adults

Commented [DB29]: Recovery process

Interviewer: When you've had your concussions, were they all in games or were some in training and some in games?

Respondent: One was in training but mainly in games cause when the adrenaline kicks in, you just do the job you need to do without thinking of anything else where when I tackle in training, I don't half ass it but the intensity level is not the same

Commented [DB30]: Physicality difference from training and games

Interviewer: Could you recall the scenarios of any of the times that you were concussed?

Respondent: My first one in juniors I was kicked in the back of the head in a ruck, my second one I was tackling a heftier prop and she landed on my head, my third one was a big powerful hit from them and I went backwards and hit my head on the floor, and the last one was a double tackle but mine and other girls' heads clashed making me fall backwards

Commented [DB31]: Incident that lead to 1st concussion

Commented [DB32]: Incident that lead to 2nd concussion

Commented [DB33]: Incident that lead to 3rd concussion

Commented [DB34]: Incident that lead to 4th concussion

Interviewer: Out of them is there one of them that was the worse, whether it was the incident or how you felt after?

Respondent: The last one was definitely the worst, I don't know if that was head impact from someone else and then head impact with the floor, I ended up with 2 black eyes and I don't know if I was knocked out from it but that was the worse one and it did take longer to get over it so I don't know if it was severity of age

Commented [DB35]: Worst concussion sustained

Commented [DB36]: Recovery process

Interviewer: Out of any of the times you were concussed did you continue to play on after?

Respondent: Yeah.... I think all of them to be fair except the one from training, I don't know what it is, I think as long as I can keep my adrenalin level high enough the effects don't kick in, but as soon as the end whistle goes, everything will hit and the adrenaline crashes and side effects up. I think not letting the team down is a big one as well.

Commented [DB37]: Unaware of effects of concussion

Commented [DB38]: Adrenalin rush not wanting to admit hurt

Commented [DB39]: 'Macho' mentality

Interviewer: Yeah, it makes sense with the adrenaline, you don't really think about anything else from the adrenaline. So do you think that there is any protective equipment that can prevent someone getting concussed

Respondent: Headguards and shoulderpads do

Interviewers: Why do you feel this?

Respondent: Headguards can protect the brain and it can reduce damage to the head from a hard impact and shoulder protects can protect the shoulder to head area as well as spine on a very heavy impact.

Commented [DB40]: Protective equipment

Interviewer: Have you ever witnessed someone whether it was from your own team or the opposition team sustain a serious concussion?

Respondent: When I was at Saracens and I got concussed, in the same game someone else from my team sustained a really bad concussion where she had to be taken to hospital, she literally stood up and then fell straight back down, and she was going through recovery for months and months

Commented [DB41]: Delayed recovery process

Interviewer: Did you offer any support to her or aid her in anyway?

Respondent: We messaged each other afterwards but I got concussed before her in the game so I wasn't really able to offer full support, luckily, we had a good physio was knew that she needed to go to hospital straight away.

Commented [DB42]: Was concussed so couldn't offer support

Commented [DB43]: Physio available to support injury

Interviewer: Where you said you played at Saracens and you had a team physio available on standby, if you ignore that fact for a second, would you say it's a player or captains' job to identify

someone who is concussed or would you say it should be more down to a coach, referee or even parents or spectators?

Respondents: I think it should be a coach's thing as they are looking at it from an impartial angle and they are there for your safety, like if I were to see something I would question it and I would expect coaches to challenge it and pull someone off if they need to and see how they are. I know that I would have appreciated it more when I was concussed playing at Gravesend as I was told I was okay to play on.

Commented [DB44]: Coach's responsibility

Commented [DB45]: Captains' responsibility as well

Commented [DB46]: Poor guidance on returning to play

Interviewer: Have you offered support in any way to someone's whose been concussed whether you're on the pitch at time or watching?

Respondent: I have had to drag one of my brother's team mates off because he was concussed and he didn't want to come off but the ref backed me on it because he could tell that he was unstable. I would say I'm really good at spotting it in other people but its different in myself as I feel like I know how to balance it which is probably wrong. I think that's the only time I think I've done it really.

