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DETERMINING THE MANAGEMENTOF PAIN IN PEOPLE WITH SPINAL CORD INJURY BY PHYSIOTHERAPISTS IN SOUTH AFRICA

A dissertation submitted in fulfilment of the requirements for the degree of Master of Science in Physiotherapy in the Faculty of Health Sciences in the Department of Physiotherapy at the University of Pretoria

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DECLARATION

I fully declare that **'The management of pain in people with spinal cord injury by physiotherapists in South Africa'** is my own original work. It has not been previously submitted in this university or another university for any purposes or for the purposes of acquiring a degree. Where other peoples' work have been used (either from a printed source, Internet, or any other source), it has been properly acknowledged and referenced in accordance with the university requirements.

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ABSTRACT

Pain is a major complaint of people living with spinal cord injury (PWSCI) and has consistently been stated as a difficult problem to manage. Pharmacological, therapeutic, and neurosurgical methods are available for the treatment of pain in spinal cord injury (SCI). Physiotherapy plays a vital role in the treatment of pain related to SCI. Physiotherapy pain treatment encompasses a broad range of treatment modalities (such as electrotherapy and manual therapy) to relieve pain and is widely reported in the literature. However, there is a dearth of literature on what modalities physiotherapists use to treat SCI-related pain in PWSCI. This study aimed to determine the methods, used by physiotherapists in South Africa to treat pain in PWSCI.

This study employed a quantitative, cross-sectional design using a therapist-based online questionnaire. Clinical physiotherapists involved in SCI rehabilitation at various facilities and hospitals across South Africa were invited to participate in the study through the South African Society of Physiotherapists (SASP) and the Physiotherapy Association of South Africa (PASA) administrators. Physiotherapists from Gauteng, Free state, Western Cape, Limpopo, Mpumalanga, Eastern Cape and KwaZulu Natal participated in the survey. A non-probability convenient sampling strategy was used. A socio-demographic tool was used to determine the physiotherapist's demographic information and a self-developed online questionnaire was used to determine the modalities and selection criteria used by the physiotherapists to manage spinal cord injury-related pain.

Forty-six valid responses were received. Most of the participants were females (72%), 80% of the participants were clinicians, and 72% of the participants held a bachelor's degree. The participants were asked to indicate the modalities that they used, separately in the order of their preference. The most used modality was TENS (n=14, 29.8%), followed by exercises (n=13,27.7%), and manipulations and mobilizations (n=14, 29.8%). The factors that guided the selection of TENS were type of pain (87.2%), duration of pain (80.9%), location of pain (83.0%), intensity of pain (85.1%), other treatments that the patient is receiving for pain (83.0%), and the psychosocial factors (87.2%). Almost all participants used outcome measures (100%) and VAS was the most used outcome measure (70%).

Similar to the global trend in managing SCI- related pain, TENS was the most used modality to treat SCI- related pain in South Africa. An understanding of the different methods used across the country can help identify the areas where greater efforts in terms of implementation is required. Our study will also help the physiotherapists understand the other available treatment modalities for SCI-related pain. We recommend that a similar study be conducted using a different recruitment strategy to target as many physiotherapists across the nation as possible. This may give a better understanding regarding the current national practices in managing the pain in PWSCI. We recommend that future studies assess the effectiveness of modalities, identify barriers and facilitators to pain management and explore in depth pain management from the patient's perspective.

Key terms: Pain, pain management, spinal cord injury, people with spinal cord injury, physiotherapists, TENS, exercises, mobilization and manipulations, South Africa.

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LIST OF ABBREVIATIONS

Abbreviation/Acronym	**Meaning**
CBT	Cognitive Behavioural Therapy
IASP	International Association for the Study of Pain
IFT	Interferential Therapy
ISCIPBDS	International Spinal Cord Injury Pain Basic Data Set
NSAIDS	Non- Steroidal Anti-Inflammatory Drugs
NTSCI	Non-Traumatic Spinal Cord Injury
PASA	Physiotherapy Association of South Africa
PNE	Pain Neuroscience Education
PWSCI	People with Spinal Cord Injury
SASP	South African Society of Physiotherapists
SC	Spinal Cord
SCI	Spinal Cord Injury
SHC	Secondary Health Conditions
TENS	Transcutaneous Electrical Nerve Stimulation
TSCI	Traumatic Spinal Cord Injury

CHAPTER 1 - INTRODUCTION / BACKGROUND

The physical disability caused by spinal cord injury (SCI) can cause loss of motor and sensory function below the level of injury. The SCI can be complete or incomplete (Alizadeh, Dyck and Karimi-Abdolrezaee, 2019). Pain, urinary tract infections, spasticity, respiratory infections, blood pressure, decubitus ulcers are common secondary health conditions (SHC) among the SCI population (Piatt, Nagata, Zahl et al., 2016). The percentage of SCI patients with pain varies from 26% to 96%. One-third of this pain is often reported as severe pain. The pain not only affects the function of the people with SCI (PWSCI), but also quality of their life (Ozlem Celik, Eda, Ahmet Gurhan et al., 2014). Despite the treatments available for pain in SCI, pain continues to be problematic to manage (Widerström-Noga, Anderson, Perez et al., 2017). Pain after SCI may be neuropathic or nociceptive and is most severe. Pharmacology, therapeutic and neurosurgical interventions are the approaches available for the management of pain in SCI (Hussain Khan, Majedi and Asaad Hassan, 2019). Nociceptive pain usually presents as musculoskeletal pain in PWSCI and normally yields to non-steroidal anti-inflammatory drugs (NSAIDS), opioid treatments, and physiotherapy (Ullrich, 2007). The unpredictable response of neuropathic pain to most pharmacological interventions makes its management difficult as a result of interrupted sensory innervation (Tibbett, Field-Fote, Thomas et al., 2020). The neuropathic pain worsens over time and its prognosis is poor in the long term (Guy, Mehta, Casalino et al., 2016). Although neuropathic pain in PWSCI adamantly resists conventional pharmacological methods of treatments like antidepressants, antiepileptic drugs, opioids, and various intrathecal medications, an interdisciplinary approach is often recommended as a paramount tactic to treat neuropathic pain in PWSCI (Stillman, Graves, New et al., 2019a).

Literature suggests that an interdisciplinary approach has intermediate and long-term benefits in the rehabilitation of pain (Svetlana, Rachel, Elke et al., 2016). In these types of pain programs, healthcare professionals who practice within the same facility, discuss the patient's progress daily and share a common vision on the treatment (Svetlana et al., 2016). Due to the different options available for treating pain after spinal cord injury, healthcare practitioners may use a combination of the available treatments. A study by Stillman et al. (2019a) found that a combination of opioids,

physiotherapy, and cognitive behavioural therapy (CBT) is prescribed by clinicians globally to treat pain related to SCI.

Physiotherapy and CBT are the widely used non-pharmacological interventions for SCI pain (Boldt, Eriks-Hoogland, Brinkhof et al., 2014). Transcutaneous electrical nerve stimulation (TENS), exercises and stretches, manipulations and mobilizations, are the commonly used physiotherapy treatments (Zeb, Arsh, Bahadur et al., 2018). Cognitive behavioural therapy, hypnosis, and visual imagery are the common behavioural management used to treat pain after SCI (Mehta, Orenczuk, McIntyre et al., 2013).

Physiotherapy is a profession that uses therapeutic interventions comprising of an extensive range of treatment modalities (WCPT, 2020). Physiotherapy aims to reduce pain and increase joint range, reduce muscle spasms, strengthen weakened muscles, promote healing, and reduce muscle spasms, and improve overall function (Harvey, 2016). Physiotherapy exercises, massage, acupuncture, and TENS are reported to complement the pharmacological therapy, to effectively reduce nociceptive and neuropathic pain after SCI (Hussain Khan et al., 2019). Guy et al. (2016) recommended that TENS may be investigated as one of the front-line therapies for neuropathic pain due to its pain relief capacity and relatively harmless side effects. Physiotherapists are an indispensable part of the interdisciplinary team using exercises and electrotherapy to complement non-therapeutic interventions therapy.

Although there has been a myriad of research done on pain and pain management in PWSCI, there is a deficiency of literature related to the physiotherapeutic management of pain in PWSCI. This study was done to determine the factors that guide the treatment, and the management of pain in PWSCI and to recognize the various treatments used by physiotherapists in the treatment of pain in PWSCI in South Africa.

1.1 PROBLEM STATEMENT

Pain following SCI is highly prevalent and is a common secondary health complication for PWSCI. Freedom in activities of daily living (ADLs), social participation, employment as well as quality of life is markedly affected by pain. For instance, shoulder pain of musculoskeletal origin is the most common type of nociceptive pain among PWSCI. The reason being, manual wheelchair users with SCI is unable to rest the upper limb despite the pain (Mashola and Mothabeng, 2019).

Pain is a complex phenomenon and it involves an array of factors including aetiology, biological and psychosocial factors (Dragesund and Øien, 2020). Long-term pharmacological management for chronic pain places the affected individuals at risk of nausea, cognitive deprivation, constipation, and the risk of substance abuse (Hagen and Rekand, 2015). People with SCI as well as their treating healthcare professionals are often intimidated by these risks posed by long-term side effects of chronic pain medications. Healthcare professionals tend to then resort to non-pharmacological therapies for the pain treatment (Boldt et al., 2014). Research states that non-pharmacological treatments such as physiotherapy may be effective and can be used in combination with pharmacological treatments to reduce pain in PWSCI (Hussain Khan et al., 2019). Despite the number of studies done in South Africa regarding SCI, there is a void in terms of published research focusing on the physiotherapy management of pain in PWSCI in the country.

In the South African health care setting, rehabilitation remains poorly understood by the government authorities (Sherry, 2014). For the same reason, access to a rehabilitation facility is finite in both scarcely resourced and well-resourced provinces (Sherry, 2014). The public sector in particular faces challenges subject to the human resource in providing rehabilitation (Mji, Lieketseng and Cloete, 2017). Owing to different school of thoughts and cultural differences, several methods prevail in the treatment implementation of the same health problem such as pain. Considering these studies by Sherry and Mji et al., it becomes crucial to understand what guides physiotherapists in determining pain management programs for PWSCI. This may be achieved by studying the experiences of trained physiotherapists with relevant experience. There are no published guidelines for the physiotherapy management of SCI-related pain in South Africa. Furthermore, no known study investigated the physiotherapeutic management of SCI related pain in South Africa.

1.2 RESEARCH QUESTION, AIM AND OBJECTIVES

1.2.1 Research Question

How do physiotherapists in South Africa manage pain in PWSCI?

1.2.2 Aim

To determine how physiotherapists in South Africa manage pain in PWSCI.

1.2.3 Objectives

- To determine the profile of the physiotherapists treating PWSCI.
- To determine the modalities physiotherapists, use to treat pain in PWSCI.
- To determine the factors that guide the modality selected to treat pain in PWSCI.
- To determine the outcome measures used by physiotherapists to manage pain in PWSCI.

1.3 IMPORTANCE AND BENEFITS OF THE PROPOSED STUDY

Pain in PWSCI, particularly neuropathic pain demands a heightened use of healthcare resources. The cost of visits to healthcare facilities, surgical procedures, and prescriptions required to treat neuropathic pain was estimated to be more than the cost of treatment of PWSCI who did not have pain (Burke, Fullen, Stokes et al., 2017). As an upper-middle-income country, in South Africa, this burden is even more, concerning the accessibility of healthcare and human resource needed to address the problem of pain (Mji et al., 2017). In such a scenario, prevention or reduction of the risks to develop secondary health conditions such as pain in PWSCI would be ideal. The risk associated with the severity of secondary health conditions can be prevented or decreased by precise management or intervention programs designed by the respective of health care professionals (Rimmer, Chen and Hsieh, 2011). For instance, a physiotherapist can avoid risk factors related to causing pain in the shoulder joints of wheelchair users. The physiotherapist can educate the patient on joint protection, prescribe strengthening exercises, and advise proper ergonomics which will prevent the overuse of shoulder joints, and subsequently reducing the risk of shoulder pain. This strategy to prevent pain in PWSCI can only be implemented by knowing the present management of pain in PWSCI by physiotherapists. An understanding of the various physiotherapy treatments in South Africa is required to make suggestions regarding what the physiotherapist can contribute to preventing the occurrence of secondary complications such as pain.

1.4 DELIMITATIONS AND ASSUMPTIONS

1.4.1 Delimitations

This study is limited to physiotherapists working with PWSCI in both in-hospital and out-patient facilities and hospitals (public and private), academia as well as companies or non-government organizations dealing with disability rehabilitation in South Africa.

1.4.2 Assumptions

The researcher assumes that the physiotherapists will have a fair knowledge about pain, pain management, and SCI. Pain management and rehabilitation are a part of the undergraduate curriculum and thus physiotherapists are given hands-on training in this area.

1.5 DEFINITION OF KEY TERMS

1.5.1 Pain

Pain is an undesirable emotional and sensory experience caused by a tissue damage (IASP, 2011). Pain caused by the provocation of visceral or somatic nociceptors, mostly associated with inflammation, disease, or trauma is called nociceptive pain. This is usually not related to a sensory or motor deficit. On the other hand neuropathic pain is due to a lesion or dysfunction of the nervous system (IASP, 2011). In this study, pain refers to neuropathic and nociceptive pain experienced by PWSCI.

1.5.2 Pain Management

Pain management is defined as treatment that aims to reduce or eliminate the pain with minimal side effects (Agus, 2020). Pain management is mostly achieved, through pharmacological and non-pharmacological approaches. Physiotherapy is a commonly used non-pharmacological approach. Pain, management in physiotherapy encompasses several treatments such as joint mobilizations, thermotherapy as well as electro-physiotherapy. The latter comprises of TENS, ultrasound therapy, electromagnetic waves therapy, vibrations, and laser phototherapy (Fattal, Kong-A-Siou, Gilbert et al., 2009). This study will determine the commonly used pain management techniques by physiotherapists in South Africa to manage pain in PWSCI.

1.5.3 Spinal Cord Injury

A complete or incomplete injury to the spinal cord (SC) causing loss of motor and sensory functions below the level of injury is considered as a spinal cord injury (SCI) (Alizadeh et al., 2019). A complete SCI presents with total or partial loss of motor and sensory function below the level of injury, with no sacral preservation (Harvey, 2016). In the case of an incomplete SCI, there is preserved sacral function. In this study, spinal cord injury refers to traumatic (caused by road

traffic accidents, falls) or non-traumatic (caused by pathology of the spine such as tumours, tuberculosis) SCI, irrespective of the injury being complete or incomplete.

