The prevalence and profile of musculoskeletal pain in elite wheelchair basketball players of different point classifications in South Africa.

By

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This dissertation is submitted in partial compliance with the requirements for the

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at the Durban University of Technology.

I, Isabel Sita Maharaj Mateus, do declare that this dissertation is representative of my own work in both conception and execution (except where acknowledgements indicate to the contrary).

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DEDICATION

I dedicate this research to my amazing parents, Manuel and Molly Mateus.

Dad, I miss you so much. I hope that you're looking down on me from Heaven, a proud Father.

Thank you, Mum and Dad, for all the sacrifices that you have made and for the support that you have given me. This qualification would not have been possible without your help. Thank you for your unconditional love, encouragement and selflessness, as well as for teaching me the value of hard work, perseverance and dreaming big no matter what circumstance you are in. I am truly blessed and privileged to have loving parents like you.

Words can never express the appreciation and love that I have for you. I love you both very much.

I also dedicate this research to the Father, Son and Holy Spirit through Whom all things are possible and for blessing me with my parents.

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ABSTRACT

Background

There has been a remarkable increase in the participation of sport for athletes with disabilities. Consequently, there have been many international studies on injuries in athletes which have shown a high prevalence in wheelchair basketball, largely attributed to the fast-paced, high intensity nature of the sport. This sport has grown worldwide including South Africa, however, very little research has been published on South African wheelchair basketball players and more research is, therefore, needed.

Aim

To determine the prevalence and profile of musculoskeletal pain in elite wheelchair basketball players of different point classifications in South Africa.

Hypothesis 1: Upper extremity (including neck and back) pain is experienced more commonly in lower point classified wheelchair basketball players than in higher point classified players.

Hypothesis 2: Lower extremity pain is experienced more commonly in higher point classified players than in lower point classified players

Method

This study was a quantitative, cross-sectional, questionnaire-based study. The questionnaire comprised of sub-sections on demographics and disability characteristics; activity levels pertaining to wheelchair basketball and other sport/physical activity; the prevalence of pain and the impact thereof on wheelchair basketball and/or activities of daily living. This questionnaire was administered to 48 wheelchair basketball players who were competing in the 2015 Supersport League. A response rate of 70% was decided as the lower limit cut-off for statistical power.

Results

Fourty-three participants responded yielding an 89.58% response rate. The mean age of participants was 33.3 (SD:9.5) years and the majority of participants (n=35) were male and African (n=29). Out of the 43 participants, 79.1% (n=34) used mobility devices, the majority (n=20) used wheelchairs. Most of the participants (n=41) played wheelchair basketball for more than five years and 32 participants did not participate in other sport. Almost half of the participants (n=25) experienced musculoskeletal pain in the last twelve months or at present, 75% of whom (n=12) visited a Physiotherapist for the pain. More than half of these participants (n=15; 60%) reported that the pain negatively affected their basketball performance. It was established that arm pain occurred frequently in lower point classified players (1.0-2.5 point players) and that hand and wrist pain was also more prevalent in lower point players than in higher point players. The prevalence of lower extremity pain was low and there was no statistically significant difference between higher and lower point classified players.

Conclusions and recommendations

The finding that upper extremity pain occurred more frequently in lower point classified players was in keeping with the first hypothesis (the null hypothesis was, therefore, rejected). The second hypothesis was, however, rejected (and the null hypothesis was, therefore, accepted) as lower extremity pain did not occur more frequently in higher point classified players than in lower point classified players. The Eta scores may have been higher and may have shown a much larger than typical relationship between point classification and the prevalence of musculoskeletal pain had there been a larger sample size. Notwithstanding this limitation, it is a challenge to obtain a significantly larger sample size due to the nature and limited number of participants in this sport. More studies are warranted on this group of individuals, as a large number experienced pain which affected more than half of the participants' performance in wheelchair basketball. These studies are important for the future success of the South African players and the sport in South Africa.

Key words: athletes; disabilities; injuries; wheelchair basketball; point classification; South Africa

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DEFINITIONS

Anterior: Front part of the body (Moore and Dalley 2006: 6-7).

Arthrogryposis: condition characterised by many joint contractures throughout the body that is present at birth. It is non-progressive (Chen 2015).

Cerebral palsy: “defect of motor power and co-ordination related to damage of the brain” (Dirckx 1997: 644).

Contralateral: Opposite side of the body in relation to another structure (Moore and Dalley 2006).

Dwarfism: “the condition of being abnormally undersized” (Dirckx 1997: 261).

Guyon’s canal: A groove between the pisiform and hammate carpal bones, found on the medial aspect of the carpus, is bridged by a band of fibrous tissue which forms this canal (Moore and Dalley 2006: 844).

Les autres: “All others” in French (Klenck and Gebke 2007).

Locomotor: “Relating to locomotion, or movement from one place to another” (Dirckx 1997: 501).

Medial Epicondylitis: Inflammation of the medial epicondyle (which is a part of the humerus, at the elbow joint, on the medial side of the arm). Also known as “Little League elbow” (Dirckx 1997: 292).

Mobility device: A device that aids mobility-impaired people in walking and/or moving around in order for them to lead more independent lives.

Muscular dystrophy: Genetic disease causing progressive weakness and degeneration of specific muscle groups *(*Longmore *et al.* 2010: 514*).*

Osteogenesis: “The formation of bone” (Dirckx 1997: 634).

Osteogenesis imperfecta: “abnormal fragility and plasticity of bone with recurring fractures on trivial trauma” (Dirckx 1997: 634). This is due to imperfect bone formation.

Osteopenia: “Decreased calcification or density of bone” (Dirckx 1997: 635).

Osteoporosis: Decreased bone mass that could lead to fractures. Wheelchair users are at high risk of this due to prolonged immobility (Longmore *et al.* 2010)

Plantarfasciitis: Inflammation of the plantarfascia found on the sole of the foot.

Residual limb: The remnants of the limb that was amputated on.

Thoracic kyphosis: Normal curvature of the thoracic spine that is concave anteriorly (Moore and Dalley 2006: 513).

Valgus: “Descriptive of any of the paired joints of the extremities with a static angular deformity in which the bone distal to the joint deviates laterally from the longitudinal axis of the proximal bone, and from the midline of the body, when the subject is in anatomical position” (Dirckx 1997: 927).

Varus: “Descriptive of any of the paired joints of the extremities with a static angular deformity in which the bone distal to the joint deviates medially from the longitudinal axis of the proximal bone, and toward the midline of the body, when the subject is in anatomical position” (Dirckx 1997: 930).

Volume of action: “The limit to which a player can move voluntarily in any direction, and with control return to the upright seated position, without holding the wheelchair for support or to aid the movement. The volume of action includes all directions, and describes the position of the ball when held with both hands” (International Wheelchair Basketball Federation 2010: 8).

ABBREVIATIONS

DUT	Durban University of Technology
IREC	Institutional Research Ethics Committee
IWBF	International Wheelchair Basketball Federation
n	Sample size
Ƞ	Eta score
p	*p*-value showing statistical significance
r	correlation
SA	South Africa
SD	Standard deviation
SPSS	Statistical Package for the Social Sciences
WBSA	Wheelchair Basketball South Africa

CHAPTER ONE

INTRODUCTION

This chapter provides background to the topic. The aim, objectives and rationale are outlined, as well as potential limitations of the study.

1.1 Background

There has been an increased participation in sport for individuals with disabilities over the decades, with wheelchair basketball being one of the more popular sports to participate in (Yildirim, Comert and Ozengin 2010). This can be clearly seen in South Africa where wheelchair basketball has become a fast growing sport (Lepera 2010). The Supersport League is an example of the great success of wheelchair basketball in South Africa with games being televised almost weekly thereby showcasing the country's elite teams and top players (Wheelchair Basketball South Africa n.d: 5).

In 2008, the South African wheelchair basketball team won their first ever game at the Paralympics, however many players suffered from repetitive strain injuries (Lepera 2010). A better knowledge of these injury or pain patterns is, therefore, of importance for healthcare practitioners involved in sports rehabilitation (Slocum, Blauwet and Allen 2015).

Wheelchair basketball is a high intensity, five players-per-side sport. The athletes competing have different disabilities and before the season are classified on a scale ranging from 1.0 to 4.5 points based on their functional ability to execute movements in basketball. Each class exhibits characteristics that are unique to the respective class (International Wheelchair Basketball Federation 2010).

Lower point players (i.e. 1.0-2.5 point players) predominantly include those with spinal cord injuries. Such players have impaired muscle power of the trunk, pelvis and hips, therefore they require wheelchairs with a 'deep' seating position (Vanlandewijck, Verellen and Tweedy 2011). According to Vanlandewijck, Verellen and Tweedy (2011), this seating position tilts the pelvis posteriorly thereby changing the length of the paravertebral and abdominal muscles which will further restrict active range of motion of the trunk. Vanlandewijck, Verellen and Tweedy (2011) further stated that this will adversely affect the range of motion of the shoulder joint and hence the athlete. A study on shoulder pain in wheelchair basketball players with or without trunk control revealed a greater incidence of shoulder pain in players with less trunk control (Yildirim, Comert and Ozengin 2010).

In the same study, by Yildirim, Comert and Ozengin (2010), higher point player's (i.e. 3.0-4.5 point players) also experienced shoulder pain, but to a lesser extent than lower point players. Higher point players are more at risk of lower limb injuries and/or pain, as this group comprises of amputees and players with congenital anomalies who require the use of prostheses (Willick and Webborn 2011; Buschbacher 2002). Willick and Webborn (2011) and Buschbacher (2002) stated further that poorly fitted prostheses and overuse injuries of the contralateral limb are common causes of pain. Improper warm-up, fatigue, overuse and repetitive positioning may also be indicated as factors affecting the risk of pain and/or injury (Slocum, Blauwet and Allen 2015). Furthermore, due to the athlete being in a wheelchair, actions such as throwing/shooting are performed from a position of mechanical disadvantage (Thiboutot 1999 cited in Lepera 2010: 2). This, together with their positioning in their chairs, may predispose these athletes to overuse injuries (Lepera 2010; Dec, Sparrow and McKeag 2000). Although the most common injuries in wheelchair basketball players seem to be that of shoulder injuries, the constant pressure on the palms of hands and the powerful gripping during wheelchair propulsion may cause injuries of the elbow or symptoms of carpal tunnel syndrome (Dec, Sparrow and McKeag 2000).

There have been several studies conducted on wheelchair athletes (Goosey-Tolfrey 2010a and b; Groah and Lanig 2000; Burnham *et al.* 1993*)*, some on wheelchair basketball players (Yildirim, Comert and Ozengin 2010; Rocco and Saito 2006), however studies performed in the South African context are limited. A fairly recent study by Lepera (2010), on the prevalence of shoulder pain in professional male wheelchair basketball players in Gauteng, found that 72.4% of players experienced shoulder pain. This indicated the need for further studies on South African wheelchair basketball players.

In addition, despite the successes and growth of South African wheelchair basketball athletes, not many studies have been published on this group (Lepera 2010). There is, therefore, a need for further research to highlight any problem areas in training or lifestyle that may be leading to injuries for optimal performance of athletes and for further growth and success of the sport.

1.2 Research Aim

To determine the prevalence and profile of musculoskeletal pain in elite wheelchair basketball players of different point classifications in South Africa.

1.3 Research Objectives

1.3.1. To determine the demographics and disability characteristics of elite wheelchair basketball players in South Africa.

1.3.2. To determine the prevalence and profile of musculoskeletal pain, respectively in elite wheelchair basketball players in South Africa.

1.3.3. To determine the impact of the musculoskeletal pain on basketball activity or activities of daily living.

1.3.4. To establish possible associations between pre-game classification and the prevalence of musculoskeletal pain.

1.4 Rationale

Involvement in sport for physically challenged individuals continues to grow in popularity (Ferrara *et al.* 1992). It is, therefore, an area of emerging interest and requiring more research. This is particularly relevant within a South African context and in the area of wheelchair basketball (Lepera 2010), due to increased participation and support of the sport.

The high demands of the sport in terms of strict training regimes and the pace of the game lead to overuse injuries and pain (Lepera 2010). Musculoskeletal pain may have an effect on the standard of game play, as well as activities of daily living and hence it is essential to be aware of it and get the necessary treatment and preventative advice (Bernardi *et al.* 2003). This is also important for healthcare practitioners, such as chiropractors, to be aware of when working with sports teams.

Additionally, the use of Chiropractic care, as a first line treatment, has increased (Daniels 2010), and is particularly evident in Sports Medicine (Hyde and Gengenbach 2007). Due to the high probability of overuse injuries in wheelchair basketball players, Chiropractic care would be of great value in ensuring that athlete's performances are not hampered by pain and/or injury.

1.5 Hypothesis

The hypotheses stated below were based on objective 1.3.4 only. It was hypothesised that:

1.5.1. Upper extremity (including neck and back) pain was experienced more commonly in lower point classified wheelchair basketball players than in higher point classified players.

1.5.2. Lower extremity pain was experienced more commonly in higher point classified players than in lower point classified players.

1.6 Limitations of the study

This study relies on the compliance of the wheelchair basketball players to participate in the research undertaking. Due to the possibility of not all the wheelchair basketball players agreeing to participate, the results generated would only be based on the wheelchair basketball players who participate and will, therefore, not take into account the non-participants.

This study is subjective as the various wheelchair basketball players will complete the questionnaire based on how they felt, either at that point in time or prior, and no objective investigations such as physical examinations would be undertaken by the researcher.

In addition, it would also be taken for granted that the questionnaires would be completed truthfully.

1.7 Outline of chapters

Chapter One introduces the topic, as well as discusses the aims, objectives, rationale and limitations of the study. Chapter Two provides a review of the literature pertinent to this topic in order to facilitate further understanding of the research and the need for the study. Chapter Three details the methods and materials that will be employed in this study, as well as how the data will be statistically analysed. Chapter Four provides the results of the data collected and directs the reader towards the interpretation of the findings. Chapter Five provides an interpretation and discussion of the results and how the results compare with those of other studies on wheelchair basketball players and/or the disabled population. Chapter Six draws conclusions from the study and provides recommendations for future studies in this field.

CHAPTER TWO

LITERATURE REVIEW

This chapter provides a background of the topic and includes documented information on the disabled athlete, in particular the wheelchair basketball athlete, and the various musculoskeletal injuries that they may be at risk of due to the nature of their disability and the sport. The research study in terms of current knowledge and the gap that this research attempts addressing is also contextualised.

2.1 Disabled athletes and sport

Athletes without disabilities, according to Klenck and Gebke (2007), face many challenges in their sporting careers, but not as many as athletes with disabilities. Despite this, participation in sporting activities for the physically challenged individual, especially the wheelchair user, has increased exponentially over the past few decades (Klenck and Gebke 2007). The Paralympic Games has undergone a rapid evolution, from sixteen people who participated in 1948 at the first Stoke Mandeville games to greater than 4 000 athletes that competed in the Paralympic Games in London 2012, which was televised worldwide (Webborn and Emery 2014).

There are many different conditions causing disability amongst these athletes, therefore these athletes are first divided into one of six disability categories that will help to determine the sport that they can compete in (Klenck and Gebke 2007; White 2002):

- The first category is the wheelchair athlete. This group comprises mainly of athletes with spinal cord injuries that have a minimum of 10% loss of lower limb function, as well as amputees.
- The second category includes cerebral palsy athletes.
- The third category is the amputee athlete. This athlete may be classified as a wheelchair athlete depending on whether they use prosthetics and the sport they compete in, and must have at least one joint missing in a limb.
- The fourth group consists of blind athletes with <20/200 vision.
- Intellectually disabled athletes make up the fifth category and these athletes must have sufficiently impaired intellectual functioning in two or more of the following areas before the age of 18: communication; functional academics; self-direction; social skills; leisure; community use; work; self-care and home living.

- The sixth category is comprised of athletes not fitting into the other groups, les autres athletes, and includes athletes with muscular dystrophy, osteogenesis imperfecta, dwarfism and arthrogryposis (Klenck and Gebke 2007; White 2002).

Once athletes are classified into one of the six categories, sport-specific classification of individual players (which differs between sports) takes place; this generally classifies athletes based on their levels of impairment (Klenck and Gebke 2007; White 2002).

The different athletes competing may become affected by musculoskeletal injuries that are localised to specific regions (Klenck and Gebke 2007). For example, the cerebral palsy athlete may experience patellofemoral joint pain, as well as foot pain due to varus and valgus deformities. Amputee athletes mainly present with injuries to the intact limb, such as plantarfasciitis, due to the increased stress applied. Furthermore, these athletes with lower limb amputations also experience low back pain due to increased lumbar extension and lateral flexion to compensate for decreased joint flexion at the site of prosthesis. Blind athletes generally exhibit lower extremity overuse injuries as these athletes often compete in sport such as soccer. Intellectually disabled athletes experience more ocular and congenital heart defects as opposed to musculoskeletal pain and/or injuries. Lastly, the wheelchair athlete presents mainly with upper extremity injuries and/or pain. (Klenck and Gebke 2007; White 2002; Nyland *et al.* 2000; Dec, Sparrow and McKeag 2000; Ferrara *et al.* 1992; Curtis and Dillon 1985)

2.2 The wheelchair athlete

Wheelchair athletes account for a large number of disabled athletes (Klenck and Gebke 2007). The most common cause of disability amongst these athletes is spinal cord injury which accounts for 65% of the cases (Curtis and Dillon 1985). Other causes include polio/post-polio syndrome (12%), neuromusculoskeletal pathologies (10%), congenital disorders such as spina bifida (9%) and amputation (3%) (Tweedy and Vanlandewijck 2011; Curtis and Dillon 1985).

There is a variety of sports that the wheelchair athlete can participate in, some examples of which include wheelchair basketball, curling, tennis, table tennis, rugby and road racing. Wheelchair basketball, road racing, tennis and rugby had the most reported injuries (Nunome *et al.* 2002; Ferrara and Peterson 2000; Curtis 1997). Bernardi *et al.* (2003) conducted a study on muscle pain in athletes with locomotor disability in Italy and found that 50,7% of wheelchair athletes reported muscle pain, of which 58,8% of the study population were wheelchair basketball players. As a result, there is a need to study these

groups of athletes and in particular, wheelchair basketball players due to the high intensity and risk of the sport.

2.3 Wheelchair basketball in South Africa and the Supersport League

Locally, wheelchair basketball is another example of the great success of sport for the physically challenged individual (Lepera 2010). Wheelchair basketball in South Africa was established in 1970 and has been expanding ever since (Wheelchair Basketball South Africa n.d: 1). The national team, also known as the Sasol AmaWheelaBoys (including females) have had a few wins under their belt including the 2007 All Africa Title (Lepera 2010). Willie Mulder, North Gauteng and Tswane Bladerunners coach and the longest serving active wheelchair basketball player in South Africa, said that much had changed since he started playing wheelchair basketball in 1987. The design of the chairs had changed and chairs now have a frame with wheels in the front and back to stabilise it (Beneke 2014). The greatest change, though, was the advancement in the skill level of players. “The level of the game has improved immensely, things they do in the chairs have changed, they can tilt and shoot, it is phenomenal to see” said Mulder (Beneke 2014: 43). Due to the heightened skill levels of these players and the fact that they are more daring on court, it could lead to an increased risk of injuries.

Wheelchair Basketball South Africa has a number of big sponsors including Sasol, Supersport and Vodacom (Wheelchair Basketball South Africa n.d: 5-6). The Supersport League showcases the country’s top teams and players (Wheelchair Basketball South Africa n.d: 5). This year it was comprised of six elite teams from KZN, Gauteng and the North West and ran from May 2015 to September 2015. Games are televised and this is the only televised wheelchair basketball in Africa.

Despite the advancements in Wheelchair basketball in South Africa, there is a lack of research on this group of individuals. Lepera’s (2010) study on the prevalence of shoulder pain in professional Gauteng-based male wheelchair basketball players revealed that 72,4% of the players experienced shoulder pain, with 37,9% having experienced shoulder pain at that point in time. This finding, together with the significant growth of the sport in South Africa, indicates a need for further research in South African wheelchair basketball players.

2.4 Characteristics and structure of the game

Wheelchair basketball is a fast-paced and high risk five player per side sport. High intensity propulsion and manoeuvring are key characteristics of the sport, together with quick passing, rebounding and reaching overhead for shooting (Lepera 2010; Goosey-Tolfrey, Morriss and Butterworth 2002; Curtis *et al.* 1999). Each game consists of four ten-minute periods with very little time to rest between quarters, except for the half-time interval which lasts fifteen minutes (International Wheelchair Basketball Federation 2012). Due to the fast-paced nature of the sport, the majority of the players are trained to quickly get back up if they fall and continue playing, unless injury forces them to be out of the game, or in the case of a low point player who may require assistance. Wheelchair basketball is a fairly good example of a sport where athletes with disabilities of varying degrees participate together, in a team, based on a system that classifies players individually (Goosey-Tolfrey 2010a).

2.5 Classification of players

Before being allowed to compete, players need to have been classified. Players are classified, according to physical function, on a scale from 1.0-4.5 (8 classifications, 0.5 intervals). The 1.0 point players have the least physical function and generally the highest level of disability (e.g. a person with a spinal cord injury who is bound to a wheelchair) whilst 4.5 point players have the most physical function and generally the lowest level of disability (e.g. a person with an amputation below the knee). The five players on court, at any given time, must not exceed 14 points as a team though lower is allowed (International Wheelchair Basketball Federation 2010). Thus, a well-structured team consists of players with a variety of disabilities, but a high level of skill (Goosey-Tolfrey 2010b) and by the process of classification, the IWBF equalises the team's functional potential (International Wheelchair Basketball Federation 2010).

Observing and assessing a player's Volume of Action is an important factor of classification. A player's Volume of Action is defined as: "The limit to which a player can move voluntarily in any direction, and with control return to the upright seated position, without holding the wheelchair for support or to aid the movement. The volume of action includes all directions, and describes the position of the ball when held with both hands" (International Wheelchair Basketball Federation 2010: 8).

There are three “planes of movement” in the seated position (Figure 2.1) that are used to assess a player’s Volume of Action (International Wheelchair Basketball Federation 2010: 8), namely:

- The sagittal plane (or the forward plane): Movement occurring in this plane will include forward flexion of the trunk (trying to reach the feet with the hands) and returning to the neutral seated position.
- The transverse plane (or the vertical plane): Trunk rotation whilst maintaining an upright seated posture.
- The coronal plane (or the sideways plane): Lateral flexion of the trunk bilaterally and returning to the neutral position (International Wheelchair Basketball Federation 2010).