Commented [DB47]: Supporting others who are concussed

Commented [DB48]: Unaware of knowledge of concussion

Commented [DB49]: Noticing others concussed rather than themselves

Interviewer: Do you think players as a whole take concussion seriously?

Respondent: Not ones that haven't been concussed, I think once you've had a bad one or one that takes the whole return to rugby process and it takes weeks, they start taking it seriously because they have to deal with having to feel sleepy, having that cloud of fog, even taking the time off work because they can't drive or can't do the job, then they do it take it seriously cause until then its just a word or its just something that happens in rugby

Commented [DB50]: Not taking concussion seriously

Commented [DB51]: Return to play

Commented [DB52]: Signs and symptoms

Interviewers: Do you think some of the players are unaware of the effects it can have on them long term?

Respondent: Yeah, I don't think there's enough information on the possible long-term consequences of concussion and the likelihood of how much more likely are to sustaining another one after receiving one in the first place in regards to dementia or motor neurone disease

Commented [DB53]: Unaware of information regarding long term concussion

Interviewer: I mean as you've said already its such a big thing at the moment in the media with all these elite rugby athletes who have struggled with long term effects. I mean, I know you briefly touched on it earlier on but are you aware of any of the return to play protocols?

Respondent: A few, so you start with stuff that builds your heart rate up slowly like a bit of a jog and then you can go onto a bit of handling and then eventually onto pad work and I think it takes a while before you can go back into full contact. I think when I got concussed it took me 5 weeks to get properly back and that was on a good one, but there the stages that I know of

Commented [DB54]: Return to play protocol

Interviewer: Just say in a game you had someone on your team encounter a concussion and when you're finding out who's available for the following week, she says that she's available to play because she feels fine, would you let her play?

Respondent: No, I still live by the old school term that your minimum is 3 weeks, I believe that was what the process was before HIA (Head Injury Assessment) was brought in and that should stay as what harm is it going to do. If you do recover in that first week then you can let your body rest for another 2 weeks. We have enough girls to give someone else a chance even if they were missing

Commented [DB55]: Return to play protocol

Interviewer: Do you think referees have any control on either identifying concussion or even reducing it?

Respondent: I do feel sorry for referees because they do have so much to look out for and the list is getting bigger on what they need to clamp down on but I think if you notice that a team is being too aggressive you need to have a word and say 'your aggression levels are great but you need to have the control with it' because if there are constantly high or dangerous tackles then it not keeping the game safe. I think if they do see something they shouldn't be afraid to blow their whistle and stop the play to check to see if someone's okay. I know as a player and a captain that I would rather my girls be safe and the game have more stoppages than one of them need treatment because we've played on and not seen it.

Commented [DB56]: Hard for refs to monitor everything

Commented [DB57]: Referees controlling concussion

Commented [DB58]: Refs need confidence

Commented [DB59]: Players safety is the most important

Interviewer: Do you think that there's enough resources on concussion as a whole?

Respondent: No, as I say you get loads of assistance but everything that I know I've had to look up myself, making people aware is not a short-term issue and you can get one concussion and be unlucky and could affect you massively in the future, more published material telling you more about it and the rates of head injury to what it leads to cause the more knowledge you have the more it can make you aware.

Commented [DB60]: Self-learning

Commented [DB61]: Repetitive concussion

Commented [DB62]: More awareness to be made

Interviewer: If there was more information on it where do you think the most beneficial place for people to access it, or even in what format?

Respondent: I would say podcasts be good by getting doctors and neuroscientists that actually do a podcast cause that's the new in thing at the moment where people could listen to it either on their way to work or in the gym and there will be a bit more able to take it in. Even putting links to popular rugby posts, maybe if England were playing underneath the team sheet putting a hyperlink to the post about it might be a bit better.

Commented [DB63]: Useful formats for concussion

Interviewer: And the final question is do you think world rugby could do more to prevent concussion, specifically comparing elite level to the amateur level

Respondent: I think amateurs definitely need to start being a thing where there is a medical person, even if its for someone who looks at both teams but I think it makes sense to have someone there in case you need them so they can say my words final, in my experience of grassroots men's rugby you get 'you will be alright stop being a tart, or shake it off' and when it comes to the head its something that needs to be treated sensibly. Even having one designated HIA person who can assess anyone who's taken a knock, not necessarily needing to be linked to a certain club but an independent source that can have a radio and be told where they need to be to offer support to someone who might need it and make sure they're okay.