1.5.4 People with Spinal Cord Injury (PWSCI)

People with SCI are individuals who have sustained an SCI as explained above. People with SCI can either have tetraplegic (partial or full motor and sensory loss of the trunk, upper and lower limbs) or paraplegia (partial or full motor and sensory loss of the lower limbs and trunk (Surgeons, 2020). In this study, PWSCI refers to a person living with SCI irrespective of the type of SCI.

1.5.5 Physiotherapist

A physiotherapist is an autonomous healthcare professional who is responsible for developing, maintaining, or restoring motor functions and movement throughout the life span using evidence-based practice (WCPT, 2020). They are mostly involved in relieving pain, treating or preventing physical conditions associated with illness, injury, or other impairments. In this study, physiotherapist refers to physiotherapists working in a hospital, rehabilitation centre or a private clinic which admits PWSCI.

1.5.6 Physiotherapy

Physical therapy is a healthcare profession concerned with identifying and maximising quality of life and movement potential within the spheres of promotion, prevention, treatment/intervention, and rehabilitation (WCPT, 2020). It uses physical approaches to promote, maintain and restore physical, social and psychological well-being, based on detailed assessments. The practice and delivery of treatments is based on evidence. In this study physiotherapy refers to the physiotherapy treatments used for the management of pain following SCI.

1.6 SUMMARY

This chapter provided information on the background, aim, and objectives of the study. The importance of the study, delimitations and assumptions, and definition of the key terms. The next chapter will discuss the relevant literature.

CHAPTER 2 - LITERATURE REVIEW

In this chapter, the available literature on the topic is discussed to support the need for this research. It gives a brief introduction on spinal cord injury (SCI), types of pain experienced by people with SCI (PWSCI), the available treatments to manage pain, and physiotherapy solutions for pain experienced by PWSCI.

2.1 SPINAL CORD INJURY

A SCI can cause, motor and/or sensory deficits and paralysis (Hagen and Rekand, 2015). Compression, contusion, laceration, vascular insults and diseases such as spinal tuberculosis, cancer and degenerations may injure the spinal cord (SC). The intensity the injury is determined by the part of the SC that is injured. The severity of the injury on body movements and sensation is directly proportional to how high the SCI is on the vertebral column or how closely it is to the brain. The impact of the injury depends on the weight of the initial insult and the concealed condition of the SC. Injury at lower levels of the SC enables the person a greater level of movement, sensation, and voluntary control (Alizadeh et al., 2019). Besides curbing the independence and functional ability of an individual, SCI causes variety of health complications as a result of the injury such as pain, fractures, deep vein thrombosis, neurogenic bowel and bladder, urinary tract infections, autonomic dysreflexia, pulmonary and cardiovascular problems, pressure ulcers, orthostatic hypotension, spasticity, and depressive disorders (Nas, Yazmalar, Şah et al., 2015).

A SCI can be classified into complete and incomplete injuries. Complete injuries lack motor and sensory function in the sacral segments S4-S5 while incomplete injuries have either sensory only or sensory and motor function preserved at the sacral; segment S4-S5 (Harvey, 2016). SCI can cause a tetraplegia or a paraplegia. Tetraplegia is often caused by cervical cord injuries when there is a reduction in motor and or sensory function in all four limbs. On the other hand, paraplegia results from thoracic or lumbar level injury, also causing a reduction in motor and sensory function in the lower limbs (Patek and Stewart, 2020). A study done by Mataliotakis and Tsirikos (2016) recorded that there were 0.93 million new reported cases of SCI, while there were 27.04 million prevalent cases of SCI globally. Causes of SCI may be traumatic (TSCI) or non-traumatic (NTSCI). The most frequent causes of TSCI are road traffic accidents, violence and falls (Bárbara-

Bataller, Méndez-Suárez, Alemán-Sánchez et al., 2018). On the other hand, NTSCI is most frequently caused by infections and tumours (Ge, Arul, Ikpeze et al., 2018). Another literature review states that based on the available data from Embase and Medline (1959-June 2011), tumours, transverse myelitis and tuberculosis related to the spine are the major causes of NTSCI in the Sub-Saharan African countries (mainly Zimbabwe), accounting for 28% and 27% of the total cases respectively (New, Cripps and Bonne Lee, 2014). The epidemiological data on SCI in South Africa is scanty due to the absence of a national registry (Joseph, Scriba, Wilson et al., 2017b). A literature review done in 2011, found that a total 30% of the TSCI in South Africa was caused by road traffic accidents, 8% was by falls, 5% was sports or recreation-related, and the major share, which was 61% was caused by violence / self-harm (Lee, Cripps, Fitzharris et al., 2014). South Africa also accounts for the highest proportion of gunshot injuries globally (Jakoet, Burger, Van Heukelum et al., 2020). South Africa's highest gun-related violence was reported in 2010 from Cape Town, which was 41 homicides per 100,000 (Jakoet et al., 2020). Spinal cord infarction, Human Immunodeficiency Virus (HIV) myelopathy, and schistosomiasis were identified as causes for NTSCI in South Africa (Abdu Kisekka, David, Paul et al., 2017).

Prevention of further injury, maintaining good blood circulation, relieving neural compression, and providing vertebral stability are the prime goals of management of SCI in the acute phase, which are prerequisites to accomplish the targets of early rehabilitation (Winter, Pattani and Temple, 2017). An individual with SCI is fit for rehabilitation as soon as he/she is stable medically. Depending upon several factors such as the severity of the injury and the consequential complications, the fitness for rehabilitation can alter from a few days to several weeks (Harvey, 2016). Rehabilitation of PWSCI, which is aimed to return individuals to a constructive and gratifying life, is brought about by the involvement of an interdisciplinary team, led by a physiatrist. The team is inclusive of the patient's family, physiotherapist, psychologist, social worker, speech therapist, occupational therapist, dietitian, etc. (Nas, 2015). Physical rehabilitation in SCI is directed to regain functions of the individual, maintain, and augment the remaining functions, and prevent secondary complications. The focus of rehabilitation in PWSCI is mainly related to improving integration into the community and increasing quality of life and which is ultimately related to, productive work, interpersonal relationships, community participation and leisure activities (Gómara-Toldrà, Sliwinski and Dijkers, 2014).

Ongoing rehabilitation is a fundamental need for PWSCI after acute care management and involves a multidisciplinary health care team (which includes a physiatrist, physiotherapist, occupational therapist, social worker, psychologist and nurse) (Chhabra, Sharma and Arora, 2018). Physiotherapists play an integral part throughout all phases of SCI management. In the acute phase, physiotherapists largely focus on airway clearance and preventing secondary health complications (SHC) related to prolonged bed rest. Whilst in the rehabilitation stage the major focus is on goals related to motor tasks such as transfers using upper limbs, pushing a wheelchair, and walking. (Harvey, 2016). People with SCI are ready for discharge from hospital following acute rehabilitation, after they have been educated about their present health status and educated on how to do their ADL with respect to their neurological level of injury. Since PWSCI are highly likely to develop SHCs post discharge, management and prevention of SHCs are also taught before discharge (Du Plessis, McGaffin, Molepo et al., 2018). The role of a physiotherapist doesnot stop with the discharge of PWSCI. It is an ongoing process to enhance and maintain the health and wellbeing upon discharge from rehabilitation to the society. Physiotherapist has a key role in motivating and educating PWSCI to stay active to prevent SHCs (Williams, Smith and Papathomas, 2018).

2.2 SECONDARY HEALTH CONDITIONS POST SPINAL CORD INJURY

People with SCI are at risk of developing various SHCs after the injury, such as pain, deep vein thrombosis, urinary tract infections, severe muscle spasms, decubitus ulcers, and respiratory complications (Callaway, Barclay, McDonald et al., 2015). Pain is a common as a SHC after SCI and is also considered problematic as it constantly interferes with sleep and mood of the PWSCI and negatively impacts the quality of life and ADLs (Widerström-Noga et al., 2017; Stillman, Graves, New et al., 2019b).

2.3 PAIN AFTER SPINAL CORD INJURY

Pain dominates as a severe health problem with prevalence rates from 11% to 94% (Raichle, Hanley, Jensen et al., 2007). Reports which identify types of pains show the highest prevalence (58% of patients 5 years after injury) in musculoskeletal pain. Of these, 12 to 42% report at-level neuropathic and 23 to 34% report below-level neuropathic pain, which is reported as the most excruciating or severe pain. A third of PWSCI, suffering from neuropathic pain report a negative

impact on their wellbeing and activities of daily living due to the intense pain experienced (Felix, 2014).

Restrained social participation, poor quality of life and functional impairments are some of the consequences caused by pain in PWSCI (Widerström-Noga et al., 2017). An average of 70% prevalence of SCI-related chronic neuropathic pain has been reported (Felix, 2014) and according to PWSCI, chronic pain after SCI is often worse than the SCI itself and is unruly to regulate (Hearn, Cotter, Fine et al., 2015). In addition to being a major hindrance to ordinary life, it also slows down a rehabilitation program. Jensen, Hoffman and Cardenas (2005) found that pain was statistically and substantially greater in PWSCI when compared to the United States' national norms. They also established that pain had a significant interference in many daily activities such as grooming, and movement. This leads to decreased levels of social integration and psychological functioning (Sezer, Akkuş and Uğurlu, 2015).

Diverse pain types related to SCI have been identified. These are fundamentally based on the dubious causes, pain locations, and the descriptors of pain. The international spinal cord injury classification of pain, classifies pain following SCI as nociceptive, neuropathic, other and unknown pain (Saulino, 2014). This classification is depicted in Table 0.1. However, this study mainly deals with the nociceptive and neuropathic type of pain.

2.3.1 Nociceptive Pain

Nociceptive pain is pain which arises due to the activation of nociceptors, due to damage of non-neural tissues (IASP, 2019). The noxious stimulation of somatic or visceral nociceptors causes nociceptive pain. Nociceptive pain, which is often related to a disease, inflammation, or trauma, is not generally associated with a motor or sensory deficit (Siddall and Middleton, 2006). Even though nociceptive pain is manageable with non-steroidal anti-inflammatory drugs (NSAIDS) and physiotherapy, it could evolve into a chronic condition (Sezer et al., 2015). While mechanical damage owing to injury of bones (fractures), joints, muscles and ligaments cause musculoskeletal nociceptive pain, constipation is the most common cause for visceral nociceptive pain (Franz, Schulz, Wang et al., 2019). Other nociceptive pain may be due to decubitus ulcers (Franz et al., 2019).

2.3.2 Neuropathic Pain

Unlike nociceptive pain, neuropathic pain occurs as a direct result of a disease or lesion affecting the somatosensory system (IASP, 2019), such as a SCI. Neuropathic pain can be either of a central or peripheral origin. The lesion or impairment of certain structures within the brain and SC causes central neuropathic pain, while the lesion of a peripheral nerve or nerve root (peripheral neural structures) leads to peripheral neuropathic pain (Franz et al., 2019).

Table 0.1 - International Spinal Cord Injury Pain Classification (Bryce, Biering-Sørensen, Finnerup, Cardenas, Defrin, Ivan et al., 2012)

	Pain type	**Pain subtype**	**Exemplary underlying cause**
1.	Nociceptive pain	Musculoskeletal pain	e.g., Periarthritis shoulder, distal radius fracture, etc.
		Visceral pain	e.g., Appendicitis, cholecystitis
		Other nociceptive pain	e.g., Migraine headaches, surgical skin incision, etc.
2.	Neuropathic pain	At level SCI pain	e.g., Compression of the spinal cord / Cauda equine, etc.
		Below level SCI pain	e.g., Spinal ischemia, compression of the spinal cord, etc.
		Other neuropathic pain	e.g., Ulnar nerve palsy, trigeminal neuralgia, etc.
3.	Other pain		e.g., Trigeminal neuralgia, complex regional pain syndrome, etc.
4.	Unknown pain		

2.3.3 Commonly Available Treatments for Pain in Spinal Cord Injury

It is extremely challenging to effectively treat pain following SCI because of its poor prognosis and worsening nature (Guy et al., 2016). In the case of at-level and below-level neuropathic pain after SCI, the treatment could at best only lead to a partial reduction of pain intensity. Both pharmacological and non-pharmacological interventions (such as physiotherapy and cognitive behavioural therapy (CBT)) are available for neuropathic and nociceptive types of pain. Antidepressants, opioids, and anti-epileptics are the primary oral drugs administered for the

treatment of neuropathic pain following SCI (Guy et al., 2016). The use of opiates, antidepressants, non-steroidal anti-inflammatory drugs (NSAIDS), anticonvulsants, and analgesics for treating neuropathic pain have been reported in several studies (Mehta et al., 2013). There are no known treatments that can treat the cause of at-level or below-level neuropathic pain apart from the treatment of a syrinx and the surgical decompression of a compromised nerve root. Hence treatments for this type of neuropathic pains are mostly symptomatic (Franz et al., 2019). Several challenges are also caused by the pain medications despite the pain relief provided. Drowsiness, nausea, and gastrointestinal irritations are the most common side effects. Long term usage can also lead to substance abuse (Clark, Cao and Krause, 2017). The understanding of the treatment of neuropathic pain has not seen many changes in the recent past. A systematic review by Bernetti, Agostini, de Sire et al. (2021) recommends that a combination therapy with pharmacology and psychotherapy for neuropathic pain.

Non-steroidal anti-inflammatory drugs (NSAIDS) are mostly administered for the symptomatic management of nociceptive pain in SCI (Hussain Khan et al., 2019). Physiotherapy treatments such as TENS, exercises, and massage are also used along with the pharmacological treatment in nociceptive pain (Hussain Khan et al., 2019). By large, abnormal posture, overuse with transfers, gait and wheelchair use contribute to the chronic inflammatory musculoskeletal pain above the level of injury, particularly in the shoulder (Boldt et al., 2014). If these causes are identified as contributing factors, then patient education, posture correction exercises, ergonomic modifications, and retraining may be plentiful to eliminate the problem (Hicks, Martin, Ditor et al., 2003).