The key factors affecting a player’s Volume of Action include the range of trunk, upper limb and lower limb function, as well as the co-ordination and strength of those regions. These factors are initially looked at individually and then assessed as a whole, when the player is in a game situation or uses various basketball movements, with particular attention being paid to trunk movement and stability (International Wheelchair Basketball Federation 2010).

In addition to trunk movement and stability, a player’s Volume of Action and classification may also be affected by their ability to stabilise their pelvis. The 1.0-2.0 point players, in general, have decreased muscle strength/ control in their trunk, pelvis and hips and therefore cannot stabilise the pelvis during trunk movements in the above mentioned three planes. These players therefore rely on passive stability such as playing on a chair with a seat that is angled resulting in the knees lying higher than the level of the pelvis, thus creating a ‘bucket’ seat (International Wheelchair Basketball Federation 2010: 10) that helps in stabilising the pelvis (Figure 2.2). They also require the use of straps around the pelvis for further stabilisation, as well as to strap the knees together to the wheelchair (International Wheelchair Basketball Federation 2010).

This ‘bucket’ or, as described by Vanlandewijck, Verellen and Tweedy (2011: 1089), ‘deep’ seating position is believed to enhance safety and performance of the players, however, this seating position will cause a posterior pelvic tilt which will alter the paravertebral and abdominal muscle lengths thereby reducing active trunk movement even further in these players (wheelchair basketball, as well as wheelchair rugby and tennis players). This decreased/lack of trunk movement will limit the range of motion of the shoulders and will therefore adversely affect certain actions of the players such as acceleration (Vanlandewijck, Verellen and Tweedy 2011).

On the other hand, 3.0-4.5 point players who have adequate muscle strength/control to actively stabilize the pelvis, will play on a chair that has a fairly flat seat with a low backrest and little support except for straps around the thighs (Figure 2.3) (International Wheelchair Basketball Federation 2010).

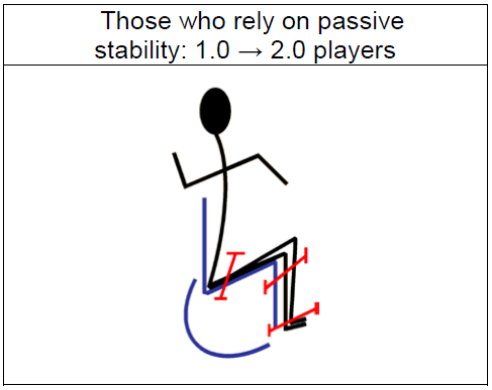


Figure 2.1. Seating position of lower point players

(International Wheelchair Basketball Federation, 2010)

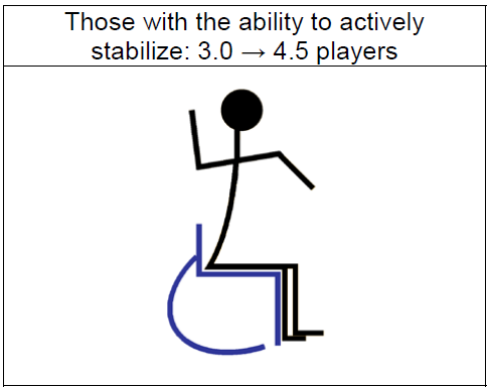


Figure 2.2. Seating position of higher point players

(International Wheelchair Basketball Federation, 2010)

2.5.1 Activity characteristics of the different point players

The characteristics unique to the different classified point players in terms of their ability to perform fundamental basketball movements will be discussed below. All information from the 1.0 to 4.5 point player has been taken from the Official Player Classification Manual (International Wheelchair Basketball Federation 2010).

2.5.1.1 One (1.0) point player

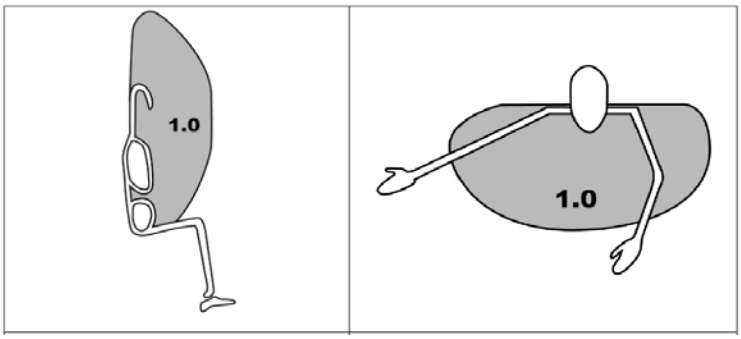


Figure 2.3. Volume of Action of a 1.0 point player in the forward and vertical plane

(International Wheelchair Basketball Federation, 2010).

Players have the least Volume of Action in all planes and due to paralysis of the lower limbs and trunk (usually as a result of a spinal cord injury), players have very little ability (if any at all) to move in these planes of movement.

Braking/ Turning: Players lean their head, neck and shoulders back and away from the direction of pivot when performing this action.

Catching/ Passing: The wheelchair is heavily relied upon for support when performing these actions. Players can only catch passes from behind when holding onto the wheelchair with one hand as they cannot rotate due to the lack of trunk function. The head neck and shoulders are moved backwards, when performing a “forceful two handed pass forward”, to maintain balance and an upright seating posture. When performing a “forceful one handed pass”, players will maintain balance and an upright seating posture by holding the wheelchair with the opposite hand.

Contact: Players, in general, lack the ability to maintain balance when contact is made and if they fall off their chairs, they will require assistance to get back on.

Dribbling: Players dribble the ball as close to the trunk as possible and to one side.

Rebounding/ Shooting: Players hold the wheelchair, with one hand, to maintain balance when rebounding overhead as rebounding is generally performed with one hand (this action will have to be performed above the head if two hands are used, but any contact may result in the player losing balance). When shooting, players will lean into the backrest of the wheelchair in order to maintain balance. Players will predominantly shoot two-handed; they may lose balance during the follow through phase of shooting and will therefore need one hand to maintain the upright seating posture.

Pushing: Whilst pushing, players predominantly maintain an upright seated posture and use the backrest of the wheelchair for balance. In order to compensate for the decreased trunk function and to maintain balance, players will move their head, neck and shoulders in a forwards and backwards motion.

2.5.1.2 Two (2.0) point player

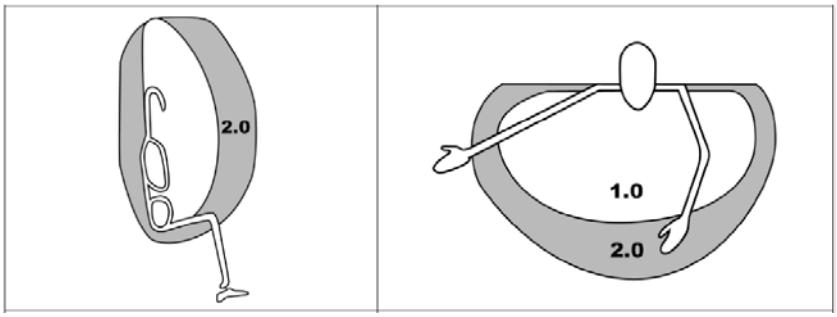


Figure 2.4. Volume of Action of a 2.0 point player in the forward and vertical plane compared to a 1.0 point player.

(International Wheelchair Basketball Federation, 2010)

Players have some Volume of Action in the forward and vertical plane, but nothing in the sideways plane due to paralysis of the lower limbs and lower trunk (also usually as a result of a spinal cord injury).

Braking/ Turning: Players may forward flex their trunk when performing these actions, but will only let go of the wheels when they're in the neutral seating position. These players, unlike the 1.0 point player, can also slightly lean towards the pivot direction.

Catching/ Passing: The wheelchair is only relied upon for support with forceful passes. Players can rotate their upper trunk to catch the ball, however, they still need to stabilize their lower trunk against the back rest of the wheelchair. When performing "forceful two handed pass forwards", the lower trunk will be stabilized onto the backrest and is not involved in the pass/ throw. When performing "forceful one handed pass forwards", the contra lateral hand will be used to hold onto the leg or wheelchair in order to maintain an upright seating posture or gain leverage.

Contact: Players, in general, lack the ability to maintain balance when forceful contact is made, particularly if they're rebounding or shooting when the contact is made. However, unlike the 1.0 point player, 2.0 point players generally have the ability to get back on the wheelchair and/ or assume the upright seating position.

Dribbling: Players can dribble in front of the wheelchair. In stances when there is a fast take-off, players may lose some stability as they start dribbling.

Rebounding/ Shooting: Players, in general, hold the wheelchair with one hand for support while rebounding overhead with the other hand. Rebounding can also be performed with two hands (there may be a slight loss of stability if this action is performed with two hands, which will increase if contact there is contact). When shooting, players usually sit against the backrest, although they can lean slightly forwards if desired. Players can also rotate their upper trunk to shoot, provided that their lower trunk is stabilized against the backrest.

Pushing: Whilst pushing, in order to increase speed, players have the ability to move their upper trunk forwards, but they may start to experience instability at a certain point.

2.5.1.3 Three (3.0) point player

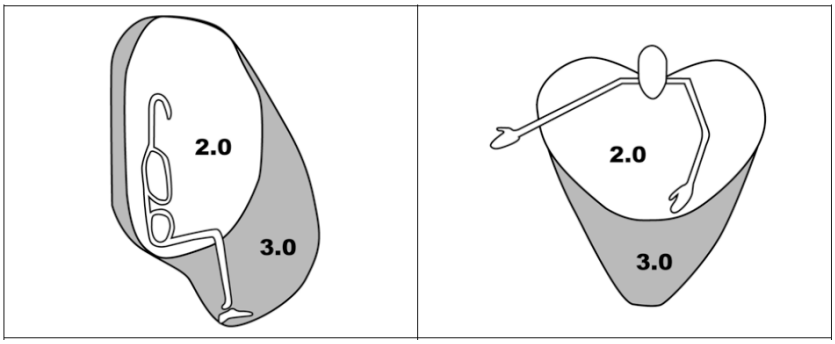


Figure 2.5. Volume of Action of a 3.0 point player in the forward and vertical plane compared to a 2.0 point player.

(International Wheelchair Basketball Federation, 2010).

Players have full Volume of Action in the vertical and forward planes, with little (if any) in the sideways plane due to the inability of the thighs and hips to stabilize (usually as a result of a spinal cord injury or bilateral amputation very proximal to the hip joint).

Braking/ Turning: 3.0 point players have more stability when performing these actions than 1.0 or 2.0 point players. They also have the ability to lean into the direction of pivot without losing stability and they can assume the upright/ neutral seating position from a forward flexed position more readily.

Catching/ Passing: The wheelchair is not relied on for support. Players can rotate their trunk to catch the ball from behind and they do not need any support from the backrest when performing this action. However, these players can only catch passes that are wide to their sides, with one hand because the contra lateral hand is needed for trunk stability. When performing “forceful two handed pass forwards”, they can use their trunk to enhance the pass/ throw (i.e. by leaning the trunk forward) without losing stability. When performing “forceful one handed pass forwards”, players will rotate their trunk towards the

direction of the pass to gain power, with the contra lateral hand being held up anterior to the body.

Contact: Players, in general, are quite stable and can maintain balance when contact occurs, even when contact is from the front or when rebounding or shooting. Players can lose stability when there is contact from the side. Players can assume the upright seating position easily without using the upper limbs (the use of the upper limbs is only required if they are not balanced in the sideways plane).

Dribbling: Players can dribble in front or from side to side without using the contra lateral hand for support (the contra lateral hand is use to push the wheelchair). These players, unlike the 2.0 point players, will not lose stability when they start dribbling after a fast take-off.

Rebounding/ Shooting: Players can rebound overhead with two hands without losing stability. When shooting, players are able to rotate their trunk to shoot without needing the backrest for stabilization.

Pushing: In order to increase speed and power whilst pushing, players are able to move their entire trunk forward without any loss of stability. The trunk moves in sync with the head, neck and shoulders.

2.5.1.4 Four (4.0) point player

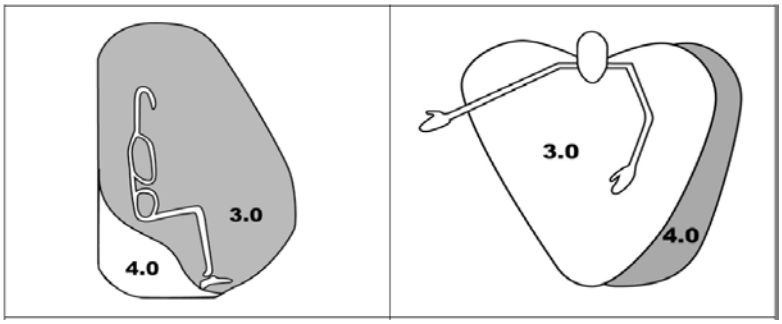


Figure 2.6. Volume of Action in a 4.0 point player in the forward and vertical plane compared to a 3.0 point player.

(International Wheelchair Basketball Federation, 2010)

Players have full Volume of Action in the forward and vertical planes and some in the sideways plane, with the Volume of Action being much stronger on one side (usually as a result of a unilateral amputation at the level of the knee).

Braking/ Turning: Players display strong trunk function or movement in all actions of wheelchair basketball and are able to maintain balance at all times.

Catching/ Passing: The wheelchair is not relied upon for support. Players can rotate their trunk to catch the ball from behind without any support from the backrest of the wheelchair. They can catch passes that are wide to their strong side with two hands, but when receiving a pass on their weak side, they have to maintain trunk stability with the use of their contra lateral hand. These players can also catch passes below seat level on their strong side, however, balance is lost if they try to do this on their weak side. When performing “forceful two handed pass forwards”, they can lean their trunk forward easier than the 3.0 point player without stability being compromised. When performing “forceful one handed pass forwards”, players will rotate their trunk towards the direction of the pass to gain power, with the contra lateral hand being held up anterior to the body.

Contact: Players are able to maintain stability even when forceful contact from the front occurs or when rebounding and shooting. Players can lose stability if there is forceful contact to their weak side. They are able to assume the upright seating position quickly and without using the upper limbs.

Dribbling: Players can dribble the ball from side to side and in front without losing balance. They can also maintain the dribble when contact is made.

Rebounding/ Shooting: Players can rebound overhead with two hands without any loss of stability even with some contact. Players can also laterally flex towards their strong side and rebound with two hands. When shooting, players are able to rotate their trunk without being stabilized by the backrest of the wheelchair. They can also flex their trunk for long range shooting.

Pushing: Players can lean their trunk forwards with ease and without losing balance whilst pushing.

2.5.1.5 Four-point-five (4.5) point player

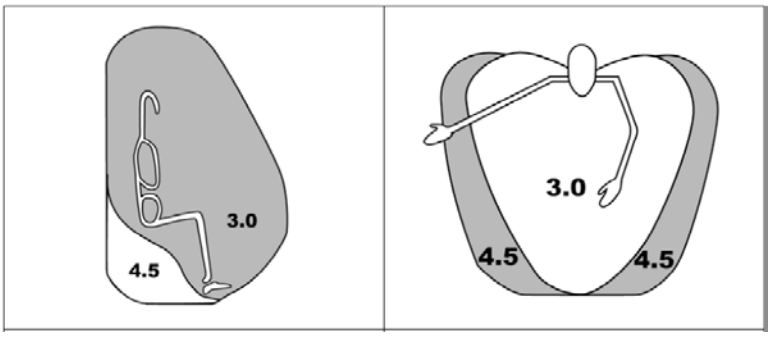


Figure 2.7. Volume of Action of a 4.5 point player in the forward and vertical plane compared to a 3.0 point player.

(International Wheelchair Basketball Federation, 2010)

Players have full Volume of Action in the forward, vertical and sideways planes. They do not display any significant weakness in any direction or sides. All basketball movements are performed with ease and without any loss of stability like the 4.0 point player, but without a weak side (this group comprises of players who have had amputations or congenital anomalies at the level of the knee or lower).

2.5.2 The association between point classification in wheelchair basketball and the prevalence of pain

Nyland *et al.* (1997), in a study investigating shoulder rotator muscle torque and the differences in wheelchair dependence of wheelchair basketball players. They found that there was an asymmetry of the external rotator muscle torque between the dominant and non-dominant shoulders in lower point players. These players were therefore at a greater risk of developing muscle imbalances, especially of the shoulder joint and hence shoulder pathology (not necessarily pain). This study, however, only had a response rate of 49% which compromised the power of the data.

A Turkish study conducted by Yildirim, Comert and Ozengin (2010) on shoulder pain in wheelchair basketball players with and without trunk control, found that 1.0-2.5 point players scored twice as high in the Performance Corrected Wheelchair User's Shoulder Pain Index than 3.0-4.5 point players. This may be due to there being increased/relatively high loading of the upper extremity particularly of the shoulder joint, as these players rely on their wheelchair's not only training and matches, but also for activities of daily living. In addition, Yildirim, Comert and Ozengin (2010), established that the number of daily transfers made by 1.0-2.5 point players were 2.5 times higher than 3.0-4.5 point players. Even though 3.0-4.5 point players did not experience it to the same extent as 1.0-2.5 point players, shoulder pain was still experienced in this group of players. This may be due to

these players taking on more ball-handling roles such as shooting, rebounding and passing which involves extensive overhead activity (Yildirim, Comert and Ozengin 2010).

Molloy and Robertson (2007), stated that there is an increased risk of injury to the shoulder joint in an able-bodied athlete with reduced thoracic extension and/or rotation, hip extension or gluteal drive. Although this study was on able-bodied athletes, this theory could apply to the 1.0-2.5 point wheelchair basketball player who has decreased function of the trunk, hips and pelvis due to paralysis.

2.6 Pain and/or injuries associated with wheelchair athletes and wheelchair basketball players

Upper extremity overuse injuries are more common in wheelchair bound individuals whilst lower extremity overuse injuries are more common in lower extremity amputees (Buschbacher 2002). Phantom pain or sensation, which is the sensation that the absent limb is still there or pain in the absent limb, is an example of pain in amputees (May and Lockard 2011). It is, however, not unique to individuals with amputations and may also be experienced by individuals with complete paralysis of one or more limbs (May and Lockard 2011).

The aetiology of injuries amongst wheelchair athletes is multi-factorial. Overuse injuries account for 23-52% of these injuries (Ferrara and Davis 1990; Groah and Lanig 2000). Wheelchair athletes are most commonly affected by soft tissue injuries, especially of the upper extremity (Curtis and Dillon 1985; Ferrara and Peterson 2000). The upper extremity in wheelchair athletes (and wheelchair users) is forced to bear weight, but is not designed and meant for weight bearing (Irwin, Restrepo and Sherman 2007) therefore easily leading to injuries. In a study on common patterns of injury in wheelchair athletes, Curtis and Dillon (1985) reported that 33% of the total injuries amongst wheelchair athletes were soft tissue injuries, with 72% of those athletes having had at least one injury due to participation in sport. Twenty-four percent of the total injuries occurred in wheelchair basketball. Curtis and Dillon (1985) also reported on a direct relationship between the rate of injury and the amount of time spent participating in sport. In a study on the epidemiology of sportive injuries in basketball wheelchair players (Rocco and Saito 2006), 26 male wheelchair basketball players were interviewed of which 54% reported pain; 79% was upper extremity pain.

2.6.1 Shoulder, neck and back pain and/or injuries

Due to a constant use of the upper extremity for wheelchair propulsion wheelchair athletes, such as wheelchair basketball players, have an increased risk of upper extremity overuse injuries especially of the shoulder (Klenck and Gebke 2007). Wheelchair sports played on court, like wheelchair basketball, also require the player to be involved in overhead activities (shooting and/or rebounding), ball handling, wheelchair manoeuvring and player pursuit which may place athletes at risk of developing chronic micro-trauma and injuries predominantly of the wrist, shoulders, neck and low back (Goosey-Tolfrey 2010a). In addition to the above points, the seating position of these athletes, especially for those with spinal cord injuries, involve the pelvis being tilted posteriorly, a forward head position and an increased thoracic kyphosis. This causes the shoulder girdle to be displaced anteriorly (Lepera 2010; Dec, Sparrow and McKeag 2000) with an increased strain on the neck and upper back with decreased scapula-thoracic function (Caliet 1980 cited in Yildirim, Comert and Ozengin 2010: 56). Insufficient strengthening programs of the stabilising muscles of the scapula and rotator cuff muscles may cause muscle imbalances in these athletes (Dec, Sparrow and McKeag 2000).

Impingement syndrome is believed to be one of the main causes of shoulder pain and/or injury in wheelchair athletes, the cause of which is multi-factorial (Burnham *et al.* 1993). Some causes include the fact that the shoulders are rarely rested and given time to recover, due to the constant need of the wheelchair user/athlete to push themselves. There is also little time for the wheelchair athlete to rest and recover due to strict training regimes and involvement in one or more sporting activities throughout the year. Additionally, due to the wheelchair-bound athlete being closer to the ground than an able-bodied athlete, movements such as flexion and abduction of the shoulder are performed continuously in daily activities of living (i.e. when reaching up for something), as well as for shooting, rebounding and passing. It has also been noted that scapular protraction and internal rotation of the shoulder has been observed with forceful propulsion and at rest (Burnham *et al.* 1993). Bayley, Cochran and Sledge (1987) discovered that 23 out of 94 wheelchair users experienced chronic shoulder pain caused by rotator cuff impingement. Being able to identify and treat the cause of pain appropriately, at the time of diagnosis, is therefore important.

There have been many studies on wheelchair athletes in general, but not nearly as much on wheelchair basketball players specifically, especially in South Africa, except for the study by Lepera (2010) which yielded significant findings on shoulder pain and which showed a need for further studies. Lepera formulated parts of the questionnaire used in

the study, from a study conducted by Curtis and Black (1999) on shoulder pain in female wheelchair basketball players, the results of which showed that 72% experienced shoulder pain. Curtis and Black (1999), however, had a very low response rate (48%). Although, this research was on the wheelchair basketball athlete specifically, seeing that the response rate needed to be at least 70% (personal communication with Singh 2015), the results obtained from this study would be difficult to use to describe the prevalence of shoulder pain in the entire female basketball population. Further research is, therefore, needed.

Although the shoulder seems to be the most common site of injury and/or pain in wheelchair athletes, Webborn and Turner (2000 cited in Webborn and Emery 2014) noted, in a study on British athletes that were going to compete in the Paralympic Games, that the cervical (59%) and thoracic spine (8%) were the primary sites of injury and caused pain to be referred to the shoulder. These findings imply that more studies aimed at establishing the prevalence of musculoskeletal pain in general, not limited to one region, are needed.