Commented [DB64]: Medics at grassroots level

Commented [DB65]: 'Macho' mentality

Commented [DB66]: Medic for grassroots

Interviewer: Thank you very much for speaking to me

Respondent: No worries, thank you

Example 2

Interviewer: So first of all, what made you want to get into rugby?

Respondent: Erm, I like the physical contact, erm I'm an aggressive person so I like to take my anger out in the game, my mental issues help me in the game so in secondary school just getting into it really helped me focus on my studies, stress relief and everything

Commented [DB67]: Physicality of Rugby – reason why playing

Interviewer: So how long have you played for now altogether?

Respondent: About 8-9 years

Interviewer: And have you played for both youth and adult?

Respondent: Yeah

Interviewer: Nice, and do you find that there is a big difference between youth and adult rugby?

Respondent: A huge difference

Interviewer: In what aspect?

Respondent: The skill set is so much higher in adults, the ball is faster, bigger hits, bigger people running at you

Commented [DB68]: Physicality of rugby, youth-adults

Interviewer: We will start off with position do you prefer to play?

Respondent: Number 8 or centre

Commented [DB69]: Current position

Interviewer: Are they the positions you predominantly play as well?

Respondent: yeah

Interviewer: Have you always played 8 or centre?

Respondent: Majority centre for youth but then also for school second row or 8

Interviewer: Is there a reason that you changed position or had to move around a bit?

Respondent: They just needed me in that position

Interviewer: Was it just down to a lack of numbers then?

Respondent: Yeah

Interviewer: So, do you know a lot of the main signs and symptoms of concussion?

Respondent: Yeah

Interviewer: Could you name a few for me?

Respondent: Erm dizziness, loss of memory, fatigue, sickness, headache obviously, light headed and yeah pretty much that

Commented [DB70]: Signs and symptoms

Interviewer: Do you have any knowledge of the effect that repetitive concussion could have on someone?

Respondent: I actually don't know to be honest

Commented [DB71]: Effect of repetitive concussion

Interviewer: That's fine, do you think that's because there's not enough information on it or do you think its just something that you haven't really thought about before?

Respondent: I know it does all the brain damage and stuff and all that but there's not really much going out there, I know there's a lot that's getting out now and I think a lot more studies are getting done now

Commented [DB72]: Aware of research into repetitive concussion

Interviewer: Yeah, so in your playing experience, what would you perceive to be the most serious way of getting concussed would be whilst playing?

Respondent: High tackle, 100%

Commented [DB73]: High tackle – serious way of concussion

Interviewer: And why in particular would you say a high tackle?

Respondent: A shoulder right into the head is a big concussion, or if you're tackling and your heads in the wrong position getting a knee to the head, so definitely like a high tackle has to be up there

Commented [DB74]: Explanation why its most serious

Interviewer: Yeah, so have you encountered any concussions whilst playing before?

Respondent: Yeah, a couple

Interviewer: Would you be able to tell me a rough number of how many or would you not even be able to?

Respondent: Probably about 5

Commented [DB75]: Amount of concussion

Interviewer: Have you had them all in games or have you had them in training and in games?

Respondent: All in games

Interviewer: Obviously when you do contact in training, do you think there's a difference in the physicality level?

Respondent: Oh yeah 100%, I mean you don't want to really hurt your team mate or injure anyone just before a game, so erm, you probably only put about 60% in instead of 100%

Commented [DB76]: Physicality of rugby – training-matches

Interviewer: Can you talk to me about any of the times that you have been concussed? Maybe as many as you can remember just like how you got concussed and how you felt afterwards?

Respondent: A high tackle, took the ball in, he didn't really get down and got a shoulder to there (points to middle of forehead), and yeah that's pretty much all I can remember and getting carried off the pitch. I couldn't really remember what happened but just remember getting a headache

Commented [DB77]: How the concussion happened

Interviewer: So, did you get knocked out?

Respondent: Yeah, for about a minute so it wasn't too bad

Interviewer: Do you know what happened in the other times?

Respondent: Probably just same, just a hit in the head

Interviewer: Were they all similar in how they happened?