Chronic pain after SCI is often intractable to pharmacological treatments (Cardenas and Felix, 2009). Also, pharmacological interventions poses risk of overuse, misuse, and addiction (Shaw and Saulino, 2020). A research by Hand, Krause and Simpson (2018) proved that PWSCI required more and long term use of opioid medications, than those without SCI owing to the greater experience of pain. Constipation, cognitive depression, nausea and the risk of substance abuse are some of the adverse effects that a chronic pain patient is exposed to, due to the use of long-term pharmacological treatments (Hagen and Rekand, 2015). Somnolence and dizziness are the other side effects that SCI patients on long-term medication can experience (Guy et al., 2016). Pain medication overuse, specifically the opioid overuse is also associated with increased

utilization of the emergency department, hospital stays and a spike in the health expenditure annually (Hand et al., 2018). Therefore, clinicians treating pain in PWSCI need to be cautious in administering pharmacological treatments and consider non-pharmacological treatments for the management of pain. The commonly suggested non-pharmacological treatments are physiotherapy, occupational therapy, relaxation, and acupuncture (Fattal et al., 2009) and this study focuses on the physiotherapeutic management of pain.

2.4 PHYSIOTHERAPY

Physiotherapy is a health care profession concerned with human movement and exercise prescription across the health spectrum and includes definitive interventions to a population of individuals or individuals where movement and function are impaired (such as disability, old age, and illness) (WCPT, 2020). It is associated with identifying and maximizing quality of life and movement potential within the limits of promotion, prevention, treatment, and rehabilitation (WCPT, 2020). Various physical approaches are used to advance, maintain, and revive physical, psychological, and social wellbeing. Physiotherapy helps PWSCI function despite the injuries in day-to-day situations (such as mobility and grooming). This involves tailor-made exercises for passive movement of the joints, as well as stimulation of the muscles and nerves below the level of injury (Harvey, 2008). Studies show that physiotherapy may also accentuate the rejuvenation of atrophied muscle functions in PWSCI (Panisset, Galea and El-Ansary, 2015).

A study regarding physiotherapy practice, states that physiotherapy is a well-accepted intervention by the patients, because of its direct interactive nature with the patients. The patients felt that they could explain their complaints much better to a physiotherapist, their preferences regarding the treatment were accounted for, and the treatment was refined regularly during the course of treatment (Michael, 2016). This kind of patient-centred approach in physiotherapy gave the patients confidence and had a huge psychological impact on the prognosis of the condition (Michael, 2016). Physiotherapy is also a key component in multidisciplinary pain management (Semmons, 2016). Pain relief brought about by a multidisciplinary approach is well supported by evidence (Burns, Delparte, Ballantyne et al., 2013; Nas, 2015). A physiatrist leads the multidisciplinary team which includes physiotherapist, speech therapist, occupational therapist, psychologist, social worker, and the patient’s family. Other specialists are included when and where necessary (Nas, 2015).

Pain management in physiotherapy primarily includes joint mobilizations, massage, electrotherapy, patient education and advice on self-management. Electrotherapy is comprised of TENS, ultrasound therapy, electromagnetic waves therapy, laser, and phototherapy (Fattal et al., 2009). Patient education, advice on exercise management and activity, and patient empowerment to promote overall function, are also key areas of physiotherapy within pain management (Semmons, 2016). Several theories like the pain gate theory, counter-irritant activation of endogenous opioids, and restoration of functions to remove a peripheral irritant, have been suggested to explain the pain relief provided by the physiotherapy intervention (Sluka, 2016)

According to the gate control theory, the nociceptive activity in the dorsal horn of the spinal cord can be reduced by the activation of large-diameter afferents. However, the counter-irritant theory suggests that endogenous pain control mechanisms that reduces pain can be activated by applying a painful stimulus (Sluka, 2016). Reduction of the dorsal horn neuronal activation decreases the input to the higher brain centres that causes pain. Physiotherapy intervention and treatments are planned based on a detailed evaluation of the patient with regards to the pathway of pain, peripheral, central conditions, and any underlying psychological factors. Mild to moderate physical activity (like stretching and strengthening exercises) has shown to have positive effects on nociceptive pain after spinal cord injury (Franz et al., 2019).

2.4.1 Popular Physiotherapy Treatments for Pain in SCI

2.4.1.1 Electrotherapy

The use of electro-physical and electromagnetic modalities to repair damaged tissue, soothe pain, and restore functions is well known within the domains of physiotherapy (Watson, 2017). The various modalities may be classified as

i. Electrical stimulation modalities: e.g., TENS, interferential currents (IFT)
ii. Thermal modalities: e.g., short wave diathermy, therapeutic ultrasound, hydrocollator packs.
iii. Non-thermal modalities: e.g., low intensity pulsed ultrasound.

Transcutaneous electrical nerve stimulation (TENS) is a non-invasive electrotherapy modality in which peripheral nerves are activated by delivering pulsed electric current. The spread of nociceptive information throughout the brain and SC is inhibited by the afferent activity induced

by TENS. This activity results in hypoalgesia (Grover, McKernan and Close, 2018). Various neurological mechanisms which affect the peripheral and central nervous system have been exhibited to be achieved by the analgesic effect of TENS. Particularly, when the electric pulses are applied to the skin, endogenous opioids ae released due to the activation of nerve fibres. This modifies the electrical transmission and dilates blood vessels ultimately leading to pain relief in neuropathic pain (Mokhtari, Ren, Li et al., 2020).

Pain is mitigated by implementing TENS in various combination of frequencies and intensities (Kılınç, Livanelioğlu, Yıldırım et al., 2014). A broad spectrum of acute and chronic pain is controlled by this modality. Pulsed electrical stimulation is imparted through adhesive electrodes onto the skin surface. Generally a high or low-frequency mode is used to deliver the TENS (Gibson, Wand, Meads et al., 2019). Another study shows that low-frequency TENS may be effective in the management of neuropathic pain in PWSCI (Celik, Erhan, Gunduz et al., 2013).

Transcutaneous electrical nerve stimulation is generally considered safe and beneficial for pain in PWSCI (Bi, Lv, Chen et al., 2015). However, precautions must be taken when applying TENS electrodes over areas where the sensation is altered, such as hyperalgesia, hypoesthesia or allodynia. Application of TENS over skin with heightened sensations such as hyperalgesia or allodynia can aggravate pain. In such cases, the electrodes must be positioned over skin adjacent the site of altered sensation where the sensation is intact (Mark, 2014). It also poses risk of burns or skin damage when applied over hypoalgesia skin. This can be resolved by applying TENS on the margins of the insensate area where the sensation is intact (Mark, 2014).

Thermal modalities such as shortwave diathermy and hydrocollator packs reduces pain and muscle spasm, it also increases the pain threshold and trigger the vasodilation. This enhances the elasticity of connective tissues and joint mobility when applied prior to exercise therapy (Karasel, Oncel and Sonmez, 2020). Therapeutic ultrasound is also a thermal modality, where the ultrasound machine conducts electrical signals through crystals present in the handheld transducer. The transducer head is applied with a coupling gel and moved in a circular motion over an injured or painful area. The purpose of ultrasound is to improve blood flow and accelerate healing (Miller, Smith, Bailey et al., 2012).

The objective of non-thermal modalities like low intensity pulsed ultrasound is to increase the cell membrane activity and thereby change the cell state, without heating effects. This can activate physiological changes, which is afterwards employed to achieve therapeutic benefits (Watson, 2017).

2.4.1.2 Joint Manipulations and Mobilizations

An externally imposed, small amplitude passive motion that produces a gliding or traction at a joint is referred to as joint mobilization. Joint manipulation is a specific technique in which the articular capsule is stretched passively by delivering a quick thrust manoeuvre to the joint (Edmond, 2006). There is moderate quality evidence which proves that small moderate reduction in the intensity of pain can be achieved in PWSCI by manipulation interventions, when compared to other intervention such as exercise. There also exists moderate quality evidence which states that mobilization interventions may have minimal effect in reducing pain when compared to interventions such as exercise (Coulter, Crawford, Hurwitz et al., 2018). Massage is a soft tissue manipulation intended at promoting health. Massage is speculated to slash lactic acid accumulation in the muscles, promote healing of connective tissues and increase circulation in the venous and lymphatic system. The established benefits of therapeutic massage range from the reduction of anxiety, depression, and fatigue to improving sleep and reduction of pain (Chase, Jha, Brooks et al., 2013). Massage therapy has proved to be effective in treating conditions associated with SCI such as musculoskeletal pain and disturbed sleep (Moyer, Rounds and Hannum, 2004). Massage has been reported as the second most commonly used complementary therapy and was rated high for pain relief in PWSCI (Lovas, Tran, Middleton et al., 2017). Nevertheless, the benefits of massage therapy for managing pain in SCI is not well established by research.

2.4.1.3 Therapeutic Exercises

Therapeutic exercise refers to the methodically planned and targeted movements or changes in posture or physical activities (Kisner, Colby and Borstad, 2017). It is suggested to prevent impairments, upgrade, reinstate, and augment physical functions, restrict health-related risk and revamp comprehensive health status and fitness (Horsak, Wunsch, Bernhart et al., 2017). The therapeutic exercise intervention includes aerobic conditioning exercises, muscle performance exercises, stretching exercises, exercises for neuromuscular control, inhibition and facilitation techniques ,postural control, balance exercises, relaxation exercises and breathing exercises

(Garber, Blissmer, Deschenes et al., 2011). A broad range of actions activities and techniques are incorporated in the therapeutic exercise procedures. However, the individualized exercise programs are tailor-made according to the physiotherapist's evaluation of the elemental cause of the impairment, functional limitation, or disability, patient's needs goal and preference (Tsimerakis, Lytras, Kottaras et al., 2021).

Exercise as a modality for treatment of pain and disability is extensively investigated using randomized control trials. The benefit of exercises is not merely limited to reduction of pain, but also the elevation of overall mood, reduction of stress, and depression (Lima, Abner and Sluka, 2017). A meta-analysis done on the hypoalgesia caused by exercises cites exercises as a therapeutic modality that is cost effective, accessible and that can be used for almost all types of chronic pain (Polaski, Phelps, Kostek et al., 2019). A study by Lima et al. (2017) shows that a regular and systematic exercise program promotes analgesia in the general population. However, a single bout of strenuous exercise in the presence of chronic pain can aggravate the pain. The same effect may be expected in PWSCI.

Exercises activate the peripheral opioid receptors, located on the sensitized nociceptors. This reduces the nociceptive input to the dorsal horn of the spinal cord, thus reducing the sensitization of the dorsal horn neurons. The inputs to the higher centres of the brain are reduced, which in turn reduces pain (Sluka, 2016). The exercise-induced pain relief is hypothesized to be primarily due to the release of endogenous opioids (Vaegter, Fehrmann, Gajsar et al., 2020). Resistance training, and aquatic exercises are the most commonly researched types of exercises for pain relief (Polaski et al., 2019). Exercises have been proven to be effective for pain relief and it helps the patients to complete their daily activities despite the pain. Thirty minutes of moderate intensity exercises for 5days / week is recommended by the American college of sports medicine to maintain fitness. However chronic pain patients are advised to do 10-20 minutes of moderate intensity exercises 2 to 3 days a week (Polaski et al., 2019).

2.4.1.4 Patient Education

Physiotherapists as rehabilitation specialists play a vital role in preventing the reoccurrence of overuse injuries/habits that can contribute to chronic pain. Imparting adequate and appropriate education regarding the various factors that can cause pain, basic anatomy and pathology of pain,

proper ergonomics, methods to prevent it, and available treatments, can help the patient to a great extent. It also gives the patient confidence to do his daily activities. Literature suggests that physiotherapists' ability to educate their patients effectively helps the patient to develop self-management skills (Harman, Bassett, Fenety et al., 2011). Pain education is a relevant issue, as the patients require pain information (such as how is it caused, what aggravates it, and how it can be prevented). Norman et al., (2010) found that patients were interested in information concerning the cause of pain, ways to have been in contact with the health care professionals, what to expect in the long term, where to seek out information regarding pain and its management. A study by Shin, Kim, Chang et al. (2017) states that imparting pain education significantly reduces the dependence on pain medications. They also suggest that pain education can be a cost-effective way to reduce dependency on pain medications. Hafifi et al., (2019) further added that pain education gives PWSCI the confidence to perform exercises themselves and to engage more in physical activities. This confidence to stay physically active may have an indirect effect on pain in PWSCI thus improving the pain and physical activity in PWSCI. The improvement in the ongoing status of the PWSCI is measured using outcome measures.

2.5 OUTCOME MEASURES

An outcome measure may be defined as a tool used to determine a patient's ongoing status (Tilson, Marshall, Tam et al., 2016). Using an outcome measure is part of good practice guidelines and systematic outcome measure is a method by which practitioners can continually improve patient care (Williams, Davies, Kolic et al., 2020). Reliable and valid outcome measures help clinicians in better decision making, clinical research and quality assurance. Outcome measures also provided vital information regarding the health conditions for the physiotherapists and the patients, thus improving the quality of patient care (Al-Muqiren, Al-Eisa, Alghadir et al., 2017). Physiotherapists' generally maintains a positive attitude towards the use of outcome measures (Abrams, Davidson, Harrick et al., 2006). Outcome measures across various domains, such as 0-10 Numerical Rating Scale, Pain Quality Assessment Scale, Short-form McGill Pain Questionnaire, visual analogue scale, and DN4 are used by clinicians to assess change following interventions on disabilities and chronic pain (Alexander, Anderson, Biering-Sorensen et al., 2009). The better assessment of patient's treatment outcomes in terms of physical functioning and pain is enabled by the reliability and validity of outcome measures. This also enables the earliest

appropriate management to minimize the risk of comorbidities (Mehta, Claydon, Hendrick et al., 2016).

An evaluation of these literatures concludes that an understanding of what guides physiotherapists in determining pain management programs for PWSCI is essential. This may be achieved by studying the perspective of trained physiotherapists with relevant experience in treating PWSCI. Researches have also found that the pain perception in PWSCI was more than the normal individuals (Widerström-Noga et al., 2017). This finding has also influenced in choosing pain management in this population of patients. The cosmopolitan socio-cultural and religious environment in South Africa as well as the various schools of thought regarding the management of pain in PWSCI may influence attitudes and approaches of physiotherapists. As the treatment of pain in PWSCI remains highly empirical, it is vital to know how different therapists manage pain in PWSCI. Additionally, a lack of sufficient literature on therapeutic methods of pain management by physiotherapists in PWSCI escalates the need for a scientific and empirical study on determining the management of pain in PWSCI by physiotherapists in South Africa.