In the study by Yildirim, Comert and Ozengin (2010) on shoulder pain in wheelchair basketball players with and without trunk control, apart from shoulder pain, it was also established that 62% of the players with trunk control and 56% of the players without trunk control experienced some elbow and/or wrist pain with wheelchair use.

2.6.2 Wrist pain and/or pathologies

The most common problem affecting the wrists of wheelchair users and athletes is Carpal Tunnel Syndrome (Groah and Lanig 2000). Carpal Tunnel Syndrome occurs when the median nerve becomes compressed in the carpal tunnel, which is a tunnel that lies on the anterior aspect of the carpal bones, deep to the flexor retinaculum and is bounded laterally by the scaphoid and trapezoid bones and medially by the pisiform and hammate bones (Moore and Dalley 2006: 839). Symptoms associated with this include aching pain in the arm and hand relieved with slight dorsiflexion of the wrist and ‘shaking’ of the hand. There is also sensory loss in the thumb, index, middle and lateral half of the fourth finger, as well as weakness of the abductor pollicus brevis muscle (Longmore *et al.* 2010: 507). As the duration of spinal cord injury increases so does the incidence of Carpal Tunnel Syndrome (Aljure *et al.* 1985). Not all wheelchair users with spinal cord injury may experience the symptoms of Carpal Tunnel Syndrome even though it is present. Some studies have shown that Carpal Tunnel Syndrome was evident in 52-100% of wheelchair users (in the population groups) electro-diagnostically, however, it is only evident in 7-67% of the cases clinically (Jackson *et al*. 1996; Burnham and Steadward 1994; Gellman *et al.*

1988). Activities that involve wrist extension will increase carpal tunnel pressures because it decreases the space in the carpal tunnel. These activities include transferring, propulsion, shooting and rebounding (Collins *et al*. 1988). Groah and Lanig (2000) suggest the use of padded gloves to ease pressure on the carpal tunnel, as well as to prevent blisters and sores, but this is not allowed in wheelchair basketball.

Ulnar neuropathy is the next most common wrist pathology found in wheelchair athletes. It occurs when there is compression of the ulnar nerve in Guyon's canal resulting in weak grip strength and sensory loss in the ulnar distribution of the hand (Groah and Lanig 2000). It may occur with continuous contact on the volar ulnar surface of the hand (Rettig 1990). Jackson *et al.* (1996) found that 2% of wheelchair basketball players displayed ulnar neuropathy electro-diagnostically, but none of them clinically. It is therefore important to have thorough questioning in order to determine the risk of pathology, as it may not be clinically evident.

Furthermore, due to increased wrist trauma during routine activities of daily living which is aggravated with sporting activities, wheelchair athletes may also have carpal instability (Groah and Lanig 2000). Due to the fact that wheelchair propulsion and the use of the wrist and hand in some athletes is not only important for their performance in sport, but it is also required for activities of daily living such as bathing, dressing and eating amongst others, emphasis needs to be placed on the conservative management of these conditions such as bracing, modification of activity or even injections, before surgery is considered (Slocum, Blauwet and Allen 2015).

2.6.3 Elbow pain and/or injuries

The median and ulnar nerves may also become compressed proximally in the elbow region, however, it has not been extensively documented in wheelchair users (Groah and Lanig 2000). Injury to the soft tissue, such as the pronator teres muscle and the rest of the wrist flexors have been documented to take place in the acceleration phase of throwing in wheelchair basketball, which will lead to medial epicondylitis. The symptoms of medial epicondylitis may become exacerbated with excessive hyperextension of the wrist during crutch use, wheelchair transfers and propulsion (Sobel, Pettrone and Nirschl 1990).

2.6.4 Lower limb pain and/or injuries

Higher point players in wheelchair basketball include those players with amputations. These players use prosthetics for daily activities of living, but not on court. Common injuries occurring in athletes with amputations include tendon and ligament injuries in the contra lateral and residual limbs, broken skin at the distal end of the residual limb where

the prosthesis joins the limb and overuse injuries of the contra lateral limb (Willick *et al*. 2011). Bernardi *et al*. (2003) investigated sports related muscle pain in athletes who had locomotor disability and found that the prevalence was 50,7% (the most common area affected being the shoulder), of which 58,8% were made up of basketball players. There was also a higher prevalence of pain in amputees (75%), with spinal cord injury locomotor disability having the second highest prevalence (58,1%). It has been suggested that there may be an improvement in an athlete's performance with the use of sport- specific prostheses as it may decrease compensation of the residual limb (Slocum, Blauwet and Allen 2015). This will also decrease the possible prevalence of pain which will affect an athlete's ability to perform.

2.6.5 Other causes of pain and/or injuries

Lastly, spinal cord injury may also cause athletes to have decreased bone mass below the injury level over time which will result in osteopenia and osteoporosis, therefore there is the possibility of an increased risk of fractures (White 2002). This is due to decreased weight bearing and a lack of use. Patatoukas *et al.* (2011) suggest that due to the fact that athletes with spinal cord injury had the highest prevalence of all basketball players and due to their high risk of osteoporosis, as well as the fact that wheelchair basketball had the highest risk for fractures because of direct contact and falls (Ferrara and Davis 1990), athletes with spinal cord injury in wheelchair basketball are more susceptible to fractures.

2.7 Implications for practitioners working with the physically challenged individual

The high demands of wheelchair basketball, in terms of strict training regimes and the pace of the game, can easily lead to overuse injuries and pain. It is therefore important, for healthcare practitioners working with sports teams, to highlight any problem areas in training or lifestyle that may be leading to these injuries for optimal performance of athletes and for further growth and success of the sport (Lepera 2010). It is essential for these practitioners to have an extensive understanding of how to prevent and treat injuries in athletes with different impairments (Slocum, Blauwet and Allen 2015) as the risk for different types of injuries will vary.

Chiropractors are an example of practitioners who work with athletes and treat musculoskeletal problems which will develop over time in athletes. The musculoskeletal problems develop as athletes are constantly training to improve on their performance, which can be at the expense of optimal musculoskeletal function/performance. Chiropractic treatment has resulted in patients using less pain medication, a decreased

risk of chronic pain and a reduced incapacitation time (Chiropractic Association of South Africa 2010-2013).

The latter benefit is of particular importance to a wheelchair user who is already dependent on a wheelchair for mobility. Consequently, the presence of upper extremity pain could be even more debilitating and could result in the loss of independence of the wheelchair user. In addition to practitioners knowing how to treat certain injuries in wheelchair athletes, it is therefore also very important for the wheelchair athlete to be aware of and to explore different treatment options available for their injuries and restoration of optimal function.

2.8 Summary

The wheelchair basketball athlete is at risk for many injuries due to the nature of the sport and the level of disability. There has been much research published on the disabled athlete, but not as much on the wheelchair basketball athlete specifically in South Africa where it has become a popular and fast growing sport.

In addition, the research on wheelchair basketball players abroad and in South Africa predominantly focus on shoulder pain in these athletes. The literature has shown, however, that shoulder pain is not the only site of pain, despite being the most common site of pain. The wheelchair basketball player is at risk for various injuries. This can be further affected by the type of disability the player presents with, and therefore the risk for different injuries will vary amongst the different point classifications. There have been no studies in South Africa which have compared the prevalence of pain amongst the different point classifications. Functional classification is the foundation of wheelchair sports which is aimed at eliminating competitive inequalities as a result of the various levels of impairment in different athletes (Crespo-Ruiz, Del Ama-Espinosa and Gil-Agudo 2011), therefore it is an area that needs to be further investigated. The objectives of this study will therefore fill the gap in the literature by determining the prevalence of musculoskeletal pain, not limited to the shoulder, in South African wheelchair basketball players and will provide insight on any differences noted amongst the different classifications.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study design

This study was a quantitative, descriptive, cross-sectional survey that provided the prevalence and profile of musculoskeletal pain in wheelchair basketball players of different point classifications in South Africa. The relationship between the prevalence of pain (dependent variable) and point classification (independent variable) were studied and no interventions were used to change conditions. A questionnaire (Appendix K), validated by a focus group and pilot study, was used as the source of obtaining information.

3.2 Sampling

Convenience sampling was used as data collection took place in Mandeville, Johannesburg at the Supersport League games and all players present were invited to participate. Due to the small study population, random sampling methods were not used. The study population, sample size, as well as inclusion and exclusion criteria are described below.

3.2.1 Study Population

There were six teams that participated in the 2015 Supersport League. The study population comprised of 48 wheelchair basketball players (8 players per team) from various parts of South Africa.

3.2.2 Sample Size

A minimum sample size of 70% of the total study population was required for appropriate power of the data. A minimum sample size of 70% was also chosen as the baseline for this study due to the presence of foreign players, recruited for the 2015 Supersport League, being excluded, as well as players under the age of eighteen (n=≥70%).

3.2.3 Inclusion Criteria

- Wheelchair basketball players in South Africa who competed in the Supersport League in 2015.
- Wheelchair basketball players who were classified on a scale from 1.0-4.5 (based on international classification guidelines).
- A minimum age of eighteen years.

- South African citizenship.
- Completed informed consent (Appendix M).

3.2.4 Exclusion Criteria

- Focus group and pilot study participants.
- Wheelchair basketball players who were absent during the times that the questionnaires were administered.
- Wheelchair basketball players under the age of eighteen years.
- Foreign players.

3.3 Procedure

The procedure of the focus group, pilot study and main research study is outlined. Ethical considerations are also highlighted below.

3.3.1 Focus group

The aim, objective and methodologies of the focus group discussion, held as part of the questionnaire development, are outlined below.

3.3.1.1 Aim and Objective

To determine face, construct and content validity (Bernard 2013) of the questionnaire.

3.3.1.2 Methodology

A focus group discussion was held after provisional ethical approval was granted to (REF 57/15) by the Institutional Research Ethics Committee (Appendix A). The focus group comprised of six members, each with their own area of expertise of value to the discussion. The first expert was an experienced wheelchair basketball player and coach of a Men's wheelchair basketball team. The second was a player who started playing wheelchair basketball approximately two years ago. The third expert was a Physiotherapist who had a background on Master's research that pertained to wheelchair basketball. The fourth and fifth included a Chiropractic Master's student and a Biokineticist intern who was working on Master's research. Lastly, the sixth expert was a qualified Chiropractor.

The research study and procedure, as well as the purpose and procedure of the focus group discussion were explained as per the letter of information (Appendix C). An informed consent form (Appendix D) was voluntarily signed by each member before the

discussion commenced. The questions were discussed as they were being read out, one at a time. The focus group discussion took approximately 30-45 minutes and was recorded. All suggestions and information was treated as confidential. The necessary changes (Appendix F) were made to the questionnaire following the focus group discussion. As per DUT requirements, the data from the focus group is to be stored for 5 years following the study and thereafter destroyed.

3.3.2 Pilot study

The aim, objective and methodology of the pilot study, which forms part of the questionnaire development and refinement, is outlined below.

3.3.2.1 Aim and objective

To further validate the questionnaire, in order to ensure that it will be suitable for the study and to ensure that it will be easily understood by the wheelchair basketball players participating in the study.

3.3.2.2 Methodology

Once the necessary changes were made to the questionnaire following the focus group discussion, the researcher attended one of the Westville Wings training sessions. After their training session, the research study and purpose of the pilot study were explained to the players and four players were invited to participate in the pilot study. Participation was limited to four players due to the limited study population. The letter of information (Appendix H) was clearly explained and an informed consent form (Appendix I) was voluntarily signed by each of the four players who volunteered, before their participation. The researcher was present during the pilot study so that all queries could be addressed.

3.3.3 Main research study

The procedure following the pilot study, leading up to and applied for the main research study, is indicated below.

3.3.3.1 Methodology

Following the pilot study, all changes (Appendix J) were made to the questionnaire. Permission from the CEO/ Secretary General of WBSA (Appendix O) and the relevant management staff was obtained. Full approval was then granted by the DUT Institutional Research Ethics Committee (Appendix R) and data collection could begin.

The researcher attended the Supersport Games at the Mandeville Sports Centre in Gauteng. The players from the six teams were addressed after their respective matches and details of the study were explained. The letters of information (Appendix L) and informed consent forms (Appendix M) were handed out and explained. The informed consent forms were voluntarily signed by the players, who met inclusion criteria, and were returned to the researcher before questionnaires were handed out. The questionnaires (Appendix K) were then handed out to the players and explanations were given, when needed. Once completed, the questionnaires were placed into a sealed ballot box to ensure confidentiality. Completed questionnaires were collated for electronic capturing, statistical analyses and subsequent reporting.

3.4 Ethical considerations

- Institutional ethics permission was granted to conduct the study.
- Permission was obtained from the CEO/ Secretary General of Wheelchair basketball SA and management staff from the various teams to address wheelchair basketball players.
- An informed consent form was voluntarily signed by each wheelchair basketball player prior to participation. Hence, participation in this study was entirely voluntary.
- The participants were free to withdraw from the study at any time without any adverse consequences or penalties.
- The questionnaires did not require names of the wheelchair basketball players or any identifying data. In addition, questionnaires were also collected separately from the consent forms to ensure anonymity and were placed in a ballot box to ensure confidentiality.
- All data will be stored in a locked cupboard in the Chiropractic Department for five years and will be destroyed thereafter.
- The results will be made available to Wheelchair Basketball SA, management staff, players and all concerned. No names of wheelchair basketball players or clubs will, however, be identifiable.

3.5 Measurement tools

The measurement tool used was a questionnaire (Appendix K) that was validated by a focus group and pilot study. The questionnaire comprised of four pages and took approximately 10-15 minutes to complete (the time taken was based on how long the wheelchair basketball players participating in the pilot study took to complete the questionnaire).

The questionnaire was divided into four sections as follows:

SECTION A: Demographics and disability characteristics.

SECTION B: Wheelchair basketball and activity level.

SECTION C: Musculoskeletal pain.

SECTION D: Impact of pain on wheelchair basketball activity/ activities of daily living.

Some aspects of the questionnaire were adapted from a study done by Lepera (2010) on shoulder pain in Gauteng based male wheelchair basketball players. Aspects of the questionnaire had been extracted by Lepera (2010) from Curtis and Black (1999), who undertook a study on female wheelchair basketball players.

3.6 Statistical Analysis

The data collected from the responses was analysed with SPSS version 23.0.

Statistical significance was set as $p<0.05$.

Descriptive statistics were presented in the results in the form of standard deviations, tables, graphs and other figures for the quantitative data that was collected.

Inferential techniques included the use of correlations which were in the form of cross tabulations and Eta scores (η) as this was the most appropriate method to use for this study.

Eta scores are used when one variable is nominal and the other is a scale measure (number). In this study the point classification is a number which was compared to various nominal data. Eta scores of 0.10 and less are interpreted to be a small/smaller than typical strength of a relationship, 0.24 is a medium/typical strength, 0.37 is a large/larger than typical strength and 0.45 and above is interpreted as a much larger than typical strength of a relationship (Morgan *et al.* 2004: 103) (see Appendix T). There is no range for Eta

scores and as a result, Eta scores are interpreted based on whether they lie closer to the lower or higher value (personal communication with Singh on 02 February 2016).

The Fisher's Exact test measuring relationship and Spearman correlation were used where applicable.

3.7 Summary

Evidently, there is a very specific method and guidelines that need to be followed when undertaking research. The procedure of the focus group, pilot and research study, as well as the study design, sampling, inclusion and exclusion criteria and how the results would be statistically analysed, have been presented and discussed.

CHAPTER FOUR

RESULTS

This chapter provides the results after statistical analysis of the collected data. Primary data was collected by using a self-administered questionnaire (Appendix K) validated by a focus group and pilot study. The results, presented as per the objectives outlined in Chapter One, are presented in the form of tables and figures, plus explanations thereof.

4.1 Response rate

The sample consisted of 48 wheelchair basketball players that participated in the 2015 Supersport League. In order for this study to be statistically valid, a minimum response rate of 70% was required (n=34).

A total of 43 questionnaires were returned yielding an 89.58% response rate thereby making this study statistically valid. Some players did not meet the inclusion criteria and were, therefore, excluded.

The questionnaire comprised of 51 questions. Not all of the questions had a response due to the fact that spin-off questions did not have to be answered if players answered “No” to some questions. If individual questions requiring responses were not answered, the answer to that question was considered unknown and omitted from the analyses. Some questions also included multiple responses. All 43 questionnaires were used wherever possible.

4.2 Demographics and Disability Characteristics of elite wheelchair basketball players in South Africa

Based on objective 1, i.e. to determine the demographics and disability characteristics of elite wheelchair basketball players in South Africa, demographic information and disability characteristics are summarised below.

4.2.1 Section A: Demographics and Disability Characteristics

This sub-section summarises the biographical characteristics of the participants.

4.2.1.1 Age and Gender

There were 39 out of the 43 participants who answered this question.

The mean age reported was 33.3 (SD: 9.5) years and the ages ranged from 20-63 years. Table 4.1 below represents the overall age distribution by age. This table incorporates the statistics for Question 1 and 2 of Section A of the questionnaire i.e. gender and age of the wheelchair basketball players. As can be seen in Table 4.1, approximately half of the participants (n=20; 51.3%) were in the 30-39 year age category.

Table 4.1 Overall gender distribution by age

			Gender		Total
			Male	Female	
Age (years)	20 - 29	Count (n)	12	3	15
		% within Age	80.0%	20.0%	100.0%
		% within Gender	34.3%	75.0%	38.5%
		% of Total	30.8%	7.7%	38.5%
	30 - 39	Count (n)	19	1	20
		% within Age	95.0%	5.0%	100.0%
		% within Gender	54.3%	25.0%	51.3%
		% of Total	48.7%	2.6%	51.3%
	40 - 49	Count (n)	1	0	1
		% within Age	100.0%	0.0%	100.0%
		% within Gender	2.9%	0.0%	2.6%
		% of Total	2.6%	0.0%	2.6%
	50 - 59	Count (n)	1	0	1
		% within Age	100.0%	0.0%	100.0%
		% within Gender	2.9%	0.0%	2.6%
		% of Total	2.6%	0.0%	2.6%
	60 - 69	Count (n)	2	0	2
		% within Age	100.0%	0.0%	100.0%
		% within Gender	5.7%	0.0%	5.1%
		% of Total	5.1%	0.0%	5.1%
Total		Count (n)	35	4	39
		% within Age	89.7%	10.3%	100.0%
		% within Gender	100.0%	100.0%	100.0%
		% of Total	89.7%	10.3%	100.0%

% within Age refers to the percentage of males and females within that age group

% within Gender refers to the percentage of males or females from that age group amongst the other males or females that participated

% of Total refers to the percentage that the males or females from a particular age group represent amongst the 39 participants.

There were 20 (51.3%) players in the 30-39 year age category. This age group represented 54.3% of the male players who answered (n=19) and 25% of the female players who answered (n=1).

The 20-29 year age category comprised of 15 players (38.5%). This age group represented 34.3% of the male players who answered (n=12) and 75% of the female players who answered (n=3).

Overall, the ratio of males to females was approximately 9:1 (89.7% : 10.3%).

4.2.1.2 Ethnicity

Figure 4.1 below is a pie chart that represents the various ethnic groups of the players. “Other” refers to Indian and Chinese players as this group represented the minority of wheelchair basketball players and were, therefore, grouped together.

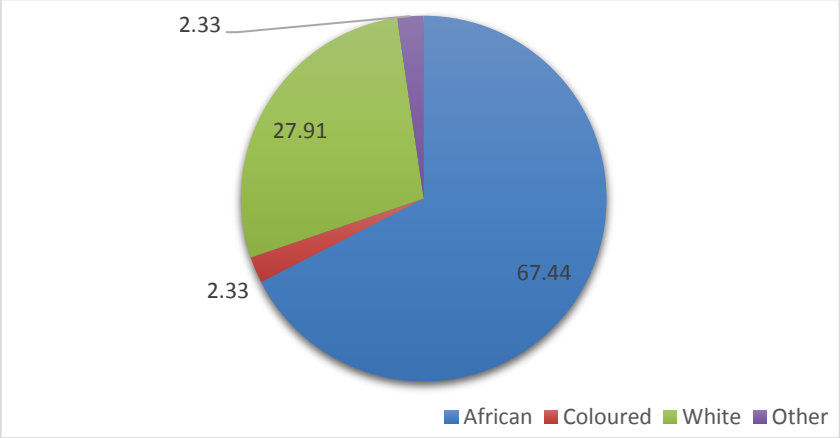


Figure 4.1 Ethnic profile

There were 43 participants who answered.

The majority of the participants (67.44%) were African (n=29), whilst the White population accounted for 27.91% of wheelchair basketball players (n=12). There were no Indian players.

4.2.1.3 Occupation

There were 41 participants who answered.

Out of the 41 participants, 26.8% were unemployed (n=11) and 7.3% were students (n=3). There were a variety of other responses, but none significant enough to report.

4.2.1.4 Participation in other sport

All 43 participants answered this question.

Out of the 43 participants, 32 did not participate in other sport. Approximately a quarter, 25.6%, of the participants played other sports (n=11) and these sports included athletics, cycling, discus, hand cycling, javelin, shotput, soccer, table tennis and wheelchair tennis. Hand cycling had the highest participation (n=3). Shotput and soccer had the second highest participation (n=2 each), with the rest of the sports having 1 participant.

4.2.1.5 Cause of disability

Over one third (34.88%) of the participants were disabled due to a spinal condition/ lesion (n=15). The second highest cause of disability (27.91%) was a birth defect/ condition (n=12). Table 4.2 below presents more detailed information on the causes of disability amongst the participants.

Table 4.2 Causes of disability

Type of condition	n	Percent
Amputation	5	11.63
Birth defect/condition	12	27.91
Spinal condition/lesion	15	34.88
Other	8	18.60
Unknown	3	6.98
Total	43	100.0

4.2.1.6 Device dependency for mobility

Out of the 43 participants, 34 (79.1%) used devices for mobility.

In some instances, more than one mobility device was used (e.g. prosthetics and crutches). Over half of these participants, 58.82% used wheelchairs (n=20), 26.47% used prosthetics (n=9) and 29.41% used crutches (n=10).

Out of the 9 participants who used prosthetics, only 1 participant (11.11%) used it whilst playing wheelchair basketball.