Respondent: Yeah, all very similar, it's always been high tackles to the head

Interviewer: Obviously as you have said they were all similar but im sure that some of them had their slight differences.....

Respondents: (Interrupts mid-way through). Yeah, there were slight differences like bigger people who would hit harder it got more of a bigger impact then some small person hitting you, you know, you won't be knocked out but you would still get the concussion symptoms

Commented [DB78]: Physicality of rugby – different concussions

Interviewer: So, when you did concussed in the times when you were playing did you continue playing after?

Respondent: Errm (Pauses to think). I came off, but I think there has been a couple of times where I didn't think I was concussed but carried on playing, erm, but then like I said majority of the time I've come off because if I've had a good ref on, they would be asking me questions and doing as assessment to find out if I should play, but sometimes they will just tell me to get off, like I can't be arsed to deal with the consequences, you've taken a hit just go off. So, I think people should actually do more of the head assessments, cause we all like to play rugby and if you're not concussed you might as well carry on playing

Commented [DB79]: Came off after concussion

Commented [DB80]: Unaware of being concussed

Commented [DB81]: More head assessments be done

Interviewer: Exactly, so when you did get concussed before and you played on did you notice a difference in your performance after?

Respondent: I didn't think anything of it but a lot of mates have after they've taken a knock to the head, like lawny (a mutual player from the University team) has had a lot of concussions and I know hes scared of getting knocked out again and again, so it does change your mentality on it

Commented [DB82]: Friends' ability was compromised after concussion

Interviewer: Do you think that there are any pieces of protective equipment that can prevent concussion?

Respondents: Im not to sure, I think headguards can protect head injuries but I don't think they can prevent concussion as I have still been concussed when wearing them, but I don't think mouthguards or shoulder pads do, I don't wear them which I probably should though

Commented [DB83]: Protective equipment

Interviewer: Yeah that's not a smart idea. Have you seen anyone from your own team or the opposition team get a serious concussion?

Respondent: Yeah, ive seen people get knocked out where we have had to call an ambulance but I don't remember what game it was in

Commented [DB84]: Ambulance needed calling after seeing concussion

Interviewer: Was there anything you did when the player got concussed?

Respondent: No, I kind of left to the people who have more of a knowledge of what to do with concussion

Commented [DB85]: Let people who have more knowledge deal with it

Interviewer: So, if you saw someone who didn't look right, do you think it would be your job to do something about it or do you think it's a coach, referees or parents/spectators job?

Respondent: I think it's the captains, coaches and referees' job to make sure everyone on the pitch is safe

Commented [DB86]: Captains, coaches, referees job to monitor it

Interviewer: Do you think any of them have more power or say over the other?

Respondent: Obviously referees will have more to say, but captains will be taking a proper look on the pitch, whereas a coach might not be looking out for someone on the opposition whereas a player can notice it and go 'look I don't think he's alright' to the ref and he can stop the game and sort it out

Interviewer: Just say there wasn't someone there who could you help do you think you would offer your support?

Respondent: Yeah, id offer my support where I'd call 111 and see what they can do and get an ambulance down to take control

Commented [DB87]: Call 111 to offer support

Interviewer: Do you think as a whole player take concussion seriously?

Respondent: erm, (pauses to think), I think people do, but like I said its hard to prevent concussions in games

Commented [DB88]: People take concussion seriously

Interviewer: of course, do you think there's enough awareness of how serious it is?

Respondent: Yeah, I do

Interviewer: So, off the top of your head do you know any of the return to play protocols after being concussed?

Respondent: like 2-3 weeks, no symptoms, and then progress, don't get into full contact straight away

Commented [DB89]: Return to play protocols

Interviewer: So as a captain, just say someone got concussed in a game and they said they were available for the following week, would you put them in your team even if they said they were feeling fine?

Respondent: No

Interviewer: You refuse to let them play?

Respondent: Either go to a doctor and get it clear or wait the 2 weeks and see how you feel

Interviewer: Yeah, so I know we briefly touched on it earlier on but do you think referees' have any control on reducing the number of concussions or maintaining the amount/

Respondent: Not really cause they're not really playing the game, it all depends on opposition our technique or tackling or wherever we put our bodies, but they can throw out punishments a lot more severe so that people can take it a lot more seriously

Commented [DB90]: Referees have no control, but can give harsher punishments

Interviewer: Yep, so are you aware of any resources online or available resources regarding concussion?