2.6 SUMMARY

This literature review included information on SCI, its epidemiology in South Africa, available treatments, the importance of physiotherapy and various physiotherapy treatments available for pain in SCI, the need for using outcome measures and the gap in the literature regarding the guidelines for physiotherapy management of pain in SCI. The next chapter will discuss the methods of this study.

CHAPTER 3 - METHODS

This chapter presents the study design, study setting, Study population and sampling method, data collection method, pilot study, data management and analysis, and the ethical and legal considerations of the study.

3.1 STUDY DESIGN

This study used a quantitative research approach. A descriptive, cross-sectional design was employed using a survey to collect the data. The online survey form was powered by Qualtrics.

3.2 STUDY SETTING

This study was conducted online using a questionnaire.

3.3 STUDY POPULATION AND SAMPLING

3.3.1 Study Population / Unit of Analysis

The study population was clinical South African physiotherapists in either the government or private sector, involved in the treatment of PWSCI. The physiotherapists needed to be treating PWSCI either as an inpatient or an outpatient.

3.3.2 Inclusion criteria

Physiotherapists including community service physiotherapists, from South Africa involved in SCI rehabilitation were included in the study.

3.3.3 Sampling Method

A non-probability convenience sampling approach was used considering the accessibility of the participants and the time required to complete the survey. The physiotherapists were contacted through the South African Society of Physiotherapists (SASP) and the Physiotherapy Association of South Africa (PASA). The SASP and PASA are professional membership bodies for physiotherapists in South Africa. All consenting physiotherapists who completed the online questionnaire were included in the study.

3.3.4 Sampling Size

The Health Professions Council of South Africa reported a total of 7734 registered physiotherapists, last updated in October 2018 (HPCSA, 2018). Spinal Cord Injury rehabilitation is a small component within the physiotherapy field with an estimated 10% of the total physiotherapists practicing in SCI (i.e., 773 physiotherapists). It would have been ideal to have 10% of the total population of SCI physiotherapists as the sample size (i.e., 77 physiotherapists) (Brink, Van der Walt and Van Rensburg, 2018). However, due to the data collection being online, the researcher aimed to achieve 56% of the sample size (i.e. n=77) response rate from physiotherapists as guided by Baruch (Baruch, 1999), and therefore this study anticipated sample size of no less than 43 SCI physiotherapists.

3.4 DATA COLLECTION

3.4.1 Measurement Tools

Data was collected using a self-developed online questionnaire on Qualtrics. Considering the geographical distribution and accessibility of the physiotherapists, an online platform was chosen to do the survey. Physiotherapists from Gauteng, Free state, Western Cape, Limpopo, Mpumalanga, Eastern Cape and KwaZulu Natal participated in the survey. The respondents could access, the survey via desktops, laptops or via smartphones. Online surveys are also cost-effective and provide quick responses (Saleh and Bista, 2017). To the best our knowledge there was no existing questionnaires to determine the physiotherapy management of pain in PWSCI. Therefore, a questionnaire was developed to address the different objectives of the study (Annexure A) guided by the International Spinal Cord Injury Basic Pain Data Set (ISCIBPDS). The supervisor edited and performed the necessary corrections to the questionnaire with regards to the formation of the questions and the technicalities of launching it. The questionnaire consisted of 19 items. The socio-demographic questions were used to determine the first objective of the study which was to determine the profile of the physiotherapists treating pain in PWSCI. Questions 11, 12, and 13 enquired about the modalities that the physiotherapist used to treat pain in PWSCI, in the order of their preference. These questions were included to address the second objective of the study which was to determine the modalities that are commonly used to treat pain in PWSCI. The third objective was determined by questioning the factors that guided the participants in choosing the modalities to treat pain. The participants were asked if they used any outcome measures to pain,

they were also asked to mention the outcome measure used. A question 'Is your pain management dictated by a protocol' was included to understand if the physiotherapists used any protocol to manage pain in PWSCI. The participants were asked for suggestions on how to treat acute nociceptive pain, chronic nociceptive pain, acute neuropathic pain, and chronic neuropathic pain. They were also asked for any other conservative treatments for the management of pain (for instance pain education, and ergonomics) in PWSCI. No details revealing the personal identity of the participant were collected in the survey. The provision to answer not applicable was also provided if the question was not of concern to the participant.

3.4.2 Measurement Methods / Technique

After receiving the clearance from the ethics committee, the required permission to distribute the questionnaire was sought from the professional bodies (SASP and PASA) (Annexures B & C). These professional bodies were approached because it was easier to get the contacts of the physiotherapists across South Africa through them. A request letter was submitted to the administrators of the above-mentioned organizations to obtain permission for the questionnaire to be distributed among the member physiotherapists in their database on behalf of the researcher. Once the permission was obtained, the link to the questionnaire was distributed to member physiotherapists by the administrators of the organizations. All physiotherapists registered with the SASP and PASA were asked to voluntarily take part in the survey. The questionnaire was also circulated amongst physiotherapists using Facebook and WhatsApp to reach the physiotherapists who were not members of the associations. Informed consent was attached to the questionnaire. All consented physiotherapists working with PWSCI were included in the study. The willingness to engage in the study was implied by informed consent. The questionnaire was made available to the participants from January until May 2020. A biweekly reminder was sent to the members until the anticipated sample size was attained. The survey was closed by May 2020.

3.4.3 Quality Control

The self-developed questionnaire was edited and required corrections were advised by the supervisor. A pilot study was conducted for content and face validity, as well as to check the practicability of the survey. Furthermore, the pilot study checked the methodology of the study, and if the result data was useful to derive conclusions, as well as to understand if the respondents

understood the questions, and to assure that the survey meets the ethical requirement of the study such as the anonymity of the participants (Thabane, Jinhui, Rong et al., 2010). The participants were assigned a participant number to curb cluster answering. Open-ended questions such as, "what is your most used treatment modality to treat pain in PWSCI" were also added in the questionnaire. The motive behind this was to check if the participants were straight-lining the answers or they are giving honest answers.

3.4.4 Pilot Study

The pilot study aimed to evaluate the viability of the proposed methodology. The pilot study sample size was determined as 10% of the total sample size, therefore the questionnaire was sent to eight physiotherapists who fit into the unit of analysis. This was done to determine the duration required to complete the questionnaire as well as an understanding of whether the questions were comprehensible to the respondents. The researcher also wanted to know details like, how long will it take, for SASP and PASA to respond to the email requesting it to be distributed among the physiotherapists, how long will it take for the physiotherapists to return a completed questionnaire. The pilot study aided to verify that the web link to the online questionnaire was working. The pilot study also observed, how the respondents answered the open-ended questions.

The pilot study was performed exactly in the method of the core study. The following results were derived from the pilot study.

- It was found that an average of 15 minutes was needed to complete the questionnaire.
- There occurred a few technical challenges concerning the link to the questionnaire. Three participants who had participated in the pilot study contacted the researcher stating that the link sent to them was not opening. This technical issue was addressed by the researcher and was sent back to the participants. They were then able to complete the questionnaire.
- It was observed that two participants gave irrelevant answers to the open-ended questions. Upon inspection, the open-ended question was clear, and it was retained in the main study. Relevant data from the pilot study were included in the core study since there were no changes in the sampling technique or the methodology.

3.5 DATA MANAGEMENT AND ANALYSIS

After collecting the data online via Qualtrics, the data was collated onto a Microsoft Excel sheet and was submitted to the statistician for analysis. Data analysis involved a major descriptive component presenting the frequencies and percentages, as well as means and standard deviations, together with an analytical component to determine the association, such as between treatment and the selection criteria. Fisher's exact test was used to determine associations. The significance was set at $p<0.05$.

3.6 DATA STORAGE

The safekeeping of the data will be done by following the research ethics committee requirement (Annexure E). Data obtained during this study will be stored at the physiotherapy department, at the University of Pretoria for a minimum of 15 years from the commencement of the study. The data will therefore be stored until 2034.

3.7 ETHICAL AND LEGAL CONSIDERATIONS

This study was conducted by the ethical principles contained in the current version of the World Medical Association Declaration of Helsinki (Annexure F), in compliance with ethical principles, including beneficence, non-maleficence, and respect. The protocol (with the declaration of plagiarism included as Annexure G) was submitted to the Faculty of Health Science Research Ethics Committee of the University of Pretoria for ethical and legal considerations and approval to conduct the study (Annexure H). Ethics approval (reference number 785/2019) was granted by the Faculty of Health Science Research Ethics Committee of the University of Pretoria. Informed consent was obtained by the submission of the online questionnaire (Annexure I). Confidentiality was maintained to protect the identity of the participants. Individuals were identified by a unique code. No compensation was given to the participants for taking part in the study, neither was there any financial burden on the participants. There are no potential risks or harm to the physiotherapists involved in the study. Participants were given autonomy by allowing them to voluntarily take part or retire from the research at any point in time during the study.

3.8 SUMMARY

The methodology of the study as described in this chapter included the data collection method, the measurement tool, data analysis, and management, and ethical considerations. The results from the study will be presented in the next chapter.

CHAPTER 4 - RESULTS

The results of this study are presented in this chapter. The demographic profile of the participants, the most used modalities to treat pain after spinal cord injury (SCI), and factors associated with the selection of the modalities are presented.

4.1 SURVEY RESPONSE RATE

Physiotherapists who participated in this study were approached through the South African Society of Physiotherapists (SASP) and the Physiotherapy Association of South Africa (PASA). The 19-item questionnaire was sent to all the physiotherapists (6090 physiotherapists) in their database via email. A total of 113 participants responded to the questionnaire out of which 57 were incomplete questionnaires. (Fig. 4.1) The incomplete questionnaires were either early terminated and the participants did not return to complete the survey or opened but unanswered. Consequently, only 46 completed questionnaires were available for data analysis and are represented henceforth.

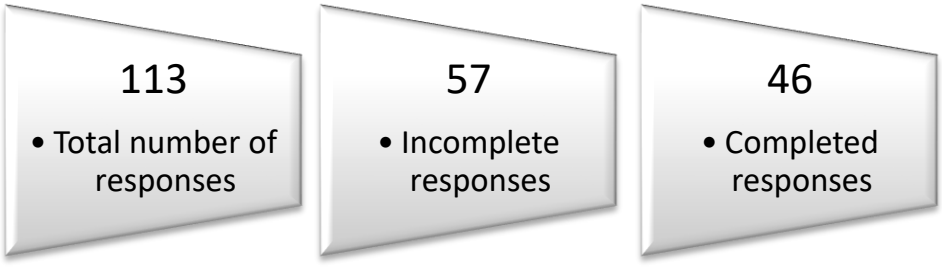

Fig. 0.1 - Breakdown of Responses in the Study

4.2 DEMOGRAPHIC RESULTS

The demographic details of the participants were collected to determine the profile of the physiotherapists treating pain in people with SCI (PWSCI) in South Africa and are depicted in Table 0.1 below. The participants who took part in the study had a mean age of 36.9 (standard deviation = 10.49) with the majority of participants between the age of 20 and 40 years (n=30, 63.9%). Community service physiotherapists were also included in the study. The yopungest physiotherapist who took part in the study was 23 years old. Majority of the participants were female physiotherapists (n=34, 72.3% vs male n=12, 25.5%) and resided in Gauteng (n=33,

70.2%). Clinical physiotherapists constituted 80.9% (n=38) of the total participants. Of the total, 53.2% (n=25) practiced in the private sector and the remaining 21 participants (44.7%) were employed in the public sector. Of the total participants, 34 (72.3%) held a bachelor's degree, 11 (23.4%) completed a master's degree and only one participant had completed a Ph.D. (2.1%).

The mean years of experience was 13.23 years (standard deviation = 10.50) with most of the years of experience ranging between 0 and 20 years (n=35, 74.5%). Thirty-six participants had experience specifically in the SCI field. This study found that the majority of the participants treated 0-20 SCI patients annually (n=45, 95.7%). Special interest in treating pain in PWSCI was reported by 17 participants (36.2 %).

Table 0.1 - Demographic Results

Demographic variables	**n (%)**
Age	
20-40	30(63.8%)
41-60	16(34.0%)
Gender	
Male	12(25.5%)
Female	34(72.3%)
Job description	
Clinician	38(80.9%)
Academic	6(12.8%)
Others	2(4.3%)
Geographical location	
Gauteng	33(70.2%)
Free state	3(6.4%)
Limpopo	3(6.4%)
Western Cape	3(6.4%)
Mpumalanga	2(4.3%)
Kwazulu-Natal	1(2.1%)
Area of employment	
Private sector	25(53.2%)
Public sector	21(44.7%)
Educational Qualification	
Bachelor's degree	34(72.3%)
Master's degree	11(23.4%)
Doctoral degree	1(2.1%)

Demographic variables	n (%)
Years of experience	
0-20	35(74.5 %)
21-40	11(23.4%)
Experience in Spinal Cord Injury (years)	
0-20	41(87.2%)
21-40	5(10.6%)
Number of SCI patients treated in a month.	
0-20	45(95.7%)
21-40	1(2.1%)

4.3 MODALITIES USED BY PHYSIOTHERAPISTS TO TREAT PAIN IN PWSCI

4.3.1 Most Used Treatment Modality

The most common treatment of choice selected to treat pain in PWSCI was TENS (n=14, 29.8%), with mobilizations and manipulation a close second most common modality selected (n=13, 27.7%). Ten participants (21.3%) used exercise therapy as shown in Table 0.2. Three participants (6.4%) used patient education and one participant used acupuncture. Shortwave diathermy was used by one participant and one other participant used therapeutic ultrasound. Three participants did not record any modalities.

Table 0.2 - Most Used Modality by the Participants

	Modality Used	Frequency (n)	Percentage (%)
1.	TENS	14	29.8
2.	Mobilization and Manipulation	13	27.7
3.	Exercise Therapy	10	21.3
4.	Patient education	3	6.4
5.	Acupuncture	1	2.1
6.	Short wave diathermy	1	2.1
7.	Therapeutic ultrasound	1	2.1
6.	Missing	3	6.4

4.3.1.1 Factors that guided the selection of TENS

The participants were asked to indicate the factors that guided the selection of the most used treatment modality for treating pain in PWSCI. The participants indicated their choices from the list of 13 stated factors. The table below (Table 0.3) details the factors that the participants used to select TENS as their first choice of treatment. The cost and the duration of the treatment modality were the only factors not considered when selecting TENS (59.6% and 46.8% respectively).