4.2.1.7 Length of dependency time on mobility device

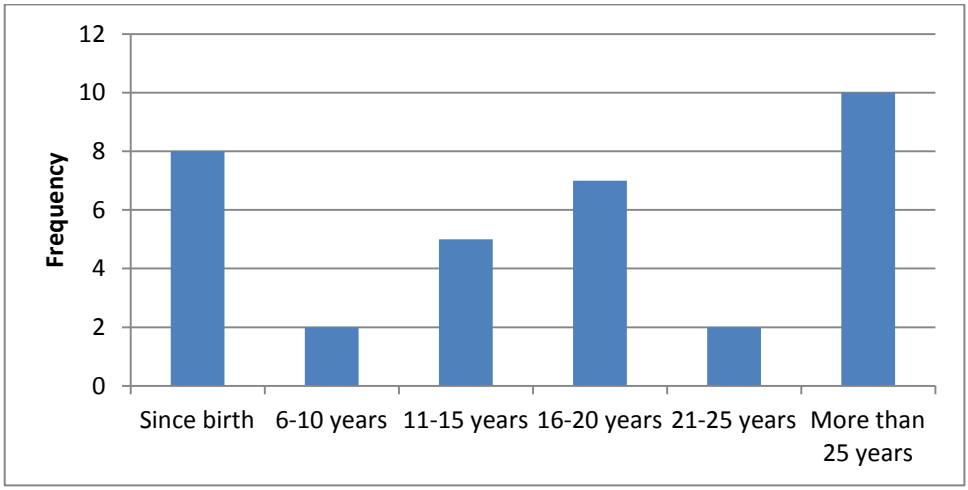


Figure 4.2 Length of dependency time on mobility device (in years)

More than half of the participants (n=18; 52.94%) indicated that they used their device/s since birth or for more than 25 years. Only 2 participants (5.88%) have been using mobility devices for 6-10 years.

4.2.1.8 Length of time since mobility device was last changed/altered/serviced

Table 4.3 Length of time since mobility device was last changed/altered/serviced (in years)

Years	n	Percent
0 years	8	23.53
0-5 years	18	52.94
6-10 years	6	17.65
11-15 years	0	0
16-20 years	2	5.88
More than 20 years	0	0
Total	34	100.0

Over half (n=18; 52.94%) of the participants changed/altered/serviced their mobility device/s in the last 0-5 years, however, 23.53% (n=8) have not changed/altered/serviced their mobility device/s.

4.2.1.9 Length of time since basketball wheelchair was last changed/altered/ serviced

Table 4.4 Length of time since basketball wheelchair was last changed/altered/serviced (in years)

Years	n	Percent
0 years	11	25.58
0-5 years	20	46.51
6-10 years	9	20.93
11-15 years	2	4.65
16-20 years	1	2.33
More than 20 years	0	0
Total	43	100.0

Less than half (n=20; 46.51%) of the participants have changed/altered/serviced their basketball wheelchairs in the past 0-5 years.

4.3 Prevalence and profile of musculoskeletal pain

Based on objective 2, i.e. to determine the prevalence and profile of musculoskeletal pain, respectively in elite wheelchair basketball players in South Africa, the participants' activity level in wheelchair basketball and/or other activities, as well as the profile of musculoskeletal pain will be summarised below.

4.3.1 Section B: Wheelchair basketball and activity level

This sub-section summarises the data collected on activity levels relating to wheelchair basketball and time spent on other activities such as work, gym, watching TV, driving, rest and playing other sports.

4.3.1.1 Years spent playing wheelchair basketball

The majority of the participants (n=41; 95.3%) have been playing wheelchair basketball for more than 5 years. Approximately 20% (n=9) were players for 11-15 years; nearly 20% (n=8) were players for 16-20 years. The fewest number of players (n=2; 4.7%) were players for less than 6 years whilst 14% (n=6) have been playing for over 20 years.

4.3.1.2 Amount of time spent per week training for wheelchair basketball during and off-season

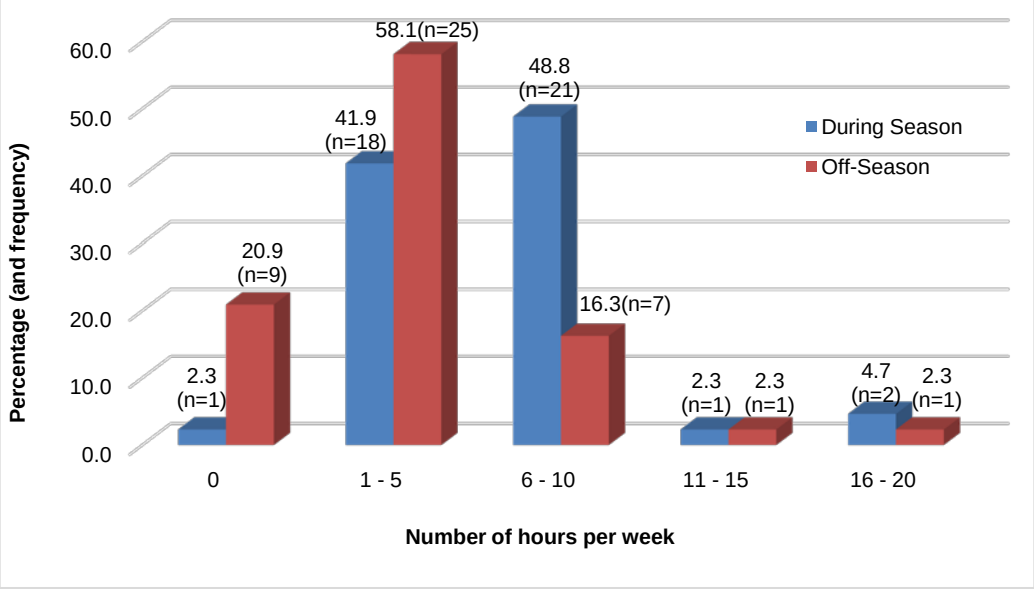


Figure 4.3 Number of hours spent training for wheelchair basketball during and off-season

During the season, nearly half (n=22; 48.8%) of the participants train for between 6-10 hours weekly. A little less than 60% (n=25) train for between 1-5 hours off-season.

Spearman correlation was used and a significant proportional correlation between the training times during and off-season was found (p=0.003; r=0.448). As can be seen from Figure 4.3, the amount of time participants spent training decreased off-season.

4.3.1.3 Amount of time spent on court per week playing wheelchair basketball matches

Almost half of the participants (n=18; 41.86%) played for more than 25 minutes, whilst nearly one quarter (n=10; 23.26%) played for close to 20 minutes on court – almost half the match.

4.3.1.4 Amount of time spent warming up and cooling down/ stretching before and after games

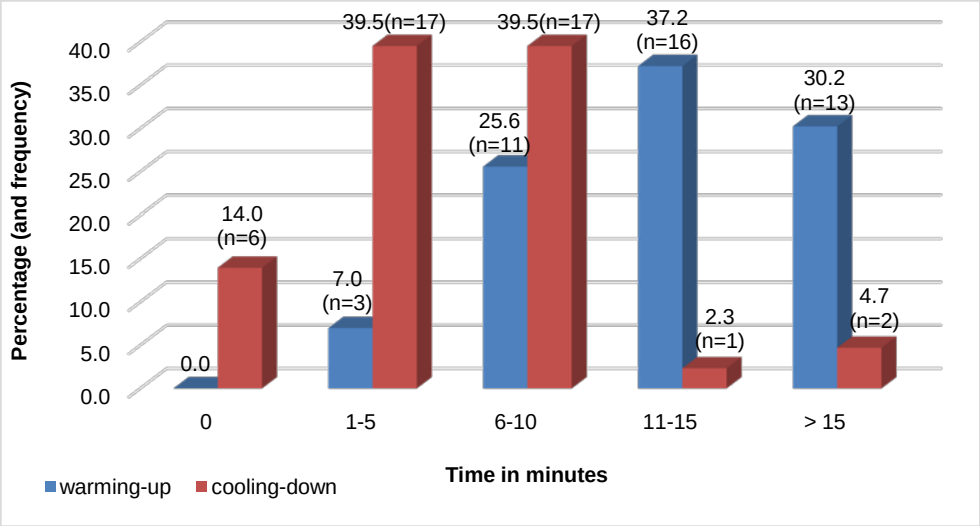


Figure 4.4 Time spent warming up and cooling down (in minutes)

It was observed that participants spent more time warming up than cooling down. The Fisher's Exact test p-value between the variables was 0.575. There was, therefore no significant relationship between the variables.

4.3.1.5 Amount of time spent per week on other activities

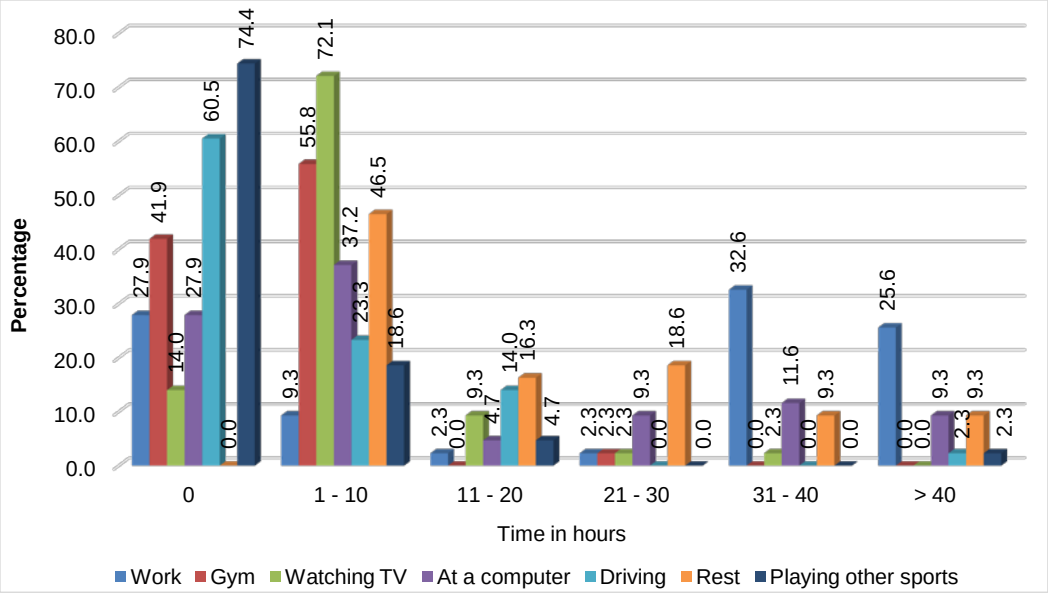


Figure 4.5 Time spent on other activities (in hours)

Work (n=25; 58.2%) takes up most of the participants' time (more than 30 hours). Almost half of the respondents (n=18; 41.9%) do not gym and 74.4% (n=32) do not play other sports.

4.3.2 Section C: Musculoskeletal pain

This sub-section summarises the prevalence of musculoskeletal pain at various times in the participants lives, as well as a profile of the pain and the intervention thereof.

4.3.2.1 The prevalence of musculoskeletal pain at various times and the regions affected

Table 4.5 The prevalence of musculoskeletal pain and the regions affected

	Count (n)					
	Have you experienced musculoskeletal pain					At present, are you experiencing any musculoskeletal pain
	before using your mobility device	since using your mobility device	before playing wheelchair basketball	since playing wheelchair basketball	in the last 12 months	
Neck	0	0	0	4	2	0
Upper back	0	1	1	4	2	2
Low back	1	2	2	8	6	2
Shoulder	3	11	12	23	19	8
Arm	1	4	1	4	2	0
Elbow	0	2	1	5	3	0
Hand and wrist	1	2	2	5	4	0
Hip	2	1	0	1	1	1
Thigh front and back	0	1	1	2	2	1
Knee	1	2	0	2	3	1
Leg front and back	0	2	0	1	1	2
Foot and ankle	2	3	1	2	2	1

The results are presented in frequencies (n) as the values are relatively low in all instances except for shoulder pain.

The prevalence of pain in all regions increased since the participants started playing wheelchair basketball with n=23 participants having experienced shoulder pain since playing wheelchair basketball and n=8 participants having experienced low back pain.
The neck, upper back, low back and upper limb seemed to be the regions most affected by pain.

4.3.2.2 Exact knowledge of the cause of pain

Out of the 25 who responded “Yes” to having pain in the last 12 months, 18 participants (72%) knew what the exact cause of the pain was, whilst 7 participants (28%) were unaware of the exact cause of the pain experienced. Table 4.6 below summarises the participants knowledge on the possible causes of pain experienced by themselves.

4.3.2.3 Possible causes of the pain

Table 4.6 Possible causes of the pain experienced by participants

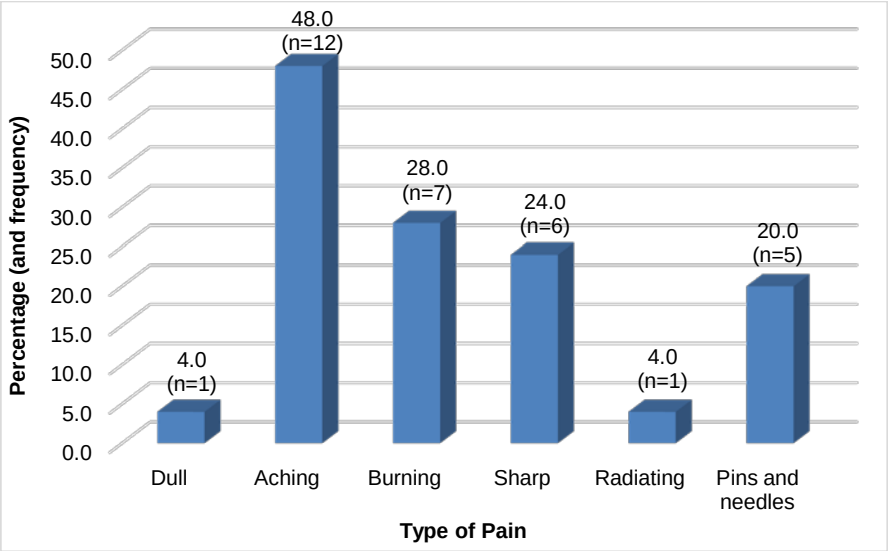
Possible causes of pain	Frequency	Percent
An instance during a basketball game	9	36.0
An instance during training	3	12.0
Over-training	3	12.0
Improper warm-up/ cool down	2	8.0
Other activities	3	12.0
Unknown	5	20.0
Total	25	100.0

Instances related to wheelchair basketball accounted for 68% of the causes of pain (n=17) with an instance during a basketball game causing the pain in 36% of the participants (n=9).

Participants also reported pushing (n=11) and pivoting movements (n=5) to be the main activities that aggravated the pain.

4.3.2.4 Type of pain experienced

The type of pain experienced by the 25 participants is summarised in figure 4.6 below.



Multiple responses were allowed so percentages do not add to 100%

Figure 4.6 Type of pain experienced by participants

The most common type of pain experienced was pain that was aching in nature (48%; n=12). Burning accounted for 28% (n=7) of the pain experienced while sharp pain was experienced by 24% (n=6).

Majority of the participants experienced pain for hours and/or days (n=17; 68%).

4.3.2.5 Practitioner consulted with for the pain, the diagnosis and treatment

Out of the 25 participants who reported pain in the last 12 months, 16 of them (64%) sought treatment for the pain from a medical practitioner whilst eight (32%) did not and one participant (4%) was unsure. Table 4.7 below summarises the types of practitioners that the participants consulted with.

Table 4.7 Practitioners consulted with for the pain

Practitioners	Frequency	Percentage
Biokineticist	1	6.3
Chiropractor	0	0.0
General Practitioner	3	18.8
Orthopaedic Surgeon	2	12.5
Pharmacist	5	31.3
Physiotherapist	12	75.0
Traditional healer	0	0.0
Unknown	0	0.0
Other	0	0.0

Multiple responses were allowed therefore frequencies do not add to 16 and percentages do not add to 100%.

Out of the 16 participants who sought treatment from a medical practitioner, the majority of the participants consulted with a physiotherapist (n=12; 75%). Chiropractors were not consulted at all.

For those participants that could recall the diagnosis given (n=11), muscles were generally affected thus causing pain (n=8; 72.7%). The treatment received by the 16 participants who consulted a practitioner are summarised below in table 4.8.

Table 4.8 Treatment received by participants

Treatment	Frequency	Percentage
Heat	3	18.8
Ice	5	31.3
Pain medication	7	43.8
Exercise	8	50.0
Rest	5	31.3
Other	5	31.3

Multiple responses were allowed therefore frequency does not add to 16 and percentage does not add to 100%.

Some form of exercise was given to 50% of the participants (n=8), with pain medication being administered/ recommended to 43.8% (n=7).

For those eight participants, who did not consult with a practitioner and the one that was unsure, five of them treated the pain with self-administration of pain medication (55.6%).

With regards to overall pain relief in the 25 participants who experienced pain, only 20 participants answered this question. Out of the 20 who answered, 19 participants (95%) felt relief from the pain, whether it was as a result of the treatment received from the

practitioner or self-administration of pain medication, whilst one participant did not experience any pain relief (5%).

4.4 Impact of musculoskeletal pain

Based on objective 3, i.e. to determine the impact of the musculoskeletal pain on basketball activity or activities of daily living, the impact of musculoskeletal pain on those activities are summarised below.

4.4.1 Section D: Impact of pain on wheelchair basketball activity/ activities of daily living

This sub-section summarises the impact of pain on the wheelchair basketball activity/ activities of daily living of the respondents. This section only needed to be completed if the participant experienced pain at the time of completing the questionnaire or if the participant experienced pain in the last 12 months.

4.4.1.1 Negative effect of pain on wheelchair basketball activity/ activities of daily living

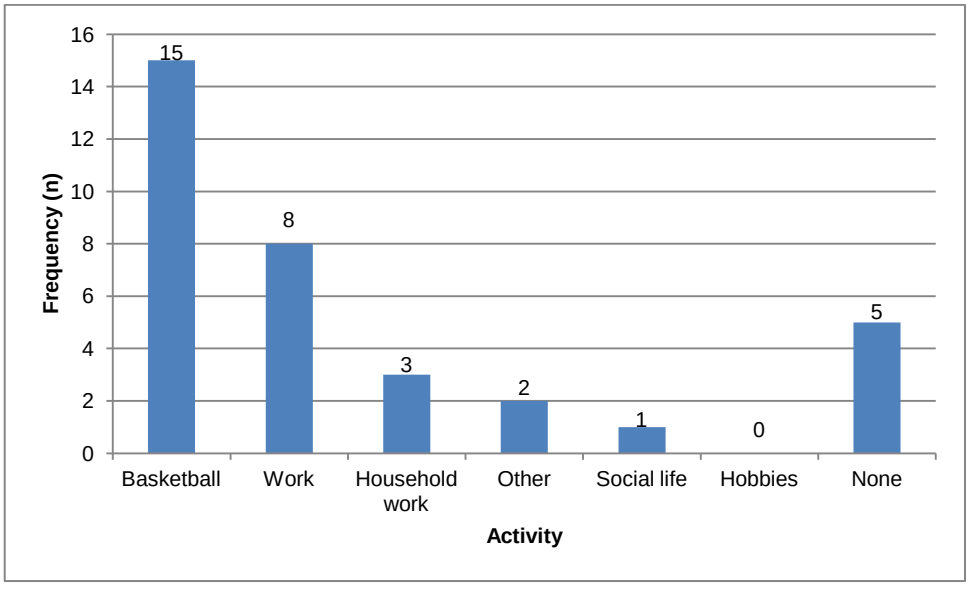


Figure 4.7 Activities affected negatively by pain

Multiple responses were allowed. Out of the 25 participants who experienced pain in the last 12 months, 20 participants (80%) reported that the pain affected at least one activity negatively. Figure 4.7 shows that basketball activity was the most negatively affected by the pain (n=15, 60%) with work being the second negatively affected activity (n=8; 32%).

4.5 Associations between pre-game classification and the prevalence of pain

Based on objective 4, i.e. to establish possible associations between pre-game classification and the prevalence of musculoskeletal pain, this section summarises these associations and aims to test the following hypotheses:

Hypothesis 1: Upper extremity (including neck and back) pain is experienced more commonly in lower point classified wheelchair basketball players than in higher point classified players.

Hypothesis 2: Lower extremity pain is experienced more commonly in higher point classified players than in lower point classified players.

The possible associations between pre-game classification and the prevalence of musculoskeletal pain at various times are summarised below.

4.5.1 Bivariate analysis

The Bivariate analysis included the use of cross tabulations. Eta scores were used to determine whether there was a statistically significant relationship between the Point classification and the prevalence of musculoskeletal pain.

Eta scores of 0.24 were interpreted as a medium/typical strength relationship, 0.37 showed a large/larger than typical relationship and 0.45 and above were interpreted as a much larger than typical strength relationship.

4.5.1.1 Point classification

Table 4.9 Point classification of players

Point	n	Percent
1	7	16.3
1.5	4	9.3
2	7	16.3
2.5	5	11.6
3	4	9.3
3.5	5	11.6
4	7	16.3
4.5	4	9.3
Total	43	100.0

The different point players were almost uniformly spread out, with 1.0; 2.0 and 4.0 point players each making up 16.3% (n=7) of the total sample.

4.5.1.2 Point classification and the prevalence of musculoskeletal pain before using a mobility device

Table 4.10 Cross tabulation between Point classification and the prevalence of musculoskeletal pain before using a mobility device

	Point classification									
Region	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**Total**	**Eta Score**
Neck	0	0	0	0	0	0	0	0	0	-
Upper back	0	0	0	0	0	0	0	0	0	-
Low back	0	0	0	1	0	0	0	0	1	0.009
Shoulder	1	0	0	1	1	0	0	0	3	0.102
Arm	1	0	0	0	0	0	0	0	1	0.227
Elbow	0	0	0	0	0	0	0	0	0	-
Hand and wrist	1	0	0	0	0	0	0	0	1	0.227
Hip	0	0	1	0	0	1	0	0	2	0.040
Thigh	0	0	0	0	0	0	0	0	0	-
Knee	0	1	0	0	0	0	0	0	1	0.155
Leg	0	0	0	0	0	0	0	0	0	-
Foot and ankle	0	1	0	0	0	0	1	0	2	0.040

-No statistics computed because the regions are constant

There was no relationship that could be analysed between point classification and the prevalence of neck, upper back, elbow, thigh and leg pain as no statistics were computed for those regions due to there being no pain experienced in any of those regions before using a mobility device.

There was no relationship between Point classification and the prevalence of low back, shoulder, arm, hand and wrist, hip, knee and foot and ankle pain before using a mobility device.