Respondent: NHS have got a lot, there's a lot of stuff out there

Commented [DB91]: NHS for resources

Interviewer: Yeah, do you think there should be more or do you think there's enough?

Respondent: I think there should be more because I think some people don't know how serious a concussion is, even a mild a concussion can have quite a lot of impact, I think there should be more

Commented [DB92]: Should be more resources on concussion

Interviewer: if there were to be more information to be released, in what form do you think it should be and where do you think it should be put to be the most beneficial for people to see

Respondent: Either on the England rugby page, NHS is a huge one, put more information out there

Commented [DB93]: England rugby page or NHS for more awareness

Interviewer: Yeah, and the last question, do you think that world rugby can do more to either prevent concussion or maintain concussion both at an amateur and an elite level?

Respondent: Yeah, I reckon they could be fair, I don't know how but I think they have the power, making stuff mandatory like scum hats or something

Commented [DB94]: World rugby can do more

Interviewer: Do you think they do a lot for elites in comparison to grassroots?

Respondent: oh 100%, grassroots you barely get the help you need for concussion whereas athletes get so much support like assessments to go through in comparison to us where its just like sit out

Commented [DB95]: Grassroots don't get much support

Interviewer: Have you played in a game whether that's for club or Uni where there has been a team doctor available?

Respondent: Only for my local club

Interviewer: Is that for adults?

Respondent: Adults and academy, the only reason there was one is because the teams I played for played at a relatively high standard so they had available physios or doctors there rather than being assigned to our team, but we have played in games where the opposition didn't have one and needed support so we offered ours to keep everyone safe

Interviewer: Lovely, that's everything, thank you for taking the time to complete this interview

Respondent: Thank you

Commented [DB96]: Physios available at games but not for my specific team

Appendix 5 – Coding and Thematic Analysis

First Identified Themes
Signs and symptoms
Physicality/level of rugby

Available resources
Repetitive Concussion
Awareness of what to do when noticing concussion
Information from other sources, coaches/parents/other players/referees
Self-learning concussion
Training vs games
Media knowledge
Unaware of effects of concussion
Return to play protocols
Seriousness of effects of concussion
Return to play protocols
Seriousness of concussion/unaware
'Macho' mentality to play on
Grassroots v professionals
Physios
Incidents that lead to concussion
Unaware recovery process in concussion
Referees' knowledge of handling concussion

Final Identified Themes
Available resources
Signs and symptoms
Unaware of effects of concussion
Repetitive concussion
Return to play protocol
Unaware recovery process in concussion
Grassroots vs professionals
Protective equipment to prevent concussion

Appendix 6 – Example of questionnaire taken place in May and June 2021

1) What is your gender?

- Male
- Female
- Prefer not to say

2) What is your age?

- 18-25
- 26-30
- 31-35
- 36-40
- 40+

3) What position do you normally play? (Please state)

Short answer text

4) How many years have you participated within rugby union/rugby league? (Please state)

Short answer text

5) How many concussions have you experienced in your rugby career? (Please state)

Short answer text

6) Describe the incident that lead to your most recent concussion? (Please state?)

Long answer text

Signs and Symptoms



The following questions will be asking you about your knowledge and understanding of the signs and symptoms of concussion

...

7) Which of the following do you think are the common signs and symptoms of concussion? (Please tick as many answers as you wish too)

- Arm Pain
- Bleeding Gums
- Chest Pain
- Confusion
- Cut to the face
- Difficulty Concentrating
- Dizziness
- Drowsiness

- Ear Discharge
- Feeling or Being Sick
- Feeling in a 'Fog'
- Headache
- Hot/Cold flushes
- Knocked out
- Losing teeth
- Memory Loss
- Neck Pain
- Nosebleed
- Stomach Cramps
- Unsteady Legs
- Don't know

8) Which of the following do you think is the next step for a player who has sustained a concussion and has been symptom free for 24 hours? (Tick one option)

- Nothing, they should rest another 24 hours
- Nothing, they should just rest another 3 days
- Jogging up to 70% max Heart Rate
- Running drills, no head impact activities
- Non-contact drills
- Contact Drills
- Don't know