Table 0.3 - Frequency and percentages of factors that guided the Selection of TENS

	Factors for Selection of Most used Modality	**Yes** **n, (%)**	**No** **n, (%)**
1.	Type of pain (neuropathic/nociceptive)	41, (87.2)	2, (4.3)
2.	Onset of pain (sudden / gradual)	34, (72.3)	9, (19.1)
3.	Duration of pain (acute/chronic)	38, (80.9)	5, (10.6)
4.	Location of pain (above the level of injury / below the level of injury)	39, (83.0)	4, (8.5)
5.	Intensity of pain (mild/severe)	40, (85.1)	3, (6.4)
6.	Pain interference with daily activity	39, (83.0)	4, (8.5)
7.	Pain interference with the overall mood	33, (70.2)	10, (21.3)
8.	Pain interference with sleep	31, (66.0)	12, (25.5)
9.	Cost of treatment modality	15, (31.9)	28, (59.6)
10.	Duration of treatment modality	21, (44.7)	22, (46.8)
11.	Patients' preference	33, (70.2)	10, (21.3)
12.	Other treatments that patients receive including past medical history	39, (83.0)	4, (8.5)
13.	Psychosocial factors (e.g., cultural considerations, depression, lifestyle factors)	41, (87.2)	2, (4.3)

4.3.1.2 Associations between the demographic profile of participants and TENS selection

The Fisher's Exact Test was used to test associations between the demographic profile of the participants and the modality used as well as associations between the modality selected and the factors that guided the selection.

There was a significant association between the age category of the participants and the most used modality (Fishers exact = 21.578, p = 0.027). A significantly younger population (20-40 years) of the participants used TENS (64.2%). Participants who held a bachelor's degree (71.4%) were significantly associated with selecting TENS as their first choice of treatment. (Fishers exact = 30.416, p = 0.043).

There was a significant association between a participant's special interest in pain in PWSCI and using TENS to treat the pain (Fishers exact =20.486, p = 0.043). Fifty-seven percent of the participants, who reported having a special interest in pain in PWSCI, used TENS most commonly to treat pain.

There was also a significant association between TENS and the use of a protocol for treating pain in PWSCI (Fishers Exact = 20.721, p = 0.04). All participants who did not follow a protocol to treat pain in PWSCI used TENS as the most used modality (87.2%).

4.3.1.3 Association between factors that guided the modality selection and TENS

The significant association between the factors that guided the selection of modalities and the most used modality, that is TENS, is listed in the table below (Table 0.4). These results show that the participants selected TENS for treating pain in PWSCI based on the type of pain (87.2%), the duration of pain (80.9%), the location of pain (83.0%), the intensity of pain (85.1%), other the treatments that the patient is receiving for pain (83.0%) and the psychosocial factors (87.2%).

Table 0.4 - Association between Factors that guided the modality selection and TENS

Factor	**Fishers exact**	**P value**
Type of pain	33.947	0.003
Duration of the treatment modality	29.339	0.024
Location of pain	29.823	0.022
Intensity of pain	31.762	0.008
Other treatments that the PWSCI received	28.437	0.047
Psychosocial factors	33.947	0.003

4.3.2 Second Most Used Modality to Treat Pain in PWSCI

Exercise was the second most used modality (n=13, 27.7%) followed by manipulations and mobilizations (n=12, 25.5%). Patient education was among the least selected treatment modalities 6.4% (n=3) to treat pain in PWSCI. Three participants used hot packs (6.4%). One participant used acupuncture, while one other used laser, and one participant used shortwave diathermy.

Table 0.5 - Second Most Used Modalities by the Participants

	Modality used	**Frequency**	**Percentage**
1.	Exercises	13	27.7
2.	Manipulations and mobilizations	10	21.3
3.	TENS	7	14.9
4.	Patient education	3	6.4
5.	Hotpacks	3	6.4
6.	Acupuncture	1	2.1
7.	Laser	1	2.1
8.	Shortwave Diathermy	1	2.1
9.	Combination	1	2.1
10.	Missing	3	6.4

4.3.2.1 Factors that guided the selection of exercises

Table 0.6 below details the factors that the participants used to select Exercises as their second most used treatment modality. All factors except for the cost of the treatment modality (59.6%) were considered when selecting exercises as a treatment choice.

Table 0.6 - Factors that Guided the Selection of Exercises

	Factors for Selection of Exercises	**Yes (n,%)**	**No (n,%)**
1.	Type of pain (neuropathic/nociceptive)	41, (87.2)	2, (4.3)
2.	Onset of pain (sudden/ gradual)	38, (80.9)	5, (10.6)
3.	Duration of pain (acute/chronic)	41, (87.2)	2, (4.3)
4.	Location of pain (above the level of injury/ below the level of injury)	38, (80.9)	4, (8.5)
5.	Intensity of pain (mild/severe)	41, (87.2)	2, (4.3)
6.	Pain interference with daily activity	41, (87.2)	2, (4.3)
7.	Pain interference with the overall mood	34(72.3)	9, (19.1)
8.	Pain interference with sleep	35, (74.5)	8, (17.0)
9.	Cost of treatment modality	15, (31.9)	28, (59.6)
10.	Duration of treatment modality	25, (53.2)	18, (38.3)
11.	Patients' preference	32, (68.1)	11, (23.4)
12.	Other treatments that patients receive including past medical history	38, (80.9)	5, (10.6)
13.	Psychosocial factors (e.g., cultural considerations, depression, lifestyle factors)	39, (83.0)	3, (6.4)

4.3.2.2 Association between the demographic profile of participants and exercise selections

The Fishers Exact Test found a significant association between the age of the participants and exercises (Fishers Exact = 26.149, p = 0.038). Most of the younger participants (20-40 years) used exercises as their second used modality to treat pain in PWSCI (84.6%).

The years of experience as a trained physiotherapist also showed a significant association with exercises (Fishers Exact = 30.088, p = 0.004). Most of the participants who had 0-20 years of experience used exercises as their second most used modality to treat pain in PWSCI (92.3%).

4.3.2.3 Association between the factors that guided the modality selection and exercises.

Fishers Exact Test was conducted to find the relationship between the factors that guided the selection of modalities and exercises. The significant relationships are listed in Table 0.7 below.

Table 0.7 - Relationship between the factors that guided the selection and exercises.

Factors	Fishers exact	P value
Type of pain	45.705	0.000
Onset of pain	44.640	0.000
Duration of pain	46.943	0.000
Location of pain	42.162	0.000
Intensity of pain	50.835	0.000
Interference with daily activities	45.705	0.000
Interference with overall mood	38.084	0.007
Interference with sleep	39.969	0.002
Duration of the modality	46.922	0.000
Patients' preference	39.966	0.003
Other treatments that the PWSCI received	43.470	0.000
Psychosocial factors	42.634	0.000

These relationships reveal that the participants selected exercises based on all these stated factors for treating pain in PWSCI. The percentages were as follows: the type of pain (87.2%), the onset of pain (80.9%), the duration of pain (87.2%), the location of pain (80.9%), the intensity of pain (87.2%), the interference with daily activities (87.2%), the interference with mood (72.3%), the interference with sleep (74.5%), the duration of the modality (53.2%), the patients' preference (68.1%), other the treatments the PWSCI is receiving (80.9%) and, psychosocial factors (83.0%).

4.3.3 Third Most Used Modality to Treat Pain In PWSCI

When asked for the third most used modality, most participants responded with manipulations and mobilizations (29.8%). Hot packs were used by 6 participants (12.8%). Patient education was used by two participants (4.3%) while another two used therapeutic ultrasound (4.3%). Interferential therapy was used by one participant (2.1%).

Table 0.8 - Third Most Used Modality

	Modality	**Frequency**	**Percentage**
1.	Manipulations and mobilizations	14	29.8
2.	Exercise	6	12.8
3.	Hot pack	6	12.8
4.	TENS	5	10.6
5.	Referrals to doctors /psychologist	3	6.4
6.	Patient education	2	4.3
7.	Therapeutic Ultrasound	2	4.3
8.	Acupuncture	2	4.3
9.	IFT	1	2.1
10.	Not applicable	2	4.3
11.	Missing	3	6.4

4.3.3.1 Factors that guided the selection of manipulations and mobilizations

The participants were also asked to indicate the factors that guided the selection of their third most used treatment modality. The frequency and percentages of the responses are depicted in Table 0.9 below. Like TENS and exercises, all factors for the selection of manipulations and mobilizations were considered except the cost of the treatment (57.4%).

Table 0.9 - Factors that Guided the Selection of Manipulations and Mobilizations

	Factors for Selection of Manipulations and Mobilizations	**Yes (n, %)**	**No (n%)**
1.	Type of pain (neuropathic/nociceptive)	41, (87.2)	2, (4.3)
2.	Onset of pain (sudden/ gradual)	37, (78.7)	6, (12.8)
3.	Duration of pain (acute/chronic)	37, (78.7)	6, (12.8)
4.	Location of pain (above the level of injury/ below the level of injury)	41, (87.2)	2, (4.3)
5.	Intensity of pain (mild/severe)	39, (83.0)	4, (8.5)
6.	Pain interference with daily activity	40, (85.1)	3, (6.4)
7.	Pain interference with the overall mood	36, (76.6)	7, (14.9)

8.	Pain interference with sleep	36, (76.6)	7, (14.9)
9.	Cost of treatment modality	16, (34.0)	27, (57.4)
10.	Duration of treatment modality	24, (51.1)	19, (40.4)
11.	Patients' preference	31, (66.0)	12, (25.5)
12.	Other treatments that patients receive including past medical history	42, (89.4)	1, (2.1)
13.	Psychosocial factors (e.g., cultural considerations, depression, lifestyle factors)	39, (83.0)	4, (8.5)

4.3.3.2 Associations between the demographic profiles of the participants and manipulations and mobilizations

We did not find any associations between the participants' demographic profile and selecting manipulation and mobilizations to treat pain after SCI.

4.3.3.3 Associations between the factors that guided the selection and manipulations and mobilizations

The relationship between the factors that guided the selection of modalities, and the third most used modality was studied using the Fishers Exact Test. The results revealed that the participants used all the stated criteria except the cost of the treatment modality to select manipulations and mobilizations. The significant relationships are presented in the table below (Table 0.10). The percentages were as follows: the type of pain (87.2%), the onset of pain (78.7%), the duration of pain (78.7%), the location of pain (87.2%), the intensity of pain (83.0%), the interference with daily activities (85.1%), the interference with mood (76.6%), the interference with sleep (76.6%), the duration of the modality (51.1%), the patients' preference (66.6%), other the treatments the PWSCI is receiving (89.4%), psychosocial factors (83.0%).

Table 0.10 - Relationship between Factors That Guided the Selection and Manipulations and Mobilizations

Factors	Fishers exact	P value
Type of pain	55.246	0.000
Onset of pain	50.439	0.006
Duration of pain	49.628	0.010
Location of pain	56.940	0.000
Intensity of pain	51.204	0.004
Interference with daily activities	52.543	0.002
Interference with overall mood	50.989	0.004
Interference with sleep	50.907	0.004
Duration of the modality	48.631	0.017
Patients' preference	56.392	0.000
Other treatments that the PWSCI received	61.794	0.000
Psychosocial factors	50.839	0.005

4.4 USE OF OUTCOME MEASURES

Majority of participants in this study used an outcome to measure the pain in PWSCI (n=42, 91.5%). The Visual Analogue Scale (VAS) was the most used outcome measure (n=33, 70.2%). While six other participants used numerical rating scale (NRS) (12.8%), neuropathic pain scale was used by 2 participants (4.3%). Only one participant used Borg scale (2.1%). This data is represented in the figure below (Fig. 0.2)

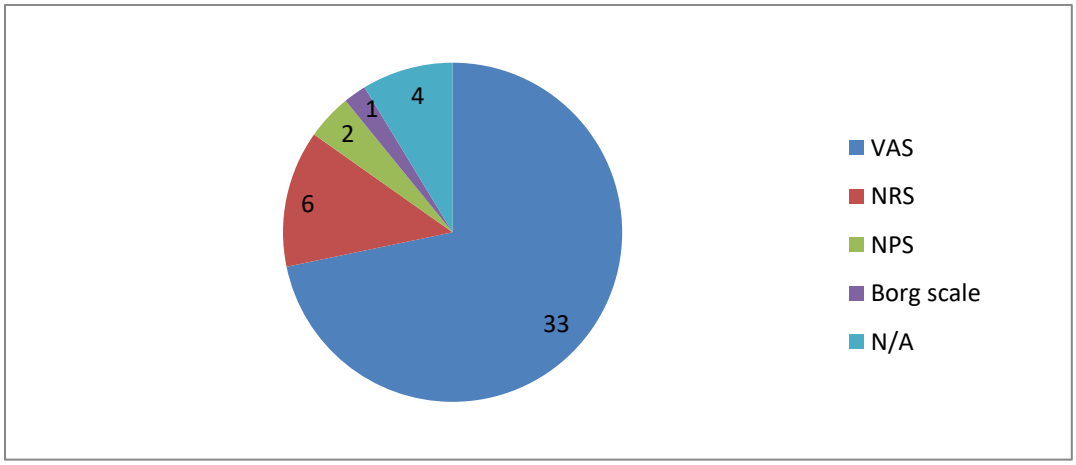

Fig. 0.2 - Use of Outcome Measures

Although four participants did not use any outcome measures, they asked the patient how they felt physically in terms of exertion, intensity of pain (increased or decreased), and change of pain behaviour after the treatment and observed their functional performances before and after the treatment (n=4, 8.7%).

Most of the physiotherapists reported that they did not follow a protocol for managing pain in PWSCI (n=41, 87.2 %). While twenty-eight (59.6%) participants spent 0-30 minutes on each patient for the management of pain while 18 participants (38.3%) spent 31-60 minutes treating the patient's pain.

4.5 TREATMENT RECOMMENDATIONS

The participants were asked to recommend treatments for the management of acute and chronic nociceptive pain as well as acute and chronic neuropathic pain. The recommendations indicated by the participants are being presented in this section.