4.5.1.3 Point classification and the prevalence of musculoskeletal pain since using a mobility device

Table 4.11 Cross tabulation between Point classification and the prevalence of musculoskeletal pain since using a mobility device

	Point classification									
Region	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**Total**	**Eta Score**
Neck	0	0	0	0	0	0	0	0	0	-
Upper back	1	0	0	0	0	0	0	0	1	0.227
Low back	1	0	0	1	0	0	0	0	2	0.170
Shoulder	3	1	2	2	0	0	1	2	11	0.087
Arm	2	1	1	0	0	0	0	0	4	0.362*
Elbow	1	0	0	0	0	0	0	1	2	0.040
Hand and wrist	1	0	1	0	0	0	0	0	2	0.222
Hip	0	0	1	0	0	0	0	0	1	0.082
Thigh	0	0	1	0	0	0	0	0	1	0.082
Knee	0	0	1	0	0	0	0	1	2	0.145
Leg	0	0	1	0	0	0	1	0	2	0.092
Foot and ankle	0	0	2	0	0	0	1	0	3	0.028

-No statistics computed because the regions are constant

The Eta score showed a larger than typical relationship between point classification and the prevalence of arm pain since using mobility devices (η=0.362). This was further seen in the frequency table 4.11 which clearly showed that arm pain is more dominant in the lower point players (1.0-2.5 point players). The prevalence of arm pain also increased in the lower point players since using mobility devices when compared to before using mobility devices (table 4.11).

There was no relationship between point classification and the prevalence of back and lower extremity pain since using a mobility device.

There was no relationship that could be analysed between point classification and the prevalence of neck pain as no statistics were computed for the neck due to there being no pain experienced in the neck since using a mobility device.

4.5.1.4 Point classification and the prevalence of musculoskeletal pain before playing wheelchair basketball

Table 4.12 Cross tabulation between Point classification and the prevalence of musculoskeletal pain before playing wheelchair basketball

	Point classification									
Region	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**Total**	**Eta Score**
Neck	0	0	0	0	0	0	0	0	0	-
Upper back	0	0	0	0	0	0	1	0	1	0.176
Low back	0	0	0	2	0	0	0	0	2	0.033
Shoulder	1	0	2	3	0	2	3	1	12	0.175
Arm	1	0	0	0	0	0	0	0	1	0.223
Elbow	0	0	0	0	0	0	0	1	1	0.243
Hand and wrist	1	1	0	0	0	0	0	0	2	0.271*
Hip	0	0	0	0	0	0	0	0	0	-
Thigh	0	0	0	0	1	0	0	0	1	0.043
Knee	0	0	0	0	0	0	0	0	0	-
Leg	0	0	0	0	0	0	0	0	0	-
Foot and ankle	0	0	0	0	0	0	1	0	1	0.176

-No statistics computed because the regions are constant

*Eta scores of 0.24 are considered medium/ typical strength of a relationship

The Eta score of 0.271 for hand and wrist showed that there was a slightly greater than medium/typical strength relationship between Point classification and the prevalence of hand and wrist pain before playing wheelchair basketball. It can also be noted, after analysis of the frequency table 4.12, that hand and wrist pain only occurred in low point players which further showed the greater than medium/typical relationship between the two variables.

There was no relationship between point classification and the prevalence of back, thigh and foot and ankle pain before playing wheelchair basketball.

There was no relationship that could be analysed between point classification and the prevalence of neck, hip, knee and leg pain as no statistics were computed for those regions due to there being no pain experienced in any of those regions before playing wheelchair basketball.

4.5.1.5 Point classification and the prevalence of musculoskeletal pain since playing wheelchair basketball

Table 4.13 Cross tabulation between Point classification and the prevalence of musculoskeletal pain since playing wheelchair basketball

	Point classification									
Region	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**Total**	**Eta Score**
Neck	0	1	1	1	0	0	0	1	4	0.014
Upper back	1	0	1	0	1	0	1	0	4	0.048
Low back	2	0	1	1	2	1	1	0	8	0.072
Shoulder	4	1	3	3	0	4	5	3	23	0.200
Arm	3	0	0	1	0	0	0	0	4	0.358*
Elbow	1	1	0	2	0	0	0	1	5	0.086
Hand and wrist	1	2	1	0	0	0	1	0	5	0.211
Hip	0	0	1	0	0	0	0	0	1	0.090
Thigh	0	0	2	0	0	0	0	0	2	0.128
Knee	0	0	1	0	0	0	1	0	2	0.062
Leg	0	0	1	0	0	0	0	0	1	0.090
Foot and ankle	0	0	2	0	0	0	0	0	2	0.128

The Eta score for Arm pain (η=0.358) showed a larger than typical relationship between point classification and the prevalence of arm pain since playing wheelchair basketball. This was further seen in the frequency table 4.13 which clearly showed that arm pain was more dominant in the lower point players (1.0-2.5 point players).

There was no statistically significant relationship between Point classification and the prevalence of neck, back and lower extremity pain since playing wheelchair basketball.

4.5.1.6 Point classification and the prevalence of musculoskeletal pain in the last 12 months

Table 4.14 Cross tabulation between Point classification and the prevalence of musculoskeletal pain in the last 12 months

	Point classification									
Region	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**Total**	**Eta Score**
Neck	0	1	0	0	0	0	0	1	2	0.062
Upper back	1	0	0	0	0	0	1	0	2	0.033
Low back	2	0	0	2	1	1	0	0	6	0.147
Shoulder	4	1	3	2	0	4	4	1	19	0.008
Arm	2	0	0	0	0	0	0	0	2	0.319*
Elbow	1	0	0	0	1	0	0	1	3	0.037
Hand and wrist	0	0	2	1	1	0	0	0	4	0.083
Hip	0	0	1	0	0	0	0	0	1	0.090
Thigh	0	0	2	0	0	0	0	0	2	0.128
Knee	0	0	2	0	0	0	1	0	3	0.002
Leg	0	0	1	0	0	0	0	0	1	0.090
Foot and ankle	0	0	2	0	0	0	0	0	2	0.128

The Eta score showed a much greater than medium/typical, but less than large relationship between point classification and the prevalence of arm pain in the last 12 months (η=0.319). This relationship could be seen in the frequency table 4.14 where it clearly showed that arm pain was experienced by two 1.0 point players.

There was no statistically significant relationship between Point classification and the prevalence of neck, back and lower extremity pain in the last 12 months.

4.5.1.7 Point classification and the current prevalence of musculoskeletal pain

Table 4.15 Cross tabulation between Point classification and the current prevalence of musculoskeletal pain

	Point classification									
Region	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**Total**	**Eta Score**
Neck	0	0	0	0	0	0	0	0	0	-
Upper back	0	0	0	0	0	0	2	0	2	0.252
Low back	1	1	0	0	0	0	0	0	2	0.271*
Shoulder	1	1	1	0	0	1	3	1	8	0.160
Arm	0	0	0	0	0	0	0	0	0	-
Elbow	0	0	0	0	0	0	0	0	0	-
Hand and wrist	0	0	0	0	0	0	0	0	0	-
Hip	0	0	1	0	0	0	0	0	1	0.090
Thigh	0	0	1	0	0	0	0	0	1	0.090
Knee	0	0	1	0	0	0	0	0	1	0.090
Leg	0	0	1	1	0	0	0	0	2	0.081
Foot and ankle	0	0	1	0	0	0	0	0	1	0.090

-No statistics computed because the regions are constant

*Eta scores of 0.24 are considered medium/ typical strength of a relationship

The Eta score of 0.271 for low back pain showed that there was a slightly greater than medium/typical strength relationship between Point classification and the current prevalence of low back pain. It can also be noted, after analysis of the frequency table 4.15, that low back pain only occurred in low point players which further showed the greater than medium/typical relationship between the two variables.

There was no relationship between point classification and the current prevalence of upper back, shoulder and lower extremity pain.

There was no relationship that could be analysed between point classification and the current prevalence of neck, arm, elbow and hand and wrist pain as no statistics were computed for those regions due to there being no pain that was currently experienced in any of those regions.

CHAPTER FIVE

DISCUSSION

This chapter provides a discussion of the results in the context of documented literature mentioned in the literature review. It summarises the key findings and compares and contrasts these to similar studies that have been conducted.

5.1 Demographics and Disability Characteristics of elite wheelchair basketball players in South Africa

Based on objective 1, i.e. to determine the demographics and disability characteristics of elite wheelchair basketball players in South Africa, the results pertaining to the demographics and disability characteristics are discussed below. This study did not attempt to identify associations between the demographics and disability characteristics and the prevalence of pain.

5.1.1 Section A: Demographics and Disability Characteristics

This sub-section discusses the biographical characteristics of the participants.

5.1.1.1 Age and Gender

The mean age of 33.3 years, reported in this study, compares similarly with the findings of Lepera (2010) who indicated the average age of participants in her study as 30 years. The current study did not examine age in relation to pain prevalence. Lepera (2010), however, found that age did not impact on the prevalence of shoulder pain (p=0.14) which was similarly reported by Curtis and Black (1999) when an association between age and shoulder pain was investigated in female wheelchair basketball players.

The ratio of 9:1 (89.7%:10.3%) between males and females indicated that the sport in South Africa is male dominant. The results from previous studies (Lepera 2010; Curtis and Black 1999), on male wheelchair basketball players and on female wheelchair basketball players respectively, have shown that there may not be a relationship between gender and the prevalence of pain in these athletes, as both studies showed that approximately 70% of players reported shoulder pain. Having said this, a definitive statement cannot be made as these studies were two separate studies and further research is needed.

5.1.1.2 Ethnicity

The majority of the participants in this study were African (67.44%) and White (27.91%). Due to it not being possible to make statistical comparisons on ethnic groups overseas, there is a lack of research on this topic. There has also been no published research on pain in wheelchair basketball players of different ethnic groups in South Africa and consequently no conclusions or comparisons can be made with other studies with regards to pain in different ethnic groups.

5.1.1.3 Cause of disability and device dependency for mobility

Due to the cause and extent of the participants' disabilities, 79.1% required the use of devices for mobility. Irwin, Restrepo and Sherman (2007) stated that wheelchair users suffer overuse injuries of the upper extremity as a result of the upper extremity being forced to weight-bear even though it is not designed for such a function. This study found that over half of the participants using mobility devices were wheelchair users; this indicates that nearly half of the 43 participants were at risk of upper extremity injuries due to the fact that they used wheelchairs for mobility. According to Fullerton, Borckardt and Alfano (2003), the shoulder is most commonly affected in the upper extremity and if overuse was indeed the cause of shoulder pain, then the process would become accelerated with wheelchair sport. Fullerton, Borckardt and Alfano (2003), however, found that wheelchair athletes had more shoulder pain-free years than non-athletic wheelchair users.

5.1.1.4 Length of dependency time on mobility device

Lepera (2010) found that the prevalence of shoulder pain in wheelchair basketball players in South Africa increased with the length of wheelchair dependency ($p=0.03$). Pentland and Twomey (1991) also showed an association between shoulder pain and the duration of wheelchair use, regardless of age (the population, however, was limited to females). More than half of the participants in this study used mobility devices since birth or for more than 25 years which indicated a risk for upper extremity (particularly shoulder) pain based on the above mentioned studies. Furthermore, these participants have an even higher risk for pain if they were wheelchair users.

5.1.1.5 Length of time since mobility device and basketball wheelchair were last changed/ altered/ serviced

The majority of the participants (70.59%) changed/altered/serviced their mobility device/s in the last 10 years of which 52.94% did so in the last 1-5 years. Similarly, with regards to

changing/altering/servicing of basketball wheelchairs, over two thirds (67.44%) did so in the last 10 years.

Beekman, Miller-Porter and Schoneberger (1999) stated that there was an improved ability to efficiently propel a lightweight wheelchair as opposed to a standard wheelchair in both paraplegics and tetraplegics. This in essence should decrease strain on the upper extremity. Repetitive strain injuries (causing shoulder and/ or wrist pain for example) are more likely to develop over time if wheelchairs are not properly set up for individuals using them (Boninger *et al.* 1999). This pertained to a good few participants in this study who have used wheelchairs since birth or for more than 25 years, as wheelchair models are constantly changing for more efficient propulsion as was stated earlier, as well as for better stabilisation (Beneke 2014). Materials, such as titanium and aluminium, that are used in the frame of wheelchairs makes it lighter, faster and more responsive, whilst being firm (Cooper and De luigi 2014). In addition to an athlete's conditioning and level of skill, the wheelchair configuration and the wheelchair-athlete interaction, will determine an athlete's performance (Goosey-Tolfrey 2010a). There has been literature that has shown that the ergonomics of performance in sports for athletes is influenced by wheel size, hand-rim configurations, the rear wheel camber and seat positioning (Mason, Van der Woude and Goosey-Tolfrey 2013; Vanlandewijck, Verellen and Tweedy 2011). Lastly, it can be said that regular maintenance of wheelchairs will ensure that it functions optimally. The majority of participants showed some sort of recent maintenance.

5.2 Prevalence and profile of musculoskeletal pain

Based on objective 2, i.e. to determine the prevalence and profile of musculoskeletal pain, respectively in elite wheelchair basketball players in South Africa, the participants activity level in wheelchair basketball and/or other activities, as well as the profile of musculoskeletal pain will be discussed below.

5.2.1 Section B: Wheelchair basketball and activity level

This sub-section discusses the findings from the data collected on activity levels relating to wheelchair basketball and time spent on other activities such as work, gym, watching TV, driving, rest and playing other sports. This study did not attempt to establish a relationship between these variables and pain prevalence.

5.2.1.1 Years spent playing wheelchair basketball

The majority of the participants (95.3%) have been playing wheelchair basketball for more than 5 years. Fullerton, Borckardt and Alfano (2003) found that the number of years spent

participating in wheelchair sports was unrelated to the prevalence of shoulder pain, however, it was found that wheelchair athletes were shoulder pain-free for twelve years on average after becoming wheelchair bound as opposed to non-athletes who were shoulder pain-free for only eight years since becoming wheelchair bound.

5.2.1.2 Weekly training time and time spent on court

Ferrara *et al.* (1992) found that 62% of injuries in track, basketball and road racing occurred during practice sessions. The findings in our study found that 24% of the participants who reported pain said that it was due to an instance during training or over-training. This study found that during the season, nearly half of the participants (48.8%) train for 6-10 hours weekly, however off-season majority of the participants (58.1%) train for 1-5 hours. This indicates that during the season, the most common training time for 48.8% of the participants was 6-10 hours which decreased to 16.3% off-season. Having said this, the majority of the players still train off-season and maintain conditioning by training for 1-5 hours. One fifth of the players (20.9%), however, do not train at all off-season. This may result in injury and/or pain upon returning to training when the season commences as one may be unfit or not properly conditioned.

Curtis and Dillon (1985) also reported a fairly large number of participants training for 6-10 hours (36% of 128 questionnaires completed). Curtis and Dillon (1985) studied common patterns and prevention of wheelchair athletic injuries and found a direct association ($p<0.02$) between the rate of injury and the amount of time one participates in sport. There was a greater number of reported injuries in those athletes who spent a greater number of hours training per week. Locally, Lepera (2010) found no statistically significant association between the prevalence of shoulder pain and the time spent training ($p=0.31$).

Over one third, but less than half of the participants (41.86%) played for more than 25 minutes. Due to the fast-paced nature of the game and with little time to rest between ten minute quarters (except for the 15 minute half-time interval), it can be proposed that fatigue can set in which can lead to an increased chance of overuse and pain and/or injury. Lepera (2010) found no statistically significant association, however, between the prevalence of shoulder pain and time spent on court ($p=0.85$).

5.2.1.3 Time spent warming up and cooling down/ stretching before and after games

Thompson, Snodgrass and Osmotherly (2015) reported that 72% of participants warmed up and stretched in order to prevent injury. In this study, 37.2% of participants warmed up

for 11-15 minutes, however, only 2.3% spent that time cooling down. Cooling down/ stretching after a game is important to prevent muscle stiffness and possible pain and/or injury as a result. In this study, 8% of participants who experienced pain in the last 12 months reported that the possible cause of the pain was improper warm-up or cool down, although this is not a very large percentage.

5.2.1.4 Time spent per week on other activities

Work (58.2%) took up most of the participants time (more than 30 hours) with 25.6% spending more than 40 hours weekly at work. Lepera (2010) found an association between the prevalence of shoulder pain and time worked (p=0.05) and stated that it could be due to the type of work done i.e. “sedentary desk type jobs” (Lepera 2010: 63). In this study, there was a wide variety of occupations with 11 participants (26.8%) being unemployed and 3 (7.3%) being students and one could not make an assumption that participants worked at a desk. Having said this, 20 participants (46.51%) used wheelchairs, therefore, it can be assumed that more than 30-40 hours per week at work would be fatiguing. This could result in improper ergonomic handling during transfers from wheelchairs onto other surfaces and *vice versa*, wheelchair propulsion and/ or activities of daily living eventually leading to injury and pain (Lepera 2010).

Nearly three-quarters of the participants (n=32; 74.4%) did not participate in other sports. The other sports that the 11 participated in included athletics; cycling; discus; hand cycling; javelin; shotput; soccer; table tennis and wheelchair tennis. Hand cycling had the highest participation (n=3). Shotput and soccer had the second highest participation (n=2 each), with the rest of the sports having 1 participant. Burnham and Steadward (1994) stated that during wheelchair basketball season one should not participate in other sports, and that optimal training and conditioning time was three times a week.

5.2.2 Section C: Musculoskeletal pain

This sub-section discusses the prevalence of musculoskeletal pain at various times in the participants’ lives, as well as discusses the profile of the pain and the intervention thereof.

5.2.2.1 The prevalence of musculoskeletal pain and possible causes

The prevalence of pain in all regions increased since the participants started playing wheelchair basketball; 23 participants having experienced shoulder pain since playing wheelchair basketball, 8 participants having experienced low back pain and 5 participants having experienced hand and wrist pain. The neck, upper back, low back and upper limb seemed to be the regions most affected by pain since participants started playing wheelchair basketball. This will be discussed further under objective 4.

Most of the 25 participants (68%) who reported pain in the last 12 months attributed their pain to instances related to wheelchair basketball (such as an instance during a basketball game, during training, over-training and improper warm up/ cool down) with an instance during a basketball game causing the pain in 36% of the participants. Wheelchair basketball requires the use of high intensity propulsion and manoeuvring, together with quick passing, rebounding and reaching overhead for shooting (Curtis *et al.* 1999 and Goosey-Tolfrey, Morriss and Butterworth 2002). As a result, intense training is required and it would, therefore, make sense that the high demands of the sport can result in pain and/or injury.

Participants also reported pushing (n=11) and pivoting movements (n=5) to be the main activities that aggravated the pain. In Lepera's study (2010), 12 out of the 21 players (57%) who experienced shoulder pain, reported that the pain was provoked during propulsion. This is further in keeping with Samuelsson, Tropp and Gerdle (2004) who found that 54% of the participants with shoulder pain experienced the pain with propulsion. This may be due to impingement as a result of increased stresses applied through the shoulder during wheelchair propulsion particularly at high speeds (Lepera 2010; Samuelsson, Tropp and Gerdle 2004). In addition, certain activities like shooting require the shoulder to be repetitively placed in the impingement position i.e. shoulder flexion and abduction (Burnham *et al.* 1993).

5.2.2.2 Practitioner consulted for the pain, the diagnosis and treatment

Of the 25 participants who reported pain, 16 of them (64%) sought treatment from a medical practitioner of which the majority (75%) consulted a Physiotherapist. The remainder consulted with biokineticists, general practitioners, orthopaedic surgeons and some visited pharmacists (more than one practitioner was consulted with in some instances). Chiropractors were not consulted at all, which could be due to a lack of knowledge about the profession. Chiropractic treatment has resulted in patients using less pain medication, a decreased risk of chronic pain and a reduced incapacitation time (Chiropractic Association of South Africa 2010-2013). As a result, the profession is of great value to people with pain and seeing that 8 out of the 11 participants (72.7%), who recalled a diagnosis, reported that muscles were the cause of the pain, Chiropractic treatment would be of great benefit to those participants.

Various treatments such as exercise, pain medication, ice and heat, as well as advice on resting were given to the participants who sought treatment. Exactly 50% of the participants were given some form of exercise to do.

5.3 Impact of musculoskeletal pain

Based on objective 3, i.e. to determine the impact of the musculoskeletal pain on basketball activity or activities of daily living, the impact of musculoskeletal pain on those activities are discussed below.

5.3.1 Section D: Impact of pain on wheelchair basketball activity/ activities of daily living

This sub-section discusses the impact of pain on the wheelchair basketball activity/ activities of daily living of the respondents. This section only needed to be completed if the respondent experienced pain at the time the questionnaire was answered or if they experienced pain in the last 12 months.

5.3.1.1 Negative effect of pain on wheelchair basketball activity/ activities of daily living

Out of the 25 participants who experienced pain in the last 12 months, 60% reported that basketball activity was affected negatively by pain i.e. decreased performance. It is important for healthcare practitioners working with sports teams to highlight any problem areas resulting in pain for optimal performance of athletes and for future growth and success of the sport (Lepera 2010).

5.4 Associations between pre-game classification and the prevalence of pain

Based on objective 4, i.e. to establish possible associations between pre-game classification and the prevalence of musculoskeletal pain, this section discusses the possible associations between pre-game classification and the prevalence of musculoskeletal pain and discusses the following hypotheses:

Hypothesis 1: Upper extremity (including neck and back) pain is experienced more commonly in lower point classified wheelchair basketball players than in higher point classified players.

Hypothesis 2: Lower extremity pain is experienced more commonly in higher point classified players than in lower point classified players.

The possible associations between pre-game classification and the prevalence of musculoskeletal pain at various times are discussed below.

5.4.1 Point classification

There were seven 1.0, seven 2.0 and seven 3.0 point players. The different point players were evenly spread out from 1.0-4.5 points as was expected. The five players on court must not exceed 14 points, therefore, the process of classification equalises the team's functional capacity (International Wheelchair Basketball Federation 2010).

Lower point players (1.0-2.5 point players) are generally players that are wheelchair bound due to a spinal cord injury, spina bifida or other birth conditions/ defects resulting in paralysis or the inability to use the lower limbs. Whilst higher point players (3.0-4.5 point players) include players with amputations, mild poliomyelitis or birth defects resulting in fairly significant leg length inequalities amongst others.

5.4.2 Point classification and the prevalence of musculoskeletal pain before using a mobility device

There were no Eta scores above 0.24 indicating no greater than typical relationships between point classification and the prevalence of musculoskeletal pain in any region before using a mobility device. Possible reasons for this could be that the participants were too young to remember, could not remember as it was too long ago or due to the fact that they may have been using mobility devices since birth. The statistics did indicate that 52.94% (n=18) reported having used mobility devices since birth or for more than 25 years.