9) Which of the following do you think is the next step for a player experiencing symptoms such as headache, dizziness, or tiredness during exercise in the week after suffering a concussion? (Tick one option)

- Rest 1 week and be reassessed
- Rest 2 days and be reassessed

- Rest 24 hours and be reassessed
- Proceed to the next stage of the return to play protocol
- Don't know

10) What do you think is the minimum time a player should have off EXERCISING once all symptoms of concussion have resolved (Tick one option)

- No time
- 24 hours
- 2 to 3 days
- 4 to 5 days
- 6 to 10 days
- 2 Weeks
- 3 Weeks
- Don't know

Return to Play Protocol



The following questions will be asking you about your knowledge and understanding of the Return to Play protocol after sustaining a concussion

...

11) Are you aware of any official guidelines regarding returning to play following a concussion?

- Yes
- No
- Don't Know

...

12a) Do you think a player who has shown signs of concussion be allowed to remain on the field of play if they feel fine and have no signs of concussion?

- Yes
- No
- Don't Know

...

12b) Do you think a player who has shown signs of concussion be allowed to remain on the field of play if they report they are fine?

- Yes
- No
- Don't know

...

13) Which of these do you think are potential risks of returning to play when concussed? (Tick all relevant)

- Second Impact Syndrome
- Slower Recovery
- Subdural Haematoma
- Injuries to other parts of the body
- More serious brain injury
- Reduced Performance
- There are no risks

Protective Equipment



The following question will ask you about the effectiveness protective equipment can have in preventing concussion



14) Which of these types of protective equipment do you think could help prevent concussion? (Tick all relevant)

- Headguard
- Shoulder Pads
- Mouthguard
- There isn't any

Prolonged Effects



The following questions will ask you about the prolonged effects concussion can have



15) At any time, which of the following do you think would slow a player's recovery from concussion? (Tick all relevant)

- Poor night's sleep
- Drinking any alcohol
- Taking Paracetamol
- Drinking excessive alcohol
- Putting ice on your head
- Wearing a headguard
- Doing school work the same day
- Going the gym the next day
- Computer games the same day

16) Which of these do you think are potential long term consequences of repeated concussion? (Tick all relevant)

- Early onset dementia
- Hair loss
- Chronic Traumatic Encephalopathy (CTE)
- Cataracts
- Early on Parkinson's Disease
- Reduced Brain function
- Cerebral Palsy
- There are no potential long-term consequences
- Don't know

Available Resources

The final questions will ask you about available resources available regarding concussion

17) Have you ever had any education regarding concussion?

- Yes
- No

18) Which of the following do you think CURRENTLY provides you information about recognising and managing concussion? (Tick all relevant)

- Online search
- IRB website
- RFU website
- Team Medic/Physiotherapist
- Coach

- Coach
- Training Course
- Other players
- Local GP
- Free smartphone apps
- Don't Know

19) In the FUTURE which of these would be your preferred source/s of information about recognising and managing concussion? (Tick all relevant)

- Online search
- IRB website
- RFU website
- Team medic/Physiotherapist
- Coach

- Coach
- Training course
- Other players
- Local GP
- Free smartphone app
- Hard copy educational handouts

After section 7 Continue to next section

Section 8 of 8

Thank you!

Thank you for taking the time to participate in this study. Your time, effort, and support is very much appreciated!

Appendix 7 – Concussion Educational Handout

A4 Educational Handout

Correct Signs and Symptoms

- Confusion ✓
- Dizziness ✓
- Reporting Headache ✓
- Drowsiness ✓
- Memory Loss ✓
- Difficulty Concentrating ✓
- Feeling in a fog ✓

Incorrect Signs and Symptoms

- Stomach Cramps ✗
- Ear Discharge ✗
- Nosebleed ✗
- Cut to face ✗
- Chest Pain ✗
- Neck Pain ✗
- Knocked out ✗

Return to Play

After encountering a concussion, remove player from the field of play immediately



After the incident of concussion, rest 2 to 3 days before starting any exercise



After symptom free, return to light aerobic exercise within a week



After 2- 3 weeks, return to full contact matches



Protective Equipment