4.5.1 Acute Nociceptive pain

Participants recommended other treatment modalities for treating acute nociceptive pain (n=13,27.7%) (Fig 4.3) namely electrotherapy modalities such as hot/cold packs (n=6,12.8%), ultrasound (n=3, 6.4%), referral to doctor's (n=2, 4.3%), shortwave diathermy (n=1,2.1%) and acupuncture (n=1. 2.1%). Exercises were recommended by eleven participants (23.4%). Eight participants (17%) recommended a combination of TENS with exercises and hot or cold pack or TENS with hot or cold packs alone or TENS in combination with mobilizations and manipulations. Seven participants (14.9%) recommended TENS alone and another seven participants (14.9 %) recommended mobilizations and manipulations alone to treat acute nociceptive pain.

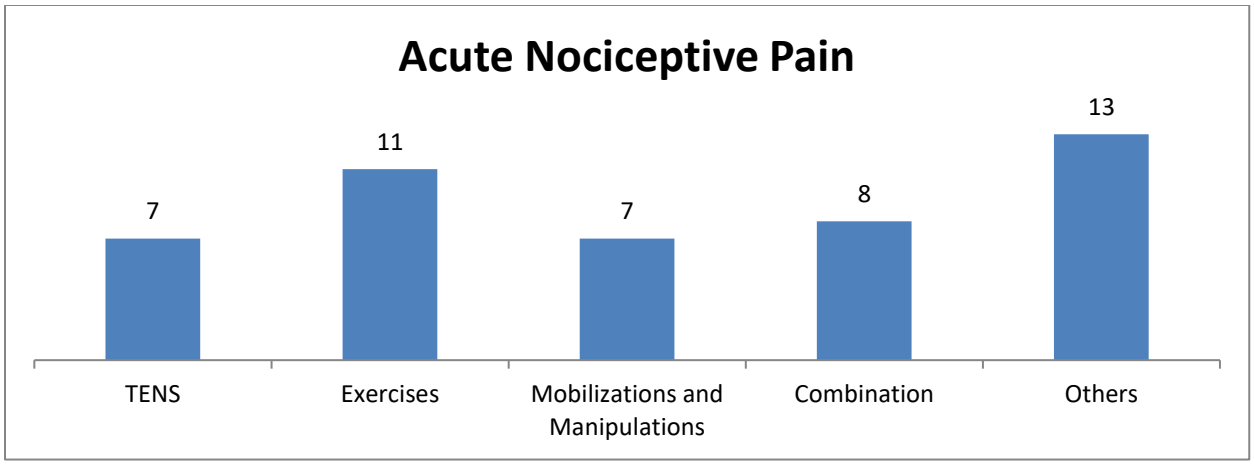

Fig. 0.3 - Recommendations for treating Acute Nociceptive Pain

4.5.2 Chronic Nociceptive Pain

The recommendations from the participants for treating chronic nociceptive pain are illustrated in the figure below (Fig. 0.4). Fifteen participants recommended the use of a combination of two or three therapies to treat chronic nociceptive pain in PWSCI. These combinations included TENS, exercise, hot/cold pack along with patient education or TENS, mobilizations and manipulations, hot/cold packs or TENS, soft tissue manipulations, hot/cold packs, or TENS with exercises. While 10 participants recommended exercises alone, another eight participants recommended mobilizations and manipulations. Two participants recommended taping and acupuncture.

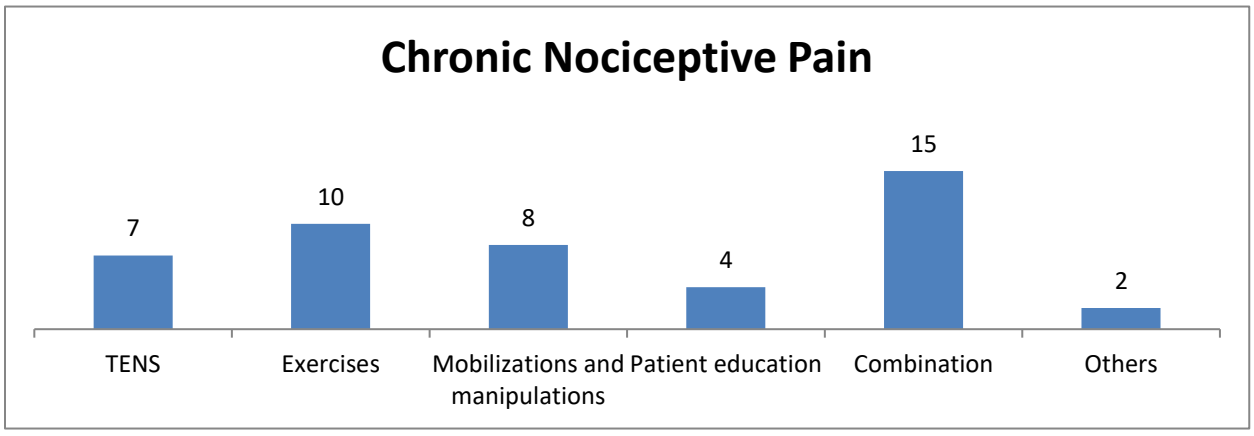

Fig. 0.4 - Recommendations for treating Chronic Nociceptive Pain

4.5.3 Acute Neuropathic Pain

Recommendations from the participants on how to treat acute neuropathic pain are illustrated in the figure below (Fig. 0.5). A combination of two or more therapies was recommended by most participants to treat acute neuropathic pain in PWSCI (n=15). These combinations mostly included TENS and exercises (n=6), TENS and neural mobilizations (n=4) or TENS, exercises, and pain education (n=5). Fourteen participants recommended TENS. One participant recommended educating the patient on management techniques to monitor and manage pain while another participant recommended desensitization techniques for the treatment of acute neuropathic pain.

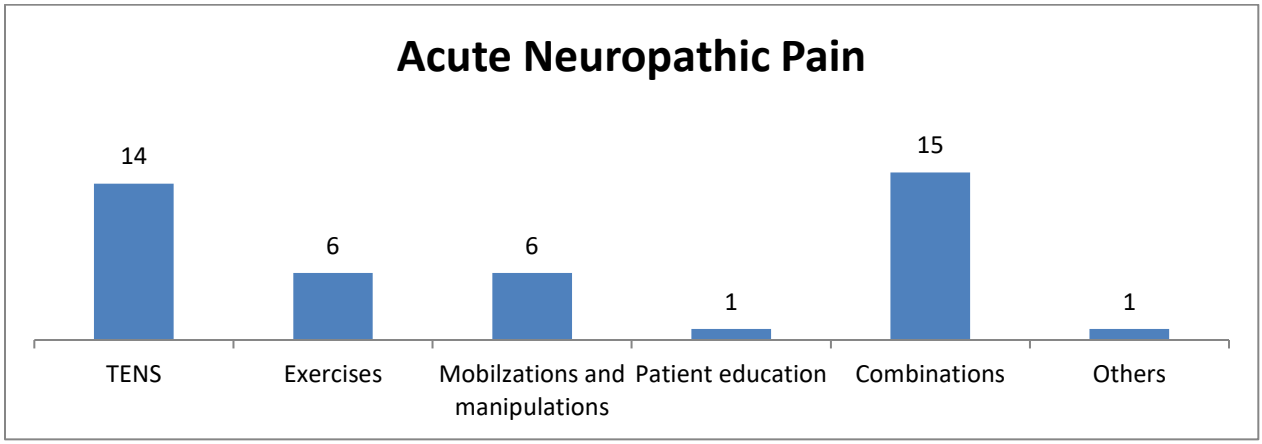

Fig. 0.5 - Recommendations for treating Acute Neuropathic Pain

4.5.4 Chronic Neuropathic Pain

Combinations of two or more modalities were also recommended by the participants to treat chronic neuropathic pain (n=19) (Fig. 0.6). These combinations included TENS and exercises (n=9), TENS and neural mobilizations (n=3) or TENS, exercises, and pain education (n=7). Six participants suggested using exercises that included nerve flossing exercises, strengthening exercises, relaxation, and breathing exercises. Other therapies such as desensitization techniques and postural correction were recommended by four participants. One participant recommended educating the PWSCI on coping and management strategies for chronic neuropathic pain.

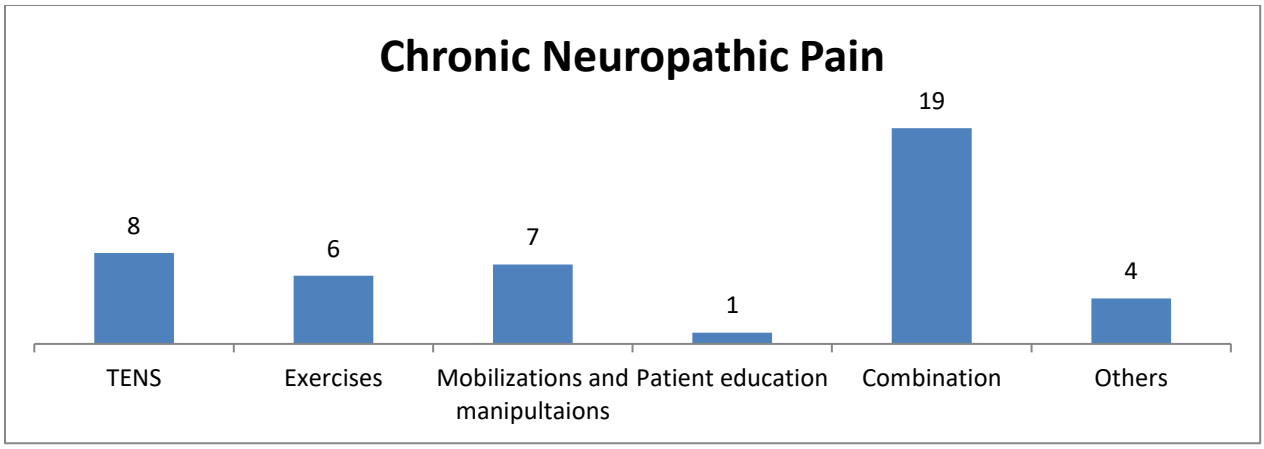

Fig. 0.6 - Recommendations for treating Chronic Neuropathic Pain

4.6 OTHER CONSERVATIVE TREATMENTS

Participants also recommended the following conservative treatments as an important part of treating pain in PWSCI. Patient education on pain (n=21), postural corrections and exercises (n=11), and ergonomics (n=2) wheelchair seating (n=7), and self-mobilization strategies (n=5). The participants thought that these conservative treatments are important to understand for the patients to comply with the therapy programs indicated by the physiotherapist.

4.7 SUMMARY

This chapter reported the various findings of the study. The demographic data of the physiotherapists were presented to state the profile of physiotherapists treating pain in PWSCI. The top three modalities used by physiotherapists to treat pain after SCI were presented. The relationships between the selection criteria and the modality selected were statistically examined to determine the factors that guided the choice of the treatment modality. The use of outcome measures by physiotherapists to measure pain and treatment recommendations were also statistically examined. The next chapter will discuss these results.

CHAPTER 5 - DISCUSSION

This study aimed to determine the management of pain in PWSCI by physiotherapists in South Africa. This section will discuss the study findings against literature according to the objectives set out in section 1.2.3. The profile of the physiotherapists treating PWSCI will be discussed first, followed by the discussion of the modalities the physiotherapists used to treat pain and the factors that influenced the selection of a particular modality. Furthermore, this chapter provides information on the relationship between the factors that guided the selection of a modality and the most used by the participants to treat pain in PWSCI.

5.1 DEMOGRAPHIC PROFILE

Most physiotherapists in this study were between the ages of 20 – 40, with a mean age of 36.9, similar to another South African study which found an age range of 27-37 years (Louw, Berner, Tiwari et al., 2020). A cross-sectional; study among physiotherapists in India reported the mean age of practicing physiotherapists as 28.6 years (Aditya Jadhav, Gupta, Nataraj et al., 2021). These studies show the current trend of younger people being in the profession. The nature of this study was an online survey and younger people are found to be more proficient in the use of technology (Broady, Chan and Caputi, 2010) and hence be able to participate in online surveys.

Similarly, to Louw et al. (2020), we also found that the majority of participants were female, our findings further emphasizing female dominance in the physiotherapy profession. A survey among physiotherapists in India reveals that the number of female physiotherapists was almost double the number of male physiotherapists (Aditya Jadhav et al., 2021). A literature review on the evolution of German physiotherapy describes its emergence as a profession, particularly for women (Schiller, 2021). The high female dominance is attributed to the opportunities of private practice, which gives them the flexibility in work hours and also the opportunity to work part time (Brosnan, 2017). The fact that most of the physiotherapists in our study were females practicing in private facilities further confirms this statement.

5.2 TREATMENT MODALITIES PHYSIOTHERAPISTS USED TO TREAT PAIN IN PWSCI IN SOUTH AFRICA

Literature has identified TENS to be beneficial for pain in spinal cord injury from as early as 1974 (Mark, 2014). It is widely used around the world for providing analgesia because it's non-invasive, inexpensive, and can be self-administered (Dissanayaka, Banerjee and Johnson, 2014). Most physiotherapists who participated in this study used TENS as their most common modality of treatment. In a meta-analysis of low-quality randomized controlled trials (RCTs), it was found that TENS was effective in reducing neuropathic pain which resulted from spinal cord injury (Krumme and Weinmann, 2020). When treated with TENS, pain reduced one to two points more on a 10 point scale than when compared with placebo TENS treatments (Krumme and Weinmann, 2020). This effect of TENS on neuropathic pain in PWSCI could be the reason why most physiotherapists chose TENS as their first-line therapy. In our research physiotherapists either used TENS as a monotherapy or in combination with mobilizations and manipulations or exercises.

Apart from scientifically established benefits, some of the merits of TENS in terms of the device may be another reason why it is popular among physiotherapists. It is a small battery-operated device that has electrodes connected to it. The comparatively smaller size of TENS makes it handy to use daily, especially for home-based and community-based treatments. It's a device with minimal adverse effects for the treatment of pain and furthermore, the pain relief provided by TENS is rapid and some patients even report prolonged analgesic effects after treatment (Mark, 2014). It can be used for both the nociceptive and neuropathic type of pain, and it is reusable (Grover et al., 2018). The TENS device and the accessories are inexpensive and can be easily bought over the counter or online (Gourav and Mark, 2013). The easy availability of the TENS device may also have contributed to the high use of TENS by physiotherapists. However prescribing TENS for the management of pain to the financially poor SCI patients in South Africa could be challenge due to the affordability.