5.4.3 Point classification and the prevalence of musculoskeletal pain since using a mobility device

The Eta score for arm pain was 0.362, which was interpreted as a larger than typical relationship between point classification and the prevalence of arm pain since using a mobility device. This relationship was further seen upon analysis of the frequency table 4.11, which clearly showed the prevalence of arm pain in lower point players (1.0-2.5 point players). Seeing that 1.0-2.5 point players are generally wheelchair bound individuals, it would make sense that they would experience arm pain since using their mobility device as their upper extremities have become weight-bearing limbs and are used for propulsion (Burnham *et al.* 1993), therefore, the upper limbs would take strain especially in the beginning.

5.4.4 Point classification and the prevalence of musculoskeletal pain before playing wheelchair basketball

The Eta score for hand and wrist pain was 0.271 which showed a slightly greater than medium/typical strength relationship between point classification and the prevalence of hand and wrist pain before playing wheelchair basketball. This was seen further upon analysis of frequency table 4.12 which showed that hand and wrist pain occurred only in lower point players (1.0-2.5 point players). Studies have shown that symptoms of Carpal Tunnel Syndrome may occur in 52-100% of wheelchair users (Jackson *et al*. 1996; Burnham and Steadward 1994; Gellman *et al.* 1988) and activities that involve wrist extension such as transferring, propulsion, shooting and rebounding may aggravate these symptoms hence wrist and hand pain (Collins *et al*. 1988). It can also be proposed that due to the upper extremities being forced to bear weight, the joints of the upper extremity may undergo arthritic changes and inflammation, leading to pain; the process may speed up due to the high intensity nature of wheelchair basketball.

Goosey-Tolfrey, Morriss and Butterworth (2002) found that different point players demonstrate altered shooting strategies. Wang *et al.* (2005) recently found that wrist muscle strength, together with that of the shoulder, was important for performance in wheelchair basketball. Wang *et al.* (2005) found that the 2.0 point player seemed to generate an increased angular velocity of the wrist for compensation. This information was given to the British National team coaches who reduced shooting volumes of these players which resulted in decreased wrist problems. Hence it is important to identify and address these issues at training in order to prevent such injury (Goosey-Tolfrey 2010a).

5.4.5 Point classification and the prevalence of musculoskeletal pain since playing wheelchair basketball

The Eta score for arm pain, once again, showed a larger than typical relationship between point classification and the prevalence of arm pain since playing wheelchair basketball (η=0.358). This was further seen upon analysis of the frequency table 4.13 which showed that arm pain occurred only in lower point players (1.0-2.5 point players).

Upon further analysis of the frequency table 4.13, it was noted that hand and wrist pain occurred predominantly in lower point players (n=4) than in higher point players (n=1), however, the Eta score was 0.211 and therefore showed a less than typical relationship. This could have been affected by the sample size as the greater the sample, the higher the power of the data.

Shoulder pain occurred in 23 participants (53.49%) since playing wheelchair basketball and was fairly evenly distributed between lower point players (n=11) and higher point players (n=12). This finding is similar to that of the study by Yildirim, Comert and Ozengin (2010) wherein which shoulder pain was found to be prevalent in 60% of lower point players and 51.72% of higher point players hence no statistical difference between the two groups ($p>0.05$). Lower point players generally use wheelchairs for activities of daily living, in addition to training and in matches, and therefore have high loads imposed on their upper extremities particularly the shoulder as opposed to higher point players. On the other hand, higher point players assume more ball handling roles due to greater control of their trunks and are therefore involved more in shooting from further distances, rebounding and passing (Yildirim, Comert and Ozengin 2010). It can, therefore, be said that wheelchair bound players (lower point players) are likely to undergo degenerative changes and hence experience shoulder pain due to the daily use of their wheelchairs, but that non-wheelchair bound players (higher point players) are also susceptible to shoulder pain due to the nature of the sport (Lepera 2010).

5.4.6 Point classification and the prevalence of musculoskeletal pain in the last 12 months

The Eta score for arm pain was 0.319 which was interpreted as a much greater than medium/typical, but less than large relationship between point classification and the prevalence of arm pain in the last 12 months. This relationship was further seen upon analysis of the frequency table 4.14 which clearly showed the prevalence of arm pain in lower point players (1.0-2.5 point players). Arm pain would commonly occur in wheelchair bound individuals (lower point players) due to the constant propulsion. The prevalence of arm pain would also depend on the conditioning of the individual.

5.4.7 Point classification and the current prevalence of musculoskeletal pain

The Eta score for low back pain was 0.271 which showed that there was a slightly greater than medium/typical strength relationship between point classification and the prevalence of low back pain at the time the questionnaires were answered. The frequency table 4.15 also clearly shows that 1.0-1.5 point players were experiencing low back pain as opposed to the higher point players and therefore there is a slightly significant relationship between the two variables.

5.5. Summary of hypotheses

Hypothesis 1: Upper extremity (including neck and back) pain was experienced more commonly in lower point classified wheelchair basketball players than in higher point classified players.

This Null hypothesis was rejected for the following reasons:

1. Arm pain was found to be more prevalent in lower point players upon analyses of frequency tables in all questions with Eta scores that showed a larger than typical relationship between point classification and the prevalence of musculoskeletal pain since using a mobility device, since playing wheelchair basketball and in the last 12 months and no discrepancies were noted.
2. Hand and wrist pain was found to be prevalent in lower point players before playing wheelchair basketball.
3. Low back pain was found to be prevalent in lower point players at the time the questionnaires were completed.

Hypothesis 2: Lower extremity pain was experienced more commonly in higher point classified players than in lower point classified players.

This Null hypothesis was not rejected for the following reason:

1. No larger than typical relationships or even medium relationships could be found between point classification and the prevalence of lower extremity pain. Higher point players did not experience lower extremity pain more frequently than lower point players.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a conclusion of the results of the study with particular reference to the hypotheses of this study. Recommendations for future studies are also suggested.

6.1 Conclusions

- Arm pain occurred in lower point classified players (1.0-2.5 point players), largely related to the fact that lower point players are generally wheelchair bound. This finding is in keeping with the hypothesis that upper extremity (including neck and back) pain is experienced more commonly in lower point classified wheelchair basketball players than in higher point classified players. The null hypothesis was, therefore, rejected.
- Hand and wrist pain was also more prevalent in lower point players than in higher point players. Not all the Eta scores for hand and wrist pain were, however, significant.
- It was established that lower extremity pain was not experienced more commonly in higher point classified players than in lower point classified players and therefore the null hypothesis, as a result, was not rejected.

6.2 Recommendations

Most studies focused on shoulder pain in these athletes including the South African study by Lepera (2010) indicating a need for further studies on the general prevalence of pain in wheelchair basketball players specifically. Studying the South African National team in this regard could be beneficial as pain can affect the national team's ability to succeed internationally and this study showed that basketball is largely affected by pain.

A larger sample size is needed for future studies as many Eta scores in this study were in the range of 0.200-0.243 for the prevalence of upper extremity pain. These scores could have shown larger relationships had there been more participants, however, a larger sample size was difficult to obtain due to the low population size.

Questionnaires should be additionally distributed to all players via e-mail as not all players were present at the time questionnaires were handed out which reduced return rate.

Point classification should be an integral part of every question so that all results are stratified according to lower and higher point classified players.

Prevalence of pain amongst different ethnic groups in South Africa is a possible topic to look into as there is currently no literature on this, despite the diversity of South African ethnicities.

The study of the prevalence of pain in individuals relatively new to the sport and a follow-up study should be conducted a few years later or a comparative study with those players who have been playing for many years. The focus of the study could possibly be centred around users of different mobility devices specifically.

A study incorporating video analysis of differences amongst the different point players that could predispose them to pain so that one does not have to rely on participants' memory to answer certain questions.

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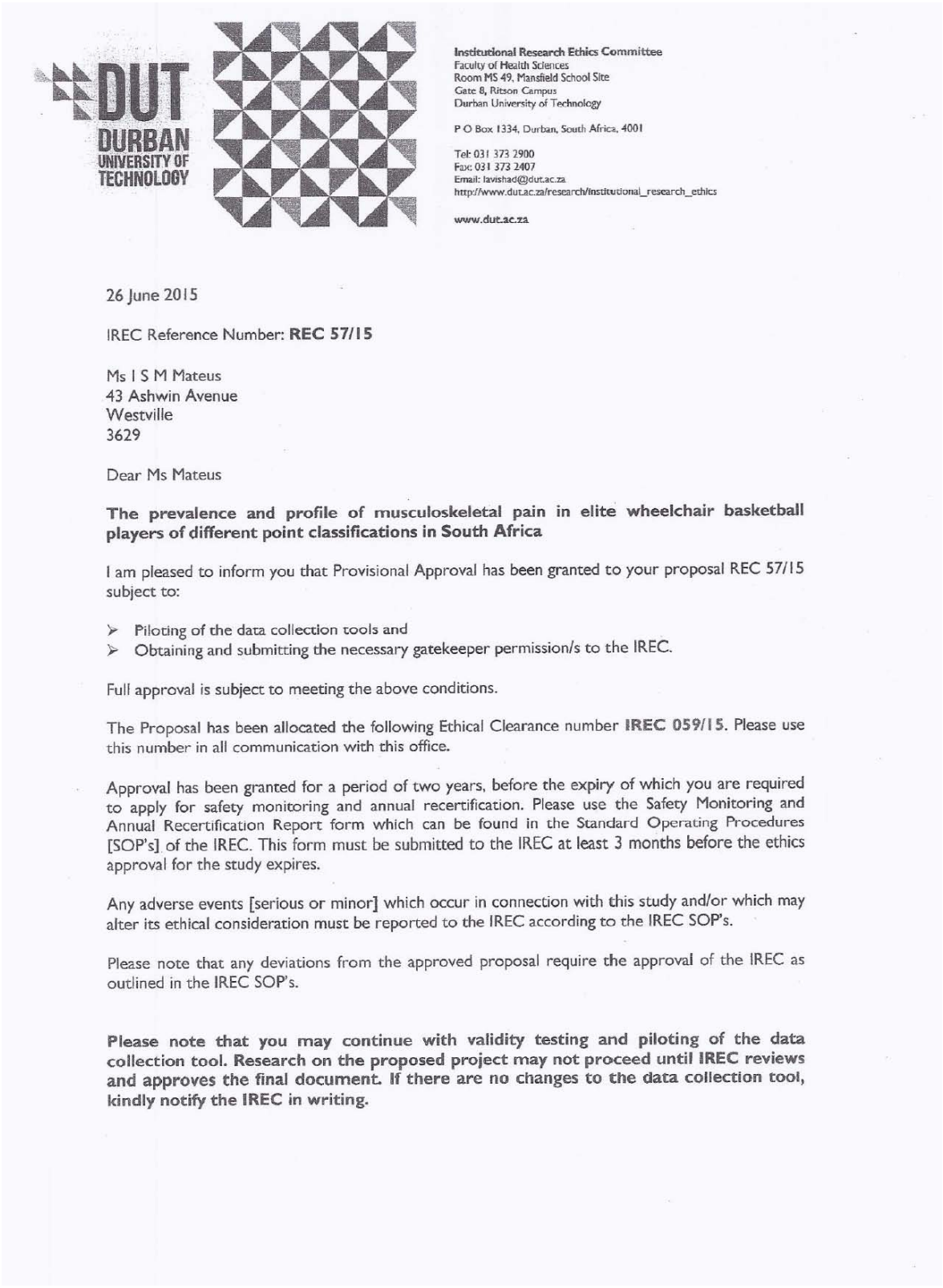
APPENDICES

Appendix A: Institutional Research Ethics Committee Letter of Provisional Approval



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Institutional Research Ethics Committee
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www.dut.ac.za

26 June 2015

IREC Reference Number: **REC 57/15**

Ms I S M Mateus
43 Ashwin Avenue
Westville
3629

Dear Ms Mateus

The prevalence and profile of musculoskeletal pain in elite wheelchair basketball players of different point classifications in South Africa

I am pleased to inform you that Provisional Approval has been granted to your proposal REC 57/15 subject to:

- Piloting of the data collection tools and
- Obtaining and submitting the necessary gatekeeper permission/s to the IREC.

Full approval is subject to meeting the above conditions.

The Proposal has been allocated the following Ethical Clearance number **IREC 059/15**. Please use this number in all communication with this office.

Approval has been granted for a period of two years, before the expiry of which you are required to apply for safety monitoring and annual recertification. Please use the Safety Monitoring and Annual Recertification Report form which can be found in the Standard Operating Procedures [SOP's] of the IREC. This form must be submitted to the IREC at least 3 months before the ethics approval for the study expires.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the IREC according to the IREC SOP's.

Please note that any deviations from the approved proposal require the approval of the IREC as outlined in the IREC SOP's.

Please note that you may continue with validity testing and piloting of the data collection tool. Research on the proposed project may not proceed until IREC reviews and approves the final document. If there are no changes to the data collection tool, kindly notify the IREC in writing.

Yours Sincerely

Professor J K Adam
Chairperson: IREC

DUT DURBAN UNIVERSITY OF TECHNOLOGY

2015 -06- 26

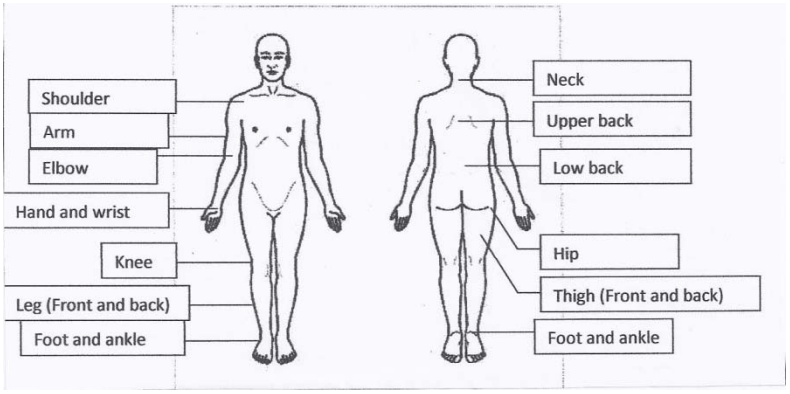
INSITUTUTIONAL RESEARCH ETHICS COMMITTEE
P O BOX 1334 DURBAN 4000 SOUTH AFRICA

Appendix B: Pre-focus group questionnaire

The prevalence and profile of musculoskeletal pain in elite wheelchair basketball players of different point classifications in South Africa.						
Please mark answers with an X where needed. Some questions are open-ended and require a more detailed answer.						
SECTION A: DEMOGRAPHICS AND DISABILITY CHARACTERISTICS						
1.	Age:					
2.	Gender:	Male		Female		
3.	Ethnicity:	African	Coloured	Indian	White	Other (please specify)
4.	Occupation (work):					
5.	What is your medical condition/ reason for disability:					
6.	Are you dependant on any devices for mobility (moving around):				Yes	No
6.1	If yes, what devices do you use for mobility:	Wheelchair	Prosthetics	Crutches	Other (please specify):	
6.2	For how long have you been dependant on that device:	Since birth	0-5 years	5-10 years	10-15 years	15-20 years
		20-25 years	More than 25 years			
6.3	If you use prosthetics, are they used whilst playing:	Yes		No		
6.4	When last did you change/ alter/ service your mobility device:	0-5 years	5-10 years	10-15 years	15-20 years	More than 20 years
SECTION B: WHEELCHAIR BASKETBALL AND ACTIVITY LEVEL						
1.	How many years have you been playing wheelchair basketball:	0-5 years	5-10 years	10-15 years	15-20 years	More than 20 years
2.	What are you classified as:	1.0	1.5	2.0	2.5	3.0
		3.5	4.0	4.5		
3.1	How many hours per week do you spend training for basketball during the season:	0 hours	0-3 hours	4-6 hours	7-9 hours	10-12 hours
		13-15 hours	16-18 hours	19-21 hours	More than 21 hours	
3.2.	How many hours per week do you spend training for basketball	0 hours	0-3 hours	4-6 hours	7-9 hours	10-12 hours

	off-season:					
		13-15 hours	16-18 hours	19-21 hours	More than 21 hours	
4.	How many hours per week do you spend playing basketball games:	0 hours	0-3 hours	4-6 hours	7-9 hours	10-12 hours
		13-15 hours	16-18 hours	19-21 hours	More than 21 hours	
5.1.	How many minutes do you spend warming up/ stretching before training/ before games:	0-5 minutes	6-10 minutes	11-15 minutes	16-20 minutes	More than 20 minutes
5.2.	How many minutes do you spend cooling down/ stretching after training/ after games:	0-5 minutes	6-10 minutes	11-15 minutes	16-20 minutes	More than 20 minutes
6.	Do you play any other sport/s?	Yes		No		
6.1.	If yes to question 6, what other sport/s do you play:					
6.2.	If yes to question 6, how many hours per week do you spend playing other sport/s:	0 hours	0-3 hours	4-6 hours	7-9 hours	10-12 hours
		13-15 hours	16-18 hours	19-21 hours	More than 21 hours	
7.	How many hours per week do you spend on the following activities:					
7.1	Work:	0 hours	0-3 hours	4-6 hours	7-9 hours	10-12 hours
		13-15 hours	16-18 hours	19-21 hours	More than 21 hours	
7.2	Gym:	0 hours	0-3 hours	4-6 hours	7-9 hours	10-12 hours
		13-15 hours	16-18 hours	19-21 hours	More than 21 hours	
7.3	Watching TV:	0 hours	0-3 hours	4-6 hours	7-9 hours	10-12 hours
		13-15 hours	16-18 hours	19-21 hours	More than 21 hours	
7.4	At a computer:	0 hours	0-3 hours	4-6 hours	7-9 hours	10-12 hours
		13-15 hours	16-18 hours	19-21 hours	More than 21 hours	
7.5	Driving:	0 hours	0-3 hours	4-6 hours	7-9 hours	10-12 hours
		13-15 hours	16-18 hours	19-21 hours	More than 21 hours	
7.6	Rest:	0 hours	0-3 hours	4-6 hours	7-9 hours	10-12 hours
		13-15 hours	16-18 hours	19-21 hours	More than 21 hours	

SECTION C: MUSCULOSKELETAL PAIN



1.	Have you experienced musculoskeletal pain before using your mobility device?	Yes	No	Unsure
1.1	If Yes to Question 1, please state the region/s based on the picture above.			
2.	Have you experienced musculoskeletal pain since using your mobility device?	Yes	No	Unsure
2.1.	If Yes to Question 2, please state the region/s based on the picture above.			
3.	Have you experienced musculoskeletal pain before playing wheelchair basketball?	Yes	No	Unsure
3.1.	If Yes to Question 3, please state the region/s based on the picture above.			
4.	Have you experienced musculoskeletal pain since playing wheelchair basketball?	Yes	No	Unsure
4.1	If Yes to Question 4, please state the region/s based on the picture above.			
5.	Have you experienced pain in the last 12 months?	Yes	No	Unsure
5.1	If Yes to Question 5, please state the region/s based on the picture above.			
6.	At present, are you experiencing any musculoskeletal pain?	Yes	No	Unsure
6.1.	If Yes to Question 6, please state the region/s based on the picture above.			
Please answer the next set of questions if you're currently experiencing pain or if you've experienced pain in the last 12 months				
6.2.	What was the possible cause of the pain?	An instance during a basketball game	An instance during training	Over-training
		Improper warm-up/ cool-down	Other activities (please specify)	Unknown
6.3.	What type of pain did you experience?	Dull	Aching	Burning
		Sharp	Radiating	Pins and needles
6.4.	What activity causes the pain to start?	Shooting	Passing	Catching
		Rebounding	Pushing	Braking
		Pivoting	Dribbling	Contact
		None	Unknown	Other (please

				specify):
6.5.	What activity makes it worse?	Shooting	Passing	Catching
		Rebounding	Pushing	Braking
		Pivoting	Dribbling	Contact
		None	Unknown	Other (please specify):
6.6.	How long does the pain last?	Seconds	Minutes	Hours
		Days	Months	Years
6.7.	Have you received any treatment for the pain?	Yes	No	Unsure
6.8.	If yes to Question 6.7, what treatment did you receive?	Heat	Ice	Pain medication
		Exercise	Rest	Other (please specify):
6.9.	Did you seek treatment from a medical practitioner?	Yes	No	Unsure
6.10	If yes to question 6.9, which practitioner did you consult with?	Biokineticist	Chiropractor	General Practitioner
		Orthopaedic surgeon	Pharmacist	Physiotherapist
		None	Unknown	Other (please specify):
6.11.	If yes to question 6.9, what did the practitioner diagnose?			
6.12	Did the treatment relieve your pain?	Yes	No	Unsure
SECTION D: IMPACT OF PAIN ON WHEELCHAIR BASKETBALL ACTIVITY/ ACTIVITIES OF DAILY LIVING Please complete if you're currently experiencing pain or if you've experienced pain in the last 12 months.				
1.	Did your pain affect any of the following activities negatively:	Shooting	Passing	Catching
		Rebounding	Pushing	Braking
		Pivoting	Dribbling	Contact
		Work	Household work	Social life
		None	Unknown	Other (please specify):
THANK YOU FOR TAKING TIME TO COMPLETE THIS QUESTIONNAIRE!				

Appendix C: Letter of information (Focus group)

LETTER OF INFORMATION

Dear Participant

I would like to welcome you into the focus group of my study and thank you for taking the time to participate.

Title of the Research Study: The prevalence and profile of musculoskeletal pain in elite wheelchair basketball players of different point classifications in South Africa.

Principal Investigator/s/researcher: Isabel. S. M. Mateus (BTech: Chiropractic)

Co-Investigator/s/supervisor/s: Dr J.D Pillay (PhD: Physiology)

Dr K. Padayachy (MTech: Chiropractic)

Brief Introduction and Purpose of the Study: Involvement in sport for physically challenged individuals continues to grow in popularity and, therefore an area requiring more research especially within the context of South Africa and in the area of wheelchair basketball due to increased participation and support.

This study is a questionnaire-based quantitative, descriptive cross sectional survey that will determine the demographics and disability characteristics of elite wheelchair basketball players in South Africa, the prevalence and profile of musculoskeletal pain, respectively in these athletes, and will identify possible associations between pre-game classification and the prevalence of musculoskeletal pain.

Purpose of the focus group: To seek your assistance in developing the questionnaire to best suit the research study and study population, through discussion of the questions and ability of one to answer them. In so doing, this focus group will help in validating the questionnaire and all changes to the questionnaire, as a result of this focus group discussion, will make it a more accurate tool.

Outline of the Procedures: The focus group discussion will be scheduled for an hour and a half at the Durban University of Technology, once ethical clearance has been obtained. The group will include two wheelchair basketball players from KZN Wings wheelchair basketball club, 2 KZN coaches (both of whom are ex- South African wheelchair basketball players), a practicing chiropractor, a physiotherapist and a person with research experience; all of whom would be required to voluntarily sign an informed consent form to participate in this discussion (APPENDIX B). Necessary changes to the questionnaire will be made following the focus group discussion.