Exercises were the second most used modality by the participants in this study. Spinal cord injury is also associated with cardiovascular risk factors which includes hypercholesterolemia, diabetes mellitus, and hyperlipidaemia (Crane, Hoffman and Reyes, 2017). People with SCI tend to adopt a sedentary lifestyle owing to their physical disability (Kooijmans, Post, Stam et al., 2017). This state of low physical fitness combined with low aerobic capacity and reduced upper body muscle

mass can cause fatigue, pain, and possible upper limb injuries (Davis, Kumaran D, Nair et al., 2017). The benefits of exercises such as increasing strength, endurance, and flexibility, building up muscle mass, reducing and maintaining body weight, are well established by researchers in people with and without disabilities (Sluka, Frey-Law and Hoeger Bement, 2018). Exercises also have beneficial effects on type 2 diabetes, hypercholesteremia, and reducing the risk of cardiovascular diseases (Miller and Herbert, 2016). Exercises improve mental wellbeing and sleep quality (Candiri and Talu, 2020) and provide analgesic effects from the endorphin hormones that are secreted as a result of exercises, and activates the peripheral opioid receptors in people without disabilities (Sluka et al., 2018).

In the current study, physiotherapists recommended exercises to treat neuropathic and nociceptive pain in PWSCI. A Swedish study found strengthening exercises and aerobic exercises was effective in relieving pain for both nociceptive and neuropathic pain (Norrbrink, Lindberg, Wahman et al., 2012). The analgesic effect of exercises on neuropathic pain seen in their study was comparable to the effects of antidepressants and anticonvulsant drugs used to treat pain in PWSCI. Therapeutic exercises can thus be used as a very powerful modality for the treatment for the management of pain in PWSCI. Despite the benefits of exercise on overall health and pain in PWSCI, there are psychological and physical barriers preventing them from regular physical activity. Accessibility, architectural barriers, transportation problems and lack of motivation were recorded as some of the barriers to exercising in PWSCI (Jaarsma, Dijkstra, Geertzen et al., 2014). Therefore, physiotherapists should bear in mind these barriers to exercises, when advising exercises for pain. This will facilitate the PWSCI to be prepared to overcome these barriers. High level motivation from the therapists is also required to inspire the patients to take up physical activity as way of life (Jaarsma et al., 2014).

In addition to these benefits, the minimal cost involved in prescribing exercise therapy makes it popular among physiotherapists (Seth, 2014). Physiotherapists across South Africa have reported inefficiency in the procurement process of therapy devices, meagre budgets, lack of transport to collect and deliver therapy devices, and lack of spare parts and repair technicians (Sherry, 2014). In such a scenario, where access to a rehabilitation facility is limited and resources in terms of infrastructure and healthcare professionals are meagre, minimal investment therapeutic modalities such as exercises are very resourceful. People with SCI in South Africa faces problems with

inadequate funds and transportation facilities when it comes to access of rehabilitation centres (Joseph, Scriba, Wilson et al., 2017a). Therefore, equipping PWSCI with home exercise programs for the self -management of pain may be a viable way to keep them pain free and healthy. The exercises can perhaps be taught to the caregivers also so that they can also positively motivate the PWSCI in doing the exercises.

Manipulations and mobilization techniques were the third most used modality for treating pain in PWSCI. These manual therapy techniques are applied at varying amplitudes and speeds to joints and related soft tissues (Kisner et al., 2017). The passive skilled techniques utilize the physiological and accessory motions for therapeutic purposes (Kisner et al., 2017). Mobilization is a manual treatment in which the joints are moved passively within the normal integrity limits and the normal range of motion. However, manipulation is a high-velocity thrust in which there is rapid adjustments of the joints often associated with a pop sound (Harihara Prakash, Mehta and Patel, 2020). The participants either used these techniques independently or in combination with exercises or TENS. A combination of manipulations and mobilizations with exercise provides better analgesia for musculoskeletal pain (Peters, Schmitt, Verhagen et al., 2020). Manipulations and mobilizations are most effective for the management of pain in PWSCI when used in combination with other modalities such as exercises (Gross, Langevin, Burnie et al., 2015). However, manipulations and mobilizations must be performed with extreme precaution in patients with SCI, because of the absence of sensation below the level of injury. This modality requires further research on which type of SCI may benefit more from its usage and guidelines regarding its safe use in PWSCI.

Thermotherapy, acupuncture, dry needling, taping, and cognitive behavioural therapy were among the least used modalities for treating pain in PWSCI in this study. In most cases, muscle spasm is one of the main causes of nociceptive pain (Bonezzi, Fornasari, Cricelli et al., 2020). Superficial heating agents have to reduces muscle shortening caused by spasm, which may be caused by underlying musculoskeletal or neurologic disease, and further gives the best results when used in combination with an exercise program, manipulations, and mobilizations. (El-Tallawy, Nalamasu, Salem et al., 2021). The results from this current study also are by this finding. Participants mostly used hot packs in combination with exercises such as flexibility exercises and soft tissue manipulations. This will in turn reduce contractures and joint stiffness, increase joint range of

motion and function, and decrease pain (El-Tallawy et al., 2021). Therapeutic cold, when applied to the area of injury, decreases haemorrhage, oedema, the local inflammatory response and thus reduces pain perception. These changes are attained by the local vasoconstriction provided by the application of cold packs (El-Tallawy et al., 2021). Application of cold packs can therefore help reducing pain in acute and chronic painful conditions. Modalities like hot and cold packs poses the risk of burns in PWSCI when applied over skin areas where the sensation is compromised. Extreme care must be given when applying these modalities especially at home.

Acupuncture is a traditional treatment that originated in China, in which fine needles are inserted into various acupuncture points of the body. These points may be distal or local to the area that requires treatment (White, 2006). Literature suggests that acupuncture is effective for short-term pain relief in various musculoskeletal conditions in people without disabilities (Wu, Meleger, Witkower et al., 2015a). This result may be expected in the case of PWSCI also. Although acupuncture is a promising treatment for many conditions, the lack of standardization, lack of guidelines to regulate acupoint selection, time of initiation, duration, and stimulation frequency makes its uses controversial (Fan, Cavus, Xiong et al., 2018). This could be a reason for acupuncture being not so popular among our participants.

Kinesiotaping is a concept that originates from traditional athletic taping. The thick sticky, firm material restricts the range of motion of a joint / muscle by immobilization and stabilization. Thus the tape prevents secondary injury, reduces pain and oedema (Wu, Hong and Chou, 2015b). The authors also suggest that kinesiotaping gives the best results when it is used as an adjunct with other pain treatment modalities. Kinesiotaping helps the patient to carry on with the activities of daily living without much pain interference or movement restrictions. Since the patients can carry on with their daily activities, some patients prefer their physiotherapists to use kinesiotaping (Krajczy, Krajczy, Bogacz et al., 2020) and although reduced pain the reduction was not significant (Tamburella, Scivoletto and Molinari, 2014). This is probably why some of the participants preferred to use taping to treat pain in PWSCI. The physiotherapists must take necessary precautionary steps while applying the kinesiotaping. The tape must not be applied over open wound or areas with altered sensation. They also must check for allergic reactions to the tape before applying. Despite its benefits, contrary to the global trend, kinesiotaping was amongst the least used modality used by physiotherapists in South Africa. The absence of high-quality evidence

regarding kinesiotaping for pain in PWSCI might have been a significant cause for its least usage (Krajczy et al., 2020).

Cognitive behavioural therapy (CBT) incorporates biopsychosocial model in the management of pain. It targets mal-adaptive behaviours of the pain patients, his/her cognitive reactions to pain and the socio-environmental responses that influence these reactions (Burke et al., 2017). Cognitive behavioural therapy generally includes relaxation training, problem solving training, setting and working towards behavioural goals, guiding behavioural activation, and cognitive restructuring (Wu et al., 2015a). Even though CBT is most commonly used by psychologists and occupational therapists, physiotherapists also have already started to use this psychological intervention to contribute considerably to better patient care (Driver, Kean, Oprescu et al., 2017). Cognitive behavioural therapy was suggested as a potentially efficient intervention for SCI pain management (Turk and Gatchel, 2018).The few trials of CBT associated with SCI, revealed it's potential efficiency, however more rigorous trials are needed (Ehde, Dillworth and Turner, 2014). Physiotherapists in this study probably also have inferred the need for changes in the practice for treating pain in PWSCI and that could be the reason why some physiotherapists chose CBT as a treatment modality for pain in PWSCI. However, CBT was also amongst the least used modalities. Currently CBT being a psychotherapeutic intervention is not a part of the undergraduate curriculum. In addition, lack of knowledge and training to confidently implement it in practice may have contributed to this trend.

5.3 ASSOCIATION BETWEEN DEMOGRAPHIC PROFILE OF THE PARTICIPANTS AND THE MOST USED MODALITY

The current study found that most of the younger physiotherapists of the study (20-40 years) used TENS more than the other age category. This trend may be because our study sample mostly consisted of younger physiotherapists. Additionally, there is a chance that we missed the older physios since the study was done on an online platform. Also, since they contacted through the associations and not directly. There may have been physios who are not registered on these organizations and who are not active on social media.

Seventeen physiotherapists showed a special interest in treating pain in PWSCI. As mentioned earlier the quality of treatment rendered by a healthcare professional is prone to be influenced by

their interest, and attitudes towards pain (Morin Chabane, Coutinho, Laliberte et al., 2018). Nonetheless results from a study among physiotherapists who treated low back pain reveals that they were not equipped with the required skills and confidence to successfully discuss and cater to the needs of the patient with pain (Synnott, O'Keeffe, Bunzli et al., 2015). In the present study, most of the physiotherapists were young with a mean 7.06 years of experience specifically in SCI rehabilitation. As mentioned earlier there is a possibility that they have not seen enough SCI patients with pain and hence is not confident and equipped enough to treat these patients. There also exists a possibility that the physiotherapists may have tried their own combinations of modalities and have not found a combination that gave good results to the patients. This perhaps may be the reason for the lack of interest in most of the physiotherapists in this study. Most of the physiotherapists in this study were bachelor's degree holders and did not have post-graduate qualifications. The SCI is a specialty area in physiotherapy, and insufficient knowledge and clinical expertise in treating patients with pain and SCI may also have contributed to this finding. Although we cannot discount the various factors applicable to attempting a postgraduate degree, such as financial feasibility, availability of expert supervisors, and appropriate academic abilities. We therefore cannot make conclusions to our participant's highest qualifications and their special interest in pain after SCI. Even though a master's degree can accentuate one's clinical expertise, interventions such as pain management should be mastered at the undergraduate level. Additionally, the physiotherapists should update themselves periodically by means of continued education programs to be in par with the current trends. This helps them to render evidence-based practise and quality patient care.

5.4 FACTORS THAT GUIDED THE MODALITY SELECTED

The actual outcome of physiotherapy pain management is governed by several factors (Semmons, 2019). An effective pain management strategy should be tailored to specific pain-generating mechanisms in each patient (Widerström-Noga, Biering-Sørensen, Bryce et al., 2014). The choice of a modality for pain management is highly dependent on these mechanisms. Determining factors that guided the selection of a particular modality was one other objective of the study.

The physiotherapists were asked to select from the stated criteria, the factors that may have guided their selection of the most used modality to treat pain in PWSCI. The stated options included the type of pain (neuropathic/nociceptive), the onset of pain (sudden/gradual), duration of pain,

location of pain, the intensity of pain, pain interference with daily activities, pain interference with overall mood, pain interference with sleep, cost of treatment modality, duration of treatment modality, patients' preference, and other treatments the patients receive, including the past medical history. In a clinical setting, these factors are very relevant to make treatment decisions concerning the pain condition of PWSCI (Widerström-Noga et al., 2014). The finding of the current research was also in agreement with this. Considering these factors whilst deciding on a treatment strategy is imperative. The type of pain, whether it is nociceptive or neuropathic in nature is very important in deciding the treatment modality. For instance, TENS may be effective in managing pain in both neuropathic and nociceptive types of pain (El-Tallawy et al., 2021). However, a heating modality like the therapeutic ultrasound or hot packs may be contraindicated in the case of a neuropathic pain patient, considering the probable sensory impairment that is involved. Study shows that TENS is more effective for pain at the level of injury rather than the radiating pain (Mark, 2014). Accordingly, TENS as a treatment modality is most effective when the physiotherapists recognize factors like the type of pain that the PWSCI is experiencing, its duration, location, and intensity. Contraindications associated with the application of TENS must be monitored against the other treatments that the patient is receiving (Mark, 2014).Transcutaneous electrical nerve stimulation is contraindicated in patients where spinal stimulators are placed (Mark, 2014). If only the physiotherapist is aware of this fixation on his or her patient, possible precautions can be considered, and adverse effects can be avoided. For this reason, the physiotherapists must be aware of other treatments that the patient is receiving.

The physiotherapists selected exercises as their second most used modality based on all the 13 stated factors except the cost of the treatment modality. The selection of a treatment strategy is based on proper evaluation of the condition of the patient. History taking is indeed the basic step in the planning of a treatment strategy and is very important to the orientation on the health problems faced by the patient. This may be with regards to the, type of pain, duration of the pain (acute/chronic), impairments, activity limitations, sleep restrictions, restrictions in social participation, personal and environmental factors (Oostendorp, Elvers, Mikolajewska et al., 2017). For instance, the psychosocial factor is an important indicator of prolonged disability, as they contribute to the transition of an acute condition to a chronic disabling condition (Peters et al., 2020). In such a scenario, the physiotherapist's awareness of the patient's psychosocial status can help them to design a treatment strategy that can alleviate the risks posed by psychosocial factors.

Strategies like group exercise therapy sessions can be arranged. Group exercises as part of a wellness program have proved to benefit pain and mood in PWSCI (Crane et al., 2017). According to previous research, a multimodal approach, including therapeutic interventions, patient education, psychosocial support, an active lifestyle, peer, and family support, can reduce the long-term psychological and socioeconomic burden of pain in PWSCI (Malfliet et al., 2019). These benefits can be very well attained by using of exercises. The physiotherapists in South Africa are possibly aware of these factors that can contribute to the pain generating mechanisms and hence selected exercises based on these factors.