Risks or Discomforts to the Participant: There are no risks/ discomforts expected with your participation in this study.

Benefits: Developing a more accurate questionnaire.

Reason/s why the Participant May Be Withdrawn from the Study: Your participation in this study is voluntary and you are free to withdraw from this study at any time without any adverse consequences.

Remuneration: There will be no remuneration (payment) for participating in this study.

Costs of the Study: You will not be expected to pay towards any costs of the study.

Confidentiality: All suggestions and information will be recorded and will be treated as confidential. All focus group data will be safely stored for approximately 5 years and will be destroyed thereafter, as per DUT requirements.

Research-related Injury: Participation in this study will not cause any injury to you.

Persons to Contact in the Event of Any Problems or Queries:
Please contact Isabel. S. M. Mateus (the researcher) on 084 518 1954, Dr J.D Pillay on 031 373 2398 and Dr K. Padayachy on 031 464 4057 (my supervisors) or the Institutional Research Ethics administrator on 031 373 2900 if you have any research related queries. Complaints can be reported to the DVC: TIP, Prof F. Otieno on 031 373 2382 or dvctip@dut.ac.za.

General:
Approximately 74 participants will be recruited to participate in this study. Please note that participation in this study is voluntary.

Appendix D: Informed consent form (Focus group)

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Isabel. S.M Mateus, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: **REC 57/15**,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____ _____ ____ _____

Full Name of Participant **Date** **Time** **Signature/Right Thumbprint**

I, _____ (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____ _____ _____

Full Name of Researcher **Date** **Signature**

_____ _____ _____

Full Name of Witness **Date** **Signature**

(if applicable)

_____ _____ _____

Full Name of Legal Guardian **Date** **Signature**

(if applicable)

Appendix E: Confidentiality statement (Focus group)

IMPORTANT: THIS FORM IS TO BE UNDERSTOOD AND COMPLETED BY EVERY PARTICIPANT IN THE EXPERT GROUP BEFORE THE EXPERT GROUP COMMENCES.

1. All information contained in the research documents and any information discussed during the expert group meeting will be kept private and confidential.
2. The returned questionnaires will be coded and kept anonymous in the research process.
3. None of the information shall be communicated to any other individual or organisation outside of this specific expert group as to the decisions of this expert group.
4. The information from this expert group will be made public in terms of a journal publication, which will in no way identify any participants of this research.

Once this form has been read and agreed to, please fill in the appropriate details below and sign to accept the agreement.

PLEASE PRINT IN BLOCK LETTERS

Participant _____ Signature _____ Date _____

Researcher _____ Signature _____ Date _____

Supervisor _____ Signature _____ Date _____

Witness _____ Signature _____ Date _____

Appendix F: Corrections from the Focus group

FOCUS GROUP RECOMMENDED CHANGES	STUDENT/ SUPERVISOR RESPONSE	QUESTION NUMBER, SECTION AND PAGE NUMBER FROM PRE-FOCUS GROUP QUESTIONNAIRE WHERE CHANGE HAS TO BE MADE	QUESTION NUMBER, SECTION, PAGE NUMBER WHERE CHANGE HAS BEEN MADE ON POST-FOCUS GROUP QUESTIONNAIRE
SECTION A: DEMOGRAPHICS AND DISABILITY CHARACTERISTICS			
Categorize question 5 **"What is your medical condition/ reason for disability"** into most common conditions, other and unknown	Added the following categories: birth defect, spinal condition/ lesion, amputation, other, unknown	Question 5. Section A. Page 1.	Question 6. Section A. Page 1.
Add in a question at the end of Section A **regarding the servicing of basketball wheelchairs**	Added in a question at the end of Section A **"When last did you change/ alter/ service your basketball wheelchair"** and added the same intervals as those for the question before regarding servicing of mobility device	Section A. Page 1.	Question 8. Section A. Page 1.
SECTION B: WHEELCHAIR BASKETBALL AND ACTIVITY LEVEL			
Change wording of question 2 from **"What are you classified as"** to **"What points are you classified as"**	Changed	Question 2. Section B. Page 1.	Question 2. Section B. Page 2.
Change wording of question 4 from **"How many hours per week do you spend playing basketball games"** to **"how much time on court per week do you spend playing basketball matches"**	Changed	Question 4. Section B. Page 2.	Question 4. Section B. Page 2.
Change intervals for question 4 from hours to **minutes**	Changed	Question 4. Section B. Page 2.	Question 4. Section B. Page 2.
Move questions 6, 6.1 and 6.2 from Section B to Section A after question 4	Moved	Question 6, 6.1, 6.2 Section B. Page 2.	Question 5, 5.1, 5.2 Section A Page 1.
Add in the **option** of **"none"** for question 5.1 and 5.2 of Section B.	Added	Question 5.1 & 5.2 Section B. Page 2.	Question 5.1 & 5.2 Section B. Page 2.
Decrease the number of **options** to	Decreased variables.	Question 7 (7.1-7.6).	Question 6 (6.1-6.6).

choose from (variables) for Question 7 of Section B and **increase intervals** to more than 40 hours.	Increased intervals.	Section B. Page 2.	Section B. Page 2
SECTION C: MUSCULOSKELETAL PAIN			
Define musculoskeletal pain for those who may not understand what it is	Added definition and referenced	Section C. Page 3.	Section C. Page 3.
Reference the diagram used	Added a reference below diagram.	Diagram Section C. Page 3.	Diagram. Section C. Page 3.
Label the different **regions** in the diagram with **alphabets or numbers** to make it easier and quicker to answer	Labeled different regions with alphabets	Diagram Section C Page 3.	Diagram Section C. Page 3.
Add in the word **"musculoskeletal"** before pain in question 5 to ensure uniformity between questions 1-6	Added	Question 5. Section C. Page 3.	Question 5. Section C. Page 3.
Ask the question **"do you know what caused the pain"** with options **yes and no** before asking "what was the possible cause of the pain"	Added	 Section C. Page 3.	Question 6.2. Section C. Page 3.
Move question 6.3 **"what type of pain did you experience"** after question 6.5 **"what activity makes it worse"**	Moved and changed numbering	Question 6.3 Section C. Page 4.	Question 6.5 Section C. Page 4.
Remove question 6.4 **"what activity causes the pain to start"** as it's repetition	Removed	Question 6.4. Section C. Page 4.	Removed
Move question 6.9 **"did you seek treatment from a medical practitioner"** after question 6.6 **"how long does the pain last"**	Moved and changed numbering	Question 6.9 Section C. Page 4	Question 6.7. Section C. Page 4.
Move question 6.10 **"If yes to question 6.9, which practitioner did you consult with"** after question **"did you seek treatment from a medical practitioner"**	Moved and changed numbering	Question 6.10. Section C. Page 4.	Question 6.8. Section C. Page 4.
Replace the option **"none"** with **"traditional healer"** for question 6.10	Replaced	Question 6.10. Section C Page 4.	Question 6.8 Section C Page 4.
SECTION D: IMPACT OF PAIN ON WHEELCHAIR BASKETBALL ACTIVITY/ ACTIVITIES OF DAILY LIVING			
Remove options of **"shooting, passing, catching, rebounding, pushing, braking, pivoting, dribbling and contact "** and **replace** it with **"basketball"**	Removed Replaced	Question 1. Section D. Page 4	Question 1. Section D. Page 4.

Add option of **“hobbies”** to Question 1.	Added	Question 1. Section D. Page 4	Question 1. Section D. Page 4.

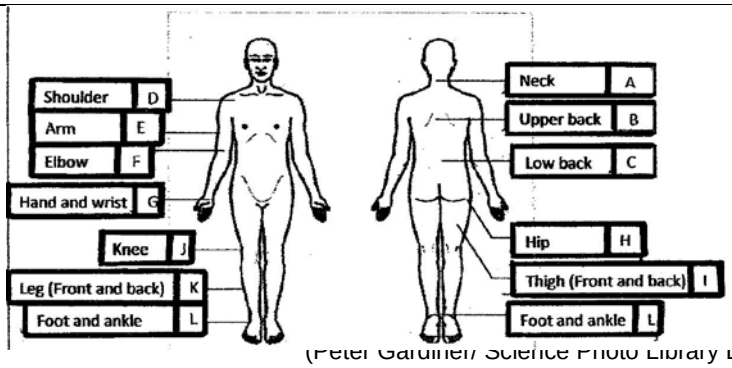
Appendix G: Post-focus group questionnaire

The prevalence and profile of musculoskeletal pain in elite wheelchair basketball players of different point classifications in South Africa.						
Please mark answers with an X where needed. Some questions are open-ended and require a more detailed answer.						
SECTION A: DEMOGRAPHICS AND DISABILITY CHARACTERISTICS						
1.	Age:					
2.	Gender:	Male		Female		
3.	Ethnicity:	African	Coloured	Indian	White	Other (please specify)
4.	Occupation (work):					
5.	Do you play any other sport/s?	Yes		No		
5.1.	If yes to question 5, what other sport/s do you play:					
5.2.	If yes to question 5, how many hours per week do you spend playing other sport/s:	0 hours	0-3 hours	4-6 hours	7-9 hours	10-12 hours
		13-15 hours	16-18 hours	19-21 hours	More than 21 hours	
6.	What is your medical condition/ reason for disability:	Birth defect	Spinal condition/ lesion	Amputation	Other (please specify):	Unknown
7.	Are you dependant on any devices for mobility (moving around):				Yes	No
7.1	If yes, what devices do you use for mobility:	Wheelchair	Prosthetics	Crutches	Other (please specify):	
7.2	For how long have you been dependant on that device:	Since birth	0-5 years	5-10 years	10-15 years	15-20 years
		20-25 years	More than 25 years			
7.3	If you use prosthetics, are they used whilst playing:	Yes		No		
7.4	When last did you change/ alter/ service your mobility device:	0-5 years	5-10 years	10-15 years	15-20 years	More than 20 years
8.	When last did you change/ alter/ service your basketball wheelchair:	0-5 years	5-10 years	10-15 years	15-20 years	More than 20 years
SECTION B: WHEELCHAIR BASKETBALL AND ACTIVITY LEVEL						
1.	How many years have you been playing wheelchair basketball:	0-5 years	5-10 years	10-15 years	15-20 years	More than 20 years

2.	What points are you classified as:	1.0	1.5	2.0	2.5	3.0
		3.5	4.0	4.5		
3.1	How many hours per week do you spend training for basketball during the season:	0 hours	1-5 hours	6-10 hours	11-15 hours	16-20 hours
		More than 20 hours				
3.2.	How many hours per week do you spend training for basketball off-season:	0 hours	1-5 hours	6-10 hours	11-15 hours	16-20 hours
		More than 20 hours				
4.	How much time on court per week do you spend playing basketball matches:	0 minutes	1-5 minutes	6-10 minutes	11-15 minutes	16-20 minutes
		21-25 minutes	26-30 minutes	31-35 minutes	More than 35 minutes	
5.1.	How many minutes do you spend warming up/ stretching before training/ before games:	0 minutes	0-5 minutes	6-10 minutes	11-15 minutes	More than 15 minutes
5.2.	How many minutes do you spend cooling down/ stretching after training/ after games:	0 minutes	0-5 minutes	6-10 minutes	11-15 minutes	More than 15 minutes
6.	How many hours per week do you spend on the following activities:					
6.1	Work:	0 hours	1-10 hours	11-20 hours	21-30 hours	31-40 hours
		More than 40 hours				
6.2	Gym:	0 hours	1-10 hours	11-20 hours	21-30 hours	31-40 hours
		More than 40 hours				
6.3	Watching TV:	0 hours	1-10 hours	11-20 hours	21-30 hours	31-40 hours
		More than 40 hours				
6.4	At a computer:	0 hours	1-10 hours	11-20 hours	21-30 hours	31-40 hours
		More than 40 hours				
6.5	Driving:	0 hours	1-10 hours	11-20 hours	21-30 hours	31-40 hours
		More than 40 hours				
6.6	Rest:	0 hours	1-10 hours	11-20 hours	21-30 hours	31-40 hours
		More than 40 hours				

SECTION C: MUSCULOSKELETAL PAIN

Musculoskeletal pain is defined as pain affecting the bones, muscles, ligaments, tendons and nerves. It can be acute (having a rapid onset with severe symptoms) or chronic (long-lasting) and it can be localized in one area or widespread (The Cleveland Clinic Foundation, 2014).



(Peter Gardiner/ Science Photo Library Ltd, 2013)

1.	Have you experienced musculoskeletal pain before using your mobility device?	Yes	No	Unsure
1.1	If Yes to Question 1, please state the region/s based on the picture above.			
2.	Have you experienced musculoskeletal pain since using your mobility device?	Yes	No	Unsure
2.1.	If Yes to Question 2, please state the region/s based on the picture above.			
3.	Have you experienced musculoskeletal pain before playing wheelchair basketball?	Yes	No	Unsure
3.1.	If Yes to Question 3, please state the region/s based on the picture above.			
4.	Have you experienced musculoskeletal pain since playing wheelchair basketball?	Yes	No	Unsure
4.1	If Yes to Question 4, please state the region/s based on the picture above.			
5.	Have you experienced musculoskeletal pain in the last 12 months?	Yes	No	Unsure
5.1	If Yes to Question 5, please state the region/s based on the picture above.			
6.	At present, are you experiencing any musculoskeletal pain?	Yes	No	Unsure
6.1.	If Yes to Question 6, please state the region/s based on the picture above.			
Please answer the next set of questions if you're currently experiencing pain or if you've experienced pain in the last 12 months				
6.2.	Do you know what caused the pain?	Yes	No	
6.3.	What was the possible cause of the pain?	An instance during a basketball game	An instance during training	Over-training
		Improper warm-up/ cool-down	Other activities (please specify)	Unknown
6.4.	What activity makes it worse?	Shooting	Passing	Catching
		Rebounding	Pushing	Braking
		Pivoting	Dribbling	Contact

		None	Unknown	Other (please specify):
6.5.	What type of pain did you experience?	Dull	Aching	Burning
		Sharp	Radiating	Pins and needles
6.6.	How long does the pain last?	Seconds	Minutes	Hours
		Days	Months	Years
6.7	Did you seek treatment for the pain from a medical practitioner?	Yes	No	Unsure
6.8.	If yes to Question 6.7, which practitioner did you consult with?	Biokineticist	Chiropractor	General Practitioner
		Orthopaedic surgeon	Pharmacist	Physiotherapist
		Traditional healer	Unknown	Other (please specify):
6.9.	If yes to question 6.7, what did the practitioner diagnose?			
6.10.	If yes to Question 6.7, what treatment did you receive?	Heat	Ice	Pain medication
		Exercise	Rest	Other (please specify):
6.11.	If no to question 6.7, did you treat the pain with self- administration of pain medication?	Yes	No	Unsure
6.12.	Did the treatment relieve your pain?	Yes	No	Unsure
SECTION D: IMPACT OF PAIN ON WHEELCHAIR BASKETBALL ACTIVITY/ ACTIVITIES OF DAILY LIVING Please complete if you're currently experiencing pain or if you've experienced pain in the last 12 months.				
1.	Did your pain affect any of the following activities negatively:	Basketball	Work	Household work
		Hobbies	Social life	Other (please specify):
		None	Unknown	
THANK YOU FOR TAKING TIME TO COMPLETE THIS QUESTIONNAIRE!				

Appendix H: Letter of information (Pilot study)

LETTER OF INFORMATION

Dear Participant

I would like to welcome you to my research study and thank you for taking the time to participate.

Title of the Research Study: The prevalence and profile of musculoskeletal pain in elite wheelchair basketball players of different point classifications in South Africa.

Principal Investigator/s/researcher: Isabel. S. M. Mateus (BTech: Chiropractic)

Co-Investigator/s/supervisor/s: Dr J.D Pillay (PhD: Physiology)

Dr K. Padayachy (MTech: Chiropractic)

Brief Introduction and Purpose of the Study: Involvement in sport for physically challenged individuals continues to grow in popularity and, therefore an area requiring more research especially within the context of South Africa and in the area of wheelchair basketball due to increased participation and support.

This study is a questionnaire-based quantitative, descriptive cross sectional survey that will determine the demographics and disability characteristics of elite wheelchair basketball players in South Africa, the prevalence and profile of musculoskeletal pain, respectively in these athletes, and will identify possible associations between pre-game classification and the prevalence of musculoskeletal pain.

Outline of the Procedures: The researcher will meet with the players from the various teams at some of their games and will explain the research study (the researcher will contact coaches prior to this and explain to them as well). Players who meet the inclusion criteria above will be asked to complete the questionnaire after voluntarily signing the letter of information and informed consent form. The completed questionnaire and forms will be folded and put into separate sealed boxes with an opening at the top in order to maintain anonymity/ confidentiality.

<u>Inclusion Criteria</u>

1. Elite wheelchair basketball players in South Africa competing in the Supersport League.
2. Players that have been classified on a scale of 1.0-4.5 (based on international classification guidelines).
3. Participants have to be 18 years or older.
4. South African citizens.
5. Participants who voluntarily sign an informed consent form (APPENDIX H).

Exclusion criteria

1. Members of the focus group or pilot study.
2. Players that were absent at the time the questionnaires were handed out.

Risks or Discomforts to the Participant: There are no risks/ discomforts expected with your participation in this study.

Benefits: The results will be made available to Wheelchair Basketball SA, coaches and players, however, no names of players or clubs will be identifiable. This may lead to improvements in any problem areas that may be identified with this study and may improve performance in the sport.

This research study will also benefit the researcher, who would obtain an MTech in Chiropractic as a result and the study and results may be published in the form of a dissertation or in peer-reviewed journals.

Reason/s why the Participant May Be Withdrawn from the Study: Your participation in this study is voluntary and you are free to withdraw from this study at any time without any adverse consequences.

Remuneration: There will be no remuneration (payment) for participating in this study.

Costs of the Study: You will not be expected to pay towards any costs of the study.

Confidentiality: All information gathered during the course of this study is strictly confidential and the results will be used for research purposes only. The results will be made available to WBSA, however, there will be no names/ identifiable data present.

Research-related Injury: Participation in this study will not cause any injury to you.

Persons to Contact in the Event of Any Problems or Queries:
Please contact Isabel. S. M. Mateus (the researcher) on 084 518 1954, Dr J.D Pillay on 031 373 2398 and Dr K. Padayachy on 031 464 4057 (my supervisors) or the Institutional Research Ethics administrator on 031 373 2900 if you have any research related queries. Complaints can be reported to the DVC: TIP, Prof F. Otieno on 031 373 2382 or dvctip@dut.ac.za.

General:
Approximately 74 participants will be recruited to participate in this study. Please note that participation in this study is voluntary.

Appendix I: Informed consent form (Pilot study)

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Isabel. S.M Mateus, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: **REC 57/15**,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____ _____ ____ _____

Full Name of Participant **Date** **Time** **Signature/Right Thumbprint**

I, _____ (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____ _____ _____

Full Name of Researcher **Date** **Signature**

_____ _____ _____

Full Name of Witness **Date** **Signature**

(if applicable)

_____ _____ _____

Full Name of Legal Guardian **Date** **Signature**

(if applicable)

Appendix J: Corrections from the pilot study

PILOT STUDY RECOMMENDED CHANGES	STUDENT/ SUPERVISOR RESPONSE	QUESTION NUMBER, SECTION AND PAGE NUMBER FROM PRE-FOCUS GROUP QUESTIONNAIRE WHERE CHANGE HAS TO BE MADE	QUESTION NUMBER, SECTION, PAGE NUMBER WHERE CHANGE HAS BEEN MADE ON POST-FOCUS GROUP QUESTIONNAIRE
SECTION A: DEMOGRAPHICS AND DISABILITY CHARACTERISTICS			
Move question 5.2 to Section B and make it question 6.7 and **alter** intervals to those in question 6.	Moved Altered	Question 5.2 Section A Page 1	Question 6.7 Section B Page 2
Add "condition" next to birth defect in question 6 option	Added	Question 6 Section A Page 1	Question 6 Section A Page 1
Alter intervals in question 7.2	Altered	Question 7.2 Section A Page 1	Question 7.2 Section A Page 1
Add option of **"0 years"** to questions 7.4 and 8	Added	Question 7.4 and 8 Section A Page 1	Question 7.4 and 8 Section A Page 1
SECTION B: WHEELCHAIR BASKETBALL AND ACTIVITY LEVEL			
Alter intervals in Question 1	Altered	Question 1. Section B Page 2	Question 1 Section B Page 2
SECTION C: MUSCULOSKELETAL PAIN			
Explain "diagnose" in Question 6.9	Used lay man's terms **"say the condition was"**	Question 6.9 Section C Page 4	Question 6.9. Section C Page 4
SECTION D: IMPACT OF PAIN ON WHEELCHAIR BASKETBALL ACTIVITY/ ACTIVITIES OF DAILY LIVING			
None			

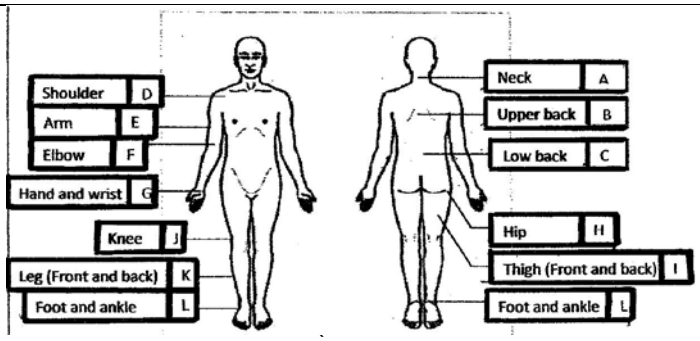
Appendix K: Research study questionnaire

The prevalence and profile of musculoskeletal pain in elite wheelchair basketball players of different point classifications in South Africa.						
Please mark answers with an X where needed. Some questions are open-ended and require a more detailed answer.						
SECTION A: DEMOGRAPHICS AND DISABILITY CHARACTERISTICS						
1.	Age:					
2.	Gender:	Male		Female		
3.	Ethnicity:	African	Coloured	Indian	White	Other (please specify)
4.	Occupation (work):					
5.	Do you play any other sport/s?	Yes		No		
5.1.	If yes to question 5, what other sport/s do you play:					
6.	What is your medical condition/ reason for disability:	Birth defect/ condition	Spinal condition/ lesion	Amputation	Other (please specify):	Unknown
7.	Are you dependant on any devices for mobility (moving around):				Yes	No
7.1	If yes, what devices do you use for mobility:	Wheelchair	Prosthetics	Crutches	Other (please specify):	
7.2	For how long have you been dependant on that device:	Since birth	0-5 years	6-10 years	11-15 years	16-20 years
		21-25 years	More than 25 years			
7.3	If you use prosthetics, are they used whilst playing:	Yes		No		
7.4	When last did you change/ alter/ service your mobility device:	0 years	0-5 years	6-10 years	11-15 years	16-20 years
		More than 20 years				
8.	When last did you change/ alter/ service your basketball wheelchair:	0 years	0-5 years	6-10 years	11-15 years	16-20 years
		More than 20 years				
SECTION B: WHEELCHAIR BASKETBALL AND ACTIVITY LEVEL						
1.	How many years have you been playing wheelchair basketball:	0-5 years	6-10 years	11-15 years	16-20 years	More than 20 years
2.	What points are you classified as:	1.0	1.5	2.0	2.5	3.0
		3.5	4.0	4.5		
3.1	How many hours per week do you spend training for basketball during	0 hours	1-5 hours	6-10 hours	11-15 hours	16-20 hours

	the season:					
		More than 20 hours				
3.2.	How many hours per week do you spend training for basketball off-season:	0 hours	1-5 hours	6-10 hours	11-15 hours	16-20 hours
		More than 20 hours				
4.	How much time on court per week do you spend playing basketball matches:	0 minutes	1-5 minutes	6-10 minutes	11-15 minutes	16-20 minutes
		21-25 minutes	26-30 minutes	31-35 minutes	More than 35 minutes	
5.1.	How many minutes do you spend warming up/ stretching before training/ before games:	0 minutes	0-5 minutes	6-10 minutes	11-15 minutes	More than 15 minutes
5.2.	How many minutes do you spend cooling down/ stretching after training/ after games:	0 minutes	0-5 minutes	6-10 minutes	11-15 minutes	More than 15 minutes
6.	How many hours per week do you spend on the following activities:					
6.1	Work:	0 hours	1-10 hours	11-20 hours	21-30 hours	31-40 hours
		More than 40 hours				
6.2	Gym:	0 hours	1-10 hours	11-20 hours	21-30 hours	31-40 hours
		More than 40 hours				
6.3	Watching TV:	0 hours	1-10 hours	11-20 hours	21-30 hours	31-40 hours
		More than 40 hours				
6.4	At a computer:	0 hours	1-10 hours	11-20 hours	21-30 hours	31-40 hours
		More than 40 hours				
6.5	Driving:	0 hours	1-10 hours	11-20 hours	21-30 hours	31-40 hours
		More than 40 hours				
6.6	Rest:	0 hours	1-10 hours	11-20 hours	21-30 hours	31-40 hours
		More than 40 hours				
6.7.	Playing other sports:	0 hours	1-10 hours	11-20 hours	21-20 hours	31-40 hours
		More than 40 hours				

SECTION C: MUSCULOSKELETAL PAIN

Musculoskeletal pain is defined as pain affecting the bones, muscles, ligaments, tendons and nerves. It can be acute (having a rapid onset with severe symptoms) or chronic (long-lasting) and it can be localized in one area or widespread (The Cleveland Clinic Foundation, 2014).



ary Ltd, 2013)

1.	Have you experienced musculoskeletal pain before using your mobility device?	Yes	No	Unsure
1.1	If Yes to Question 1, please state the region/s based on the picture above.			
2.	Have you experienced musculoskeletal pain since using your mobility device?	Yes	No	Unsure
2.1.	If Yes to Question 2, please state the region/s based on the picture above.			
3.	Have you experienced musculoskeletal pain before playing wheelchair basketball?	Yes	No	Unsure
3.1.	If Yes to Question 3, please state the region/s based on the picture above.			
4.	Have you experienced musculoskeletal pain since playing wheelchair basketball?	Yes	No	Unsure
4.1	If Yes to Question 4, please state the region/s based on the picture above.			
5.	Have you experienced musculoskeletal pain in the last 12 months?	Yes	No	Unsure
5.1	If Yes to Question 5, please state the region/s based on the picture above.			
6.	At present, are you experiencing any musculoskeletal pain?	Yes	No	Unsure
6.1.	If Yes to Question 6, please state the region/s based on the picture above.			
Please answer the next set of questions if you're currently experiencing pain or if you've experienced pain in the last 12 months				
6.2.	Do you know what caused the pain?	Yes	No	
6.3.	What was the possible cause of the pain?	An instance during a basketball game	An instance during training	Over-training
		Improper warm-up/ cool-down	Other activities (please specify)	Unknown
6.4.	What activity makes it worse?	Shooting	Passing	Catching
		Rebounding	Pushing	Braking
		Pivoting	Dribbling	Contact
		None	Unknown	Other (please specify):
6.5.	What type of pain did you experience?	Dull	Aching	Burning
		Sharp	Radiating	Pins and needles
6.6.	How long does the pain last?	Seconds	Minutes	Hours
		Days	Months	Years
6.7	Did you seek treatment for the pain from a	Yes	No	Unsure

	medical practitioner?			
6.8.	If yes to Question 6.7, which practitioner did you consult with?	Biokineticist	Chiropractor	General Practitioner
		Orthopaedic surgeon	Pharmacist	Physiotherapist
		Traditional healer	Unknown	Other (please specify):
6.9.	If yes to question 6.7, what did the practitioner diagnose (say the condition was)?			
6.10.	If yes to Question 6.7, what treatment did you receive?	Heat	Ice	Pain medication
		Exercise	Rest	Other (please specify):
6.11.	If no to question 6.7, did you treat the pain with self- administration of pain medication?	Yes	No	Unsure
6.12.	Did the treatment relieve your pain?	Yes	No	Unsure
SECTION D: IMPACT OF PAIN ON WHEELCHAIR BASKETBALL ACTIVITY/ ACTIVITIES OF DAILY LIVING Please complete if you're currently experiencing pain or if you've experienced pain in the last 12 months.				
1.	Did your pain affect any of the following activities negatively:	Basketball	Work	Household work
		Hobbies	Social life	Other (please specify):
		None	Unknown	
THANK YOU FOR TAKING TIME TO COMPLETE THIS QUESTIONNAIRE!				

Appendix L: Letter of information (Research study)

LETTER OF INFORMATION

Dear Participant

I would like to welcome you to my research study and thank you for taking the time to participate.

Title of the Research Study: The prevalence and profile of musculoskeletal pain in elite wheelchair basketball players of different point classifications in South Africa.

Principal Investigator/s/researcher: Isabel. S. M. Mateus (BTech: Chiropractic)

Co-Investigator/s/supervisor/s: Dr J.D Pillay (PhD: Physiology)

Dr K. Padayachy (MTech: Chiropractic)

Brief Introduction and Purpose of the Study: Involvement in sport for physically challenged individuals continues to grow in popularity and, therefore an area requiring more research especially within the context of South Africa and in the area of wheelchair basketball due to increased participation and support.

This study is a questionnaire-based quantitative, descriptive cross sectional survey that will determine the demographics and disability characteristics of elite wheelchair basketball players in South Africa, the prevalence and profile of musculoskeletal pain, respectively in these athletes, and will identify possible associations between pre-game classification and the prevalence of musculoskeletal pain.

Outline of the Procedures: The researcher will meet with the players from the various teams at some of their games and will explain the research study (the researcher will contact coaches prior to this and explain to them as well). Players who meet the inclusion criteria above will be asked to complete the questionnaire after voluntarily signing the letter of information and informed consent form. The completed questionnaire and forms will be folded and put into separate sealed boxes with an opening at the top in order to maintain anonymity/ confidentiality.

<u>Inclusion Criteria</u>

1. Elite wheelchair basketball players in South Africa competing in the Supersport League.
2. Players that have been classified on a scale of 1.0-4.5 (based on international classification guidelines).
3. Participants have to be 18 years or older.
4. South African citizens.
5. Participants who voluntarily sign an informed consent form (APPENDIX H).

Exclusion criteria

1. Members of the focus group or pilot study.
2. Players that were absent at the time the questionnaires were handed out.

Risks or Discomforts to the Participant: There are no risks/ discomforts expected with your participation in this study.

Benefits: The results will be made available to Wheelchair Basketball SA, coaches and players, however, no names of players or clubs will be identifiable. This may lead to improvements in any problem areas that may be identified with this study and may improve performance in the sport.

This research study will also benefit the researcher, who would obtain an MTech in Chiropractic as a result and the study and results may be published in the form of a dissertation or in peer-reviewed journals.

Reason/s why the Participant May Be Withdrawn from the Study: Your participation in this study is voluntary and you are free to withdraw from this study at any time without any adverse consequences.

Remuneration: There will be no remuneration (payment) for participating in this study.

Costs of the Study: You will not be expected to pay towards any costs of the study.

Confidentiality: All information gathered during the course of this study is strictly confidential and the results will be used for research purposes only. The results will be made available to WBSA, however, there will be no names/ identifiable data present.

Research-related Injury: Participation in this study will not cause any injury to you.

Persons to Contact in the Event of Any Problems or Queries:
Please contact Isabel. S. M. Mateus (the researcher) on 084 518 1954, Dr J.D Pillay on 031 373 2398 and Dr K. Padayachy on 031 464 4057 (my supervisors) or the Institutional Research Ethics administrator on 031 373 2900 if you have any research related queries. Complaints can be reported to the DVC: TIP, Prof F. Otieno on 031 373 2382 or dvctip@dut.ac.za.

General:
Approximately 74 participants will be recruited to participate in this study. Please note that participation in this study is voluntary.

Appendix M: Informed consent form (Research study)

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Isabel. S.M Mateus, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: **REC 57/15**,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____ _____ ____ _____

Full Name of Participant **Date** **Time** **Signature/Right Thumbprint**

I, _____ (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____ _____ _____

Full Name of Researcher **Date** **Signature**

_____ _____ _____

Full Name of Witness **Date** **Signature**

(if applicable)

_____ _____ _____

Full Name of Legal Guardian **Date** **Signature**

(if applicable)

Appendix N: Letter to Wheelchair Basketball South Africa seeking permission for data collection.

Dear Mr Saunders

RE: SEEKING PERMISSION FOR DATA COLLECTION PHASE OF STUDY ON WHEELCHAIR BASKETBALL PLAYERS

My name is Isabel Mateus. I am currently working towards my Master's in Chiropractic at the Durban University of Technology and I would like to base my study on wheelchair basketball players in South Africa.

The title of my study is "The prevalence and profile of musculoskeletal pain in elite wheelchair basketball players of different point classifications in South Africa". This study will aim to investigate the prevalence of musculoskeletal pain in players, demographics and disability characteristics and to determine the relationship between the prevalence of pain and point classification. The study will be in the form of a questionnaire which players from the six teams, competing in the Supersport League, will complete.

In order to commence my study, I require your written permission to attend the Supersport League games on the 15th of August 2015 at the Mandeville Sports Centre and approach coaches and players in this regard.

If you have any further questions, please do not hesitate to contact me.

Your assistance is greatly appreciated.

Thanking you kindly.

Kind Regards

_____

Isabel Mateus

Appendix O: Letter of permission from Wheelchair Basketball South Africa CEO/ Secretary General, Mr Charles Saunders

WBSA
WHEELCHAIR BASKETBALL SOUTH AFRICA
Reg: 2004/012463/08

Vodacom Mandeville Indoor Centre
Cnr. 10th Street & 7th Avenue
Bezuidenhout Valley, 2094
PO Box 59193, Kengray, 2100
Tel: 27 11 601 5300
Fax: 27 11 616 9236
Email: wbsa@basketball.co.za

6 August 2015

Att: Ms Isabel Mateus
The Ethics Committee

To whom it may concern

RE: Letter of Reference

Ms Mateus has requested to complete her dissertation on the prevalence and profile of musculoskeletal pain in basketball players of different point classification in Wheelchair Basketball SA.

On behalf of Wheelchair Basketball SA, we have no problem in supporting Ms Mateus in her endeavours and do so with impunity. She will conduct these studies over the weekend of the 15 & 16 August during our SuperSport League games. She has been given permission to deal directly with the current Franchised Clubs management and players.

Should there be any further query, please feel free to contact the undersigned.

Sincerely

Charles Saunders
CEO / Secretary General

Appendix P: Letter to team coaches seeking permission to collect data from players

Dear Coach/ Management

RE: SEEKING PERMISSION FOR DATA COLLECTION PHASE OF STUDY ON WHEELCHAIR BASKETBALL PLAYERS

My name is Isabel Mateus. I am currently working towards my Master's in Chiropractic at the Durban University of Technology and my study is based on wheelchair basketball players in South Africa.

The title of my study is "The prevalence and profile of musculoskeletal pain in elite wheelchair basketball players of different point classifications in South Africa". This study will aim to investigate the prevalence of musculoskeletal pain in players, demographics and disability characteristics and to determine the relationship between the prevalence of pain and point classification. The study will be in the form of a questionnaire which players from the various teams, competing in the Supersport League, will complete.

In order to conduct my study, I require your written permission to approach the players of your team on the 15th of August 2015 at the Supersport League games in Mandeville to complete the questionnaire. The players will only be approached after their game/s for the day have been completed and their training will not be disrupted in any way.

If you have any further questions, please do not hesitate to contact me.

Your assistance is greatly appreciated.

Thanking you kindly.

Yours sincerely.

_____

Isabel Mateus

Appendix Q: Email correspondence from coaches granting permission

Gmail by Google

isabel.s.m mateus <mateusisabelsm@gmail.com>

RE: PERMISSION FOR DATA COLLECTION

1 message

Koenig, Marius <MKoenig@anglogoldashanti.com> Wed, Aug 5, 2015 at 8:02 AM
To: "mateusisabelsm@gmail.com" <mateusisabelsm@gmail.com>
Cc: Wheelchair Basketball SA <wbsa@basketball.co.za>, "Shati Lions (shatimo.m@gmail.com) (shatimo.m@gmail.com)" <shatimo.m@gmail.com>, Cecil Dumond <CecilD@taulekoa.co.za>

Hi Isabel,

I am sure that our club/team will be more than willing to assist you. Please make arrangements directly through the coach of the team (Shadrack Moepeng), see e-mail address above.

Regards

Marius W Koenig

Team Manager

AGA LIONS

Vaal River District Offices – HR Department

ANGLOGOLDASHANTI

CONTINENTAL AFRICA

Tel: +27 18 478 8003

Fax: +27 18

Cell: +27 82 229 8473

Email: mkoenig@anglogoldashanti.com

Gmail by Google

isabel.s.m mateus <mateusisabelsm@gmail.com>

Re: RESEARCH STUDY ON WHEELCHAIR BASKETBALL PLAYERS - PERMISSION NEEDED

1 message

Marius Papenfus <marius.papenfus@gmail.com> Thu, Aug 6, 2015 at 3:11 PM
To: mateusisabelsm@gmail.com, Karel de Waal <kareldwl3@gmail.com>, Willie Mulder <mulinv@mweb.co.za>, Tucker Beckett <tucker.beckett@gmail.com>, Kobus Oeschger <kobusoes@gmail.com>, Aye-Htun Ohn <ayehtun@gmail.com>, Jaco Velloen <jaco.velloen@gmail.com>, "judy.hietbrink@yahoo.com" <judy.hietbrink@yahoo.com>

Hi Isabel

No problem, Bladerunners is fine.

Regards

Gmail by Google

isabel.s.m mateus <mateusisabelsm@gmail.com>

RE: RESEARCH STUDY ON WHEELCHAIR BASKETBALL PLAYERS - PERMISSION NEEDED

1 message

Leon Fleiser <leonf@sascoc.co.za> Thu, Aug 6, 2015 at 3:42 PM
To: "mateusisabelsm@gmail.com" <mateusisabelsm@gmail.com>

We are fine as Discovery Eagles, please remind me in the morning and I will put it on a letterhead for you.

Regards

Leon Fleiser | Manager: Monitoring and Evaluation
South African Sports Confederation and Olympic Committee (SASCOC)
T: +27 (0)87 351 2082 **C:** 083-564-1156 **E:** leonf@sascoc.co.za

Gmail by Google

isabel.s.m mateus <mateusisabelsm@gmail.com>

RE: RESEARCH STUDY ON WHEELCHAIR BASKETBALL PLAYERS - PERMISSION NEEDED

1 message

comsa <koinia@telkomsa.net> Thu, Aug 6, 2015 at 7:09 PM
To: mateusisabelsm@gmail.com

Mateus, I think this is fine with us – but please only address our players after the game has been –played. Before we are not available for any interview.

I m interested in the result also (am physio). I am sure you also include or control other factors ?

Kindly send me a questionnaire, I am interested in the matter. I will not ask or disclose it.

Thanks, Undine Rauter, Manager GBT Mongoose

Gmail by Google

isabel.s.m mateus <mateusisabelsm@gmail.com>

Re: RESEARCH STUDY ON WHEELCHAIR BASKETBALL PLAYERS - PERMISSION NEEDED

1 message

siphamandla gumbi <siphamandla.gumbi6@gmail.com> Fri, Aug 7, 2015 at 7:00 AM
To: mateusisabelsm@gmail.com

Dear Ms Mateus

Permission granted for you to conduct the Research with the KwaZulu Wings Wheelchair Basketball Team.

Should you require further assistance do not hesitate to contact me.

Chairman KZNWB
Siphamandla Gumbi
0828920915

Gmail by Google

isabel.s.m mateus <mateusisabelsm@gmail.com>

FW: RESEARCH STUDY ON WHEELCHAIR BASKETBALL PLAYERS - PERMISSION NEEDED

1 message

Buys, Etienne (E) <Etienne.Buys@natref.com> Fri, Aug 7, 2015 at 8:09 AM
To: "mateusisabelsm@gmail.com" <mateusisabelsm@gmail.com>
Cc: Carl Laupp <lauppcarl@gmail.com>, Wiseman Dlamini <wisedlam2000@yahoo.com>

Good morning Isabel,

I'm sure it won't be a problem. Carl Laupp is the chairperson of the club and Wiseman Dlamini, vise-chairman. Please contact one of them in advance, on the latest by next Wednesday, to do all the arrangements. Also let them know how many players from the Pumas you need for your questionnaire, so that they can identify certain players and let them know by Wednesday night at training.

Contact details:

Carl Laupp – 076 158 4117

Wiseman Dlamini – 074 226 5813

The Pumas play at 13:00, 15th of August, against the Lions. I will suggest you approach the players after the game, because to get them before the game is not always easy. Also, after each game our sponsor catering the team and supporters with food and drinks, you are welcome to join the team and then you will have all the players together.

Regards

Etienne Buys

RICOH PUMAS

Management Member

083 271 5859

Appendix R: Institutional Research Ethics Committee Letter of Full Approval

DUT
DURBAN UNIVERSITY OF TECHNOLOGY

Institutional Research Ethics Committee
Faculty of Health Sciences
Room MS 49, Mansfield School Site
Gate 8, Ritson Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2900
Fax: 031 373 2407
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

12 August 2015

IREC Reference Number: **REC 57/15**

Ms I S M Mateus
43 Ashwin Avenue
Westville
3629

Dear Ms Mateus

The prevalence and profile of musculoskeletal pain in elite wheelchair basketball players of different point classifications in South Africa

The Institutional Research Ethics Committee acknowledges receipt of your final data collection tool for review.

We are pleased to inform you that the questionnaire has been approved. Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the IREC acknowledges receipt of your gatekeeper permission letters.

Please note that FULL APPROVAL is granted to your research proposal. You may proceed with data collection.

Yours Sincerely,

[redacted]

Professor J K Adam
Chairperson: IREC

DUT DURBAN UNIVERSITY OF TECHNOLOGY
2015 -08- 12
INSITUTUTIONAL RESEARCH ETHICS COMMITTEE
P O BOX 1334 DURBAN 4000 SOUTH AFRICA

Appendix S: Email correspondence with Claudia Lepera seeking permission to adapt parts of her questionnaire in my study

11/23/2015 Gmail - Re: SEEKING PERMISSION TO ADAPT/ MODIFY QUESTIONNAIRE

Gmail by Google

isabel.s.m mateus <mateusisabelsm@gmail.com>

Re: SEEKING PERMISSION TO ADAPT/ MODIFY QUESTIONNAIRE

1 message

Claudia <leperac@yahoo.com> Sun, Feb 8, 2015 at 6:57 PM
To: "mateusisabelsm@gmail.com" <mateusisabelsm@gmail.com>

Dear Isabel

Many thanks for email. You are welcome to use the questionnaire. But could I ask to see the finished product? In order to validate it you would need to get the opinion of someone in the area of research you are looking into anyway I should think.

All the best

Regards

Claudia Lepera
Physiotherapist
CORE sport and wellness medical centre
20 Gainsborough Drive
Durban North
087 700 4800

On 07 Feb 2015, at 9:57, mateusisabelsm@gmail.com wrote:

> Dear Ms Lepera
>
> My name is Isabel Mateus and I am currently completing a Master's Degree in Chiropractic at DUT.
>
> My study is on wheelchair basketball players in South Africa and the prevalence of musculoskeletal pain and I would like to ask for your permission to adapt and modify parts of your questionnaire in my study.
>
> Looking forward to your response.
>
> Thank you.
>
> Kind regards
> Isabel Mateus
> Sent from my BlackBerry® wireless device

Appendix T: Interpretation of Eta scores

Table 6.5 ***Interpretation of the Strength of a Relationship (Effect Sizes)***

General Interpretation of the Strength of a Relationship	The *d* Family[a]	The *r* Family[b]		
	d	*r* and ϕ	*R*	η (eta)[d]
Much larger than typical	≥1.00[c]	≥.70	.70+	.45+
Large or larger than typical	.80	.50	.51	.37
Medium or typical	.50	.30	.36	.24
Small or smaller than typical	.20	.10	.14	.10

[a] *d* values can vary from 0.0 to + or −1.0 infinity, but *ds* greater than one is uncommon.
[b] *r* family values can vary from 0.0 to + or −1.0, but except for reliability (i.e., same concept measured twice), *r* is rarely above .70. In fact, some of these statistics (e.g., phi) have a restricted range in certain cases; that is, the maximum phi is less then 1.0.
[c] We interpret the numbers in this table as a ran ge of values. For example a *d* greater than .90 (or less than −.90) would be described as "much larger than typical" a *d* between say .70 and .90 would be called 'larger than typical," and *d* between say .60 and .70 would be "typical to larger than typical" We interpret the other three columns similarly.
[d] Partial etas from SPSS multivariate tests are equivalent to *R*. Use *R* column.

(Morgan *et al.* 2004: 103)