Our participants selected their third most used modality, manipulations, and mobilizations also based on all the 13 factors. The factors such as interference of pain with the daily activities of life, interference of pain with sleep, and pain interference with overall mood are equally important factors like the type of onset duration, location, and intensity of pain. Good sleep is important for good health and wellbeing (Gulia and Kumar, 2020). It is a fact that the quality of life is compromised in PWSCI due to pain (Hearn, Cotter, Fine, and Finlay, 2015). Decreased sleep or disturbed sleep can only add to this burden. A positive correlation exists between impaired sleep and pain severity necessity to assess the interference of pain with sleep has been identified (Ozlem Celik et al., 2014). Ozlem Celik et al. (2014) further found that PWSCI had reported trouble falling asleep, waking several times in between the sleep, and had to take medications to fall asleep. Keeping in line with recommendations by literature, physiotherapists in our study examined the interference of pain with sleep when selecting the treatment modalities. Poor sleep can act as a barrier to an effective pain management program (Malfliet, Ickmans, Huysmans, Coppieters, Willaert, Bogaert et al., 2019). Similarly, the overall mood, a positive attitude, and a good mood can improve the general condition of the PWSCI. Pain following SCI has a complex relationship with the mood of the patient (Kennedy and Hasson, 2017). Considering the pain interference with pain is therefore important for planning a treatment strategy. The physiotherapists of our study considered the mood factor, which is in line with the existing literature.

The cost of the treatment administered was an important factor that most physiotherapists considered. South Africa being among the most unequal nations in the world where finances are concerned, there is a disproportionate distribution of money and resources between various geographical areas (Mji et al., 2017). South Africa's healthcare system is dominated by private

healthcare facilities (Theresa Du, Surona, and Gubela, 2014), an evident inequality as the majority of the population relies on public services. (Morris, Grimmer, Twizeyemariya et al., 2019). Van Rensburg (2014) found that 44% of the health expenditure happens to be in the private sector which only serves about 16% of the South African population. For the rest of the South Africans, healthcare is either inaccessible due to geographic location or financial constraints (Morris et al., 2019). The costs of treatments in the private sector are much higher when compared to the rates in the public sector. In a developing country like South Africa where the inequalities between the upper and lower strata of people are broad, most of the population cannot afford health insurance. In such a scenario, physiotherapists must consider the cost of the treatment.

Physiotherapists must adhere to safe practices without causing harm to the patient. Knowing other treatments that the patient receive is very important in safely using treatment modalities. It is only then the treating physiotherapist may be aware of any possible contraindications to be expected. For instance, TENS is a minimal risk modality to be used in most patients. However, there are chances that TENS can adversely affect the patient if there are underlying medical conditions such as cardiovascular disease (or an implant) (Mark, 2014). The physiotherapists in our study always chose their treatment modality after enquiring about other treatments that the patient received.

5.5 USE OF OUTCOME MEASURES

Health practices are highly dependent on diagnostic measures to diagnose and decide the consequent treatment plans. Outcome measures are widely used by allied health professionals to determine the effect of therapy (Williams, Davies, Kolic, Caserta, James, and Unsworth, 2020). It is an important element of good clinical and evidence-based practice (Mehta and Grafton, 2014). The need to practice evidence-based treatments is crucial and using an outcome measure is of due importance. The documentation of the functional status of the patient is crucial in assessing the prognosis of the patient. The current study found that all physiotherapists used an outcome measure to measure pain before and after pain treatment. Most of the physiotherapists used the visual analogue scale (VAS) to measure the outcome of pain treatment. The VAS is a unidimensional scale that can be used in a varied population. It is available to use in the public domain at no cost (Hawker, Mian, Kendzerska and French, 2011). The popularity of using VAS maybe because of its simplicity in administration and the minimal demand that it puts on the patient. The VAS can be administered amongst a wide range of the population thus perhaps making it popular amongst

physiotherapists. The simplicity of VAS may help the patient to better communicate the impact of their pain to the treating physiotherapist.

Most of the physiotherapists who participated in this study reported that they do not use a particular protocol for managing pain in PWSCI but rather devised their treatment plan based on their clinical experience and the symptoms manifested by the PWSCI. Clinical experience or the knowledge derived from practice is built over years from hands-on practice with the patients. Hence it will be efficient in solving patient's problems in everyday clinical practice. Evidence- based knowledge is more useful only when it's well integrated with one's own clinical experience (Bernhardsson, Öberg, Johansson et al., 2015). Also, every healthcare facility may not have a particular protocol to be followed in the management of pain in PWSCI. These could probably be the reason why participants did not use a protocol for the management of pain in PWSCI. However, there is need for guidelines for the physiotherapy management of pain in PWSCI.

5.6 RECOMMENDED TREATMENTS

We asked our participants to suggest their recommendations for the management of acute nociceptive pain, chronic nociceptive pain, acute neuropathic pain, and chronic neuropathic pain.

5.6.1 Acute Nociceptive Pain

Exercises were recommended by most physiotherapists for acute nociceptive pain. Stretching exercises, stabilizing exercises, active and passive movements, were the most suggested among exercises. Research shows that regular exercises can prevent hyperalgesia, by the activation of opioids and serotonin to produce analgesia in PWSCI (van der Scheer, Martin Ginis, Ditor et al., 2017). According to a physical activity guideline specifically for the SCI population, an adult with SCI should engage in 20 minutes of moderate to vigorous intensity aerobic exercises twice a week and 20 minutes of strength training, twice a week and is also recommended(Martin Ginis, van der Scheer, Latimer-Cheung et al., 2018). The treating physiotherapist plays a pivotal role in promoting physical activity and exercises among PWSCI and should persistently encourage PWSCI to take up exercises as part of their healthy living.

Deep heating modalities such as Shortwave diathermy and ultrasound, superficial heating modality such as hot packs, and acupuncture, were the other recommendations indicated by the

physiotherapists in this study. However previous research states that heat application be it deep or superficial is more effective in the subacute and chronic phase of pain (El-Tallawy et al., 2021). Heating modalities also pose a risk of burns in case of PWSCI with compromised sensation. Therefore, the physiotherapists must be very cautious while treating with these heating modalities.

A study by Cardenas and Jensen (2006) shows that the pain relief duration provided by modalities such as massage and acupuncture lasted for 7 days. However, the evidence on the benefits of acupuncture on the reduction of the intensity of SCI-related pain is very conflicting, lacks standardization of process and practice principles, and is also unsatisfactory (Guy et al., 2016). Physiotherapists in this study had also recommended combinations of one or two therapeutic modalities to treat pain in PWSCI. For instance, combination of TENS, exercises, and hot packs. In addition to the therapeutic effects by the individual treatment modalities, a combination of one or two therapies is more effective than each of them applied solely as a combination of treatments has been found to provide better analgesia on the painful areas (Zubair, Sonill Sooknunan and Bashir, 2019).

5.6.2 Chronic Nociceptive pain

The use of a combination of therapies is very common in physiotherapy practice as different treatment approaches have distinct effects (Moseley, 2002). Most of the physiotherapists in this study recommended a combination of therapies for treating chronic nociceptive pain. The most recommended combinations were TENS and exercise, along with hot/cold pack and patient education. Literature supports exercise as an effective treatment in chronic pain conditions (Kroll, 2015). The cumulative pain relief of the combination of modalities and the better results with the patients may have been the cause for using these combinations.

Patient education, as recommended by physiotherapists in this study, is a popular and essential component of healthcare. Patient education aims to broaden patient's knowledge about their condition and influence their behaviour, by the medium of counselling, modifications in behaviour, and teaching (Ogwumike, Bashir-Bello and Kaka, 2020). Healthcare professionals across the globe use it as a potent tool to disseminate information, augment the self-potency of the patients, enhance self-management skills, and improve clinical outcomes (Forbes, Mandrusiak, Smith et al., 2017). Educating the patient is also important, not only that patient be aware of their condition, but also

for the patients' compliance towards the pain management program tailored by the treating physiotherapist.

5.6.3 Acute Neuropathic pain

Recommendations for acute neuropathic pain were also based on a combination of two or more therapies mostly including TENS, exercise, and manipulations/mobilizations. The TENS is effective in acute neuropathic pain (Krumme and Weinmann, 2020). The analgesic effect of TENS is brought about by the activation of nerve fibres upon applying electrical pulses to the skin surface. This causes the release of endogenous opioids, dilation of blood vessels and modifies electrical transmission. These changes will eventually lead to the relief of neuropathic pain (Mokhtari et al., 2020). The next most recommended were exercises, mobilizations and manipulations. Soft tissue manipulations were highly recommended. Soft tissue manipulation/massage is one of the most used and effective conservative pain therapy for PWSCI (Cardenas and Felix, 2009). Physiotherapists were also keen on educating the patient on the anatomy and physiology of the affected part, types of pain, differences between acute and chronic pain, probable causes of the pain, aggravating and relieving factors, fear-avoidance, the importance of being active, role of physiotherapy, coping strategies, other treatment available for management of pain, realistic outcomes of the pain management program and goal setting (Forbes et al., 2017). The physiotherapists in our study also considered patient education regarding pain, important as the patient needed to understand why they should comply with the therapy program indicated by the treating physiotherapist. Additionally, the proper understanding of their condition can empower the patient towards the desired therapy goals set by the physiotherapist.

5.6.4 Chronic Neuropathic pain

Most of our participants used a combination of therapies which mostly included TENS and exercises, TENS and neural mobilizations or TENS, exercises, and pain education. It was interesting to find that though a very small percentage of the participants, certain participants gave importance to pain neuroscience education and desensitization techniques. Rather than the physiotherapy traditional pain education, which involves anatomical, biomechanical, or pathoanatomical models of pain to understand why it hurts, modern-day physiotherapists use pain neuroscience education (PNE) (Louw, Zimney, O'Hotto et al., 2016). Similar to our study

therapists in the study by Louw et al,(2019) also recommended PNE to help their patients in pain. Pain neuroscience education works by reconceptualizing pain for people who experience pain. It increases patients' knowledge about pain using anatomical charts, plastic joint models, and educational pamphlets. Louw et al.(2019), states that this model of pain education helps patients better overcome difficulties due to pain in their everyday life and kinesiophobia (which is the fear of movement due to pain). Physiotherapists in our study had also used PNE in combination with other therapies. This finding of our survey is consistent with the previous study which states that the combined treatment program with pain neuroscience education, manual therapy and home exercise program is an effective method to reduce pain and disability and to improve performance (Saracoglu, Arik, Afsar et al., 2020). Understanding the science of pain has equipped physiotherapists to better identify a broad range of potential contributors to a patient's pain (Madden and Parker, 2020) and assists both the physiotherapists and patients to collaborate better in understanding contributors of pain and treatments that could target these contributors.

5.7 OTHER CONSERVATIVE TREATMENTS

Our participants reported postural corrections ergonomics and wheelchair seating strategies as important conservative treatments to adjunct the pain management in PWSCI. Proper ergonomics in using wheelchairs and seating strategies is very important in the daily life of PWSCI who are engaged in office-based jobs. Ergonomics is the science of examining the impact of one's means of work, conditions, process, and effect of work on humans. It also ensures and improves work comfort, safety, efficiency, and satisfaction (Alexander, Oliver and André, 2018). Improper size and type of wheelchair can affect the support, posture, function, and comfort of the patient and thus can cause pain in PWSCI. Early intervention in this area can prevent the occurrence of pain due to improper ergonomics (Arthanat and Strobel, 2006) The basic principles of wheelchair ergonomics are promoting pressure relief and postural support. Proper guidance to use wheelchair can reduce the risk of pressure sores, spasticity, and pain (Arthanat and Strobel, 2006). Hence the physiotherapists should teach proper ergonomics in using a wheelchair to PWSCI.

Similarly, postural correction also has due importance in PWSCI as a good posture can prevent pain. A lordotic posture (upright/slight rear recline), which maintains a lumbar curve, close to that of a standing individual (lordotic position), is a good posture for PWSCI using a wheelchair (Reston and Nock, 2016). Failure to maintain this posture can cause discomfort, pain, and

discomfort in PWSCI. Physiotherapists commonly use postural corrections and advice to manage spinal pain (Korakakis, O'Sullivan, O'Sullivan et al., 2019). Evidence suggests that postural interventions can potentially reduce the incidence of spinal pain (Sheeran, van Deursen, Caterson et al., 2013). Physiotherapists should take a keen interest in educating PWSCI about maintaining a good posture as it may minimize the occurrence of nociceptive pain.

Apart from these pain management techniques mentioned by the physiotherapists, we feel that strong support from the caregivers and the health care professionals is required at every stage of pain management. A study by Norrbrink and Löfgren (2016) stated that the patients wanted the healthcare professionals to be knowledgeable and interested in their pain. For this reason, we recommend that the physiotherapists should carefully listen to the pain experiences of their patients and improve pain management based on patient needs.

5.8 SUMMARY

Pain following SCI is common and affects the quality of life of PWSCI and interferes with their activities of daily living. (Burke, Fullen, Stokes, and Lennon, 2017). The interest of the treating physiotherapists towards pain can influence the quality of treatment rendered to the PWSCI (Morin Chabane, Coutinho, Laliberte, and Feldman, 2018). Hence, it becomes crucial for the physiotherapists to reflect upon how they manage pain and their special interest in treating the patients suffering from pain and SCI. This chapter discussed the findings of the research in terms of the objectives of the research. The significant findings of the current research were found to be generally in line with the existing research. The next chapter will conclude the study and highlight shortcomings and implications for future research and practice. Limitations, as well as recommendations, will also be made in the next chapter.

CHAPTER 6 - CONCLUSION

The aim of this study was to determine how physiotherapists in South Africa managed pain in PWSCI. In this chapter, conclusions will be drawn from the study. The limitations of this study and recommendations for future research will also be discussed in this chapter.

Transcutaneous electrical nerve stimulation was the modality that was most used by physiotherapists to treat pain in PWSCI. This was closely followed by exercises and manipulations and mobilizations.

6.1 LIMITATIONS

The major limitation of the study was the recruitment strategy as the sample did not represent the entire country. This study also had a low response rate which may pose a methodological limitation of a small sample size. There exist possibilities of a different result with regards to the first modality of choice, if it was a larger sample size (between TENS and exercise). The sample size was estimated using HPCSA data from 2018, even when the study began in 2019. Patient belief, mental health status (e.g., mood, depression or their ability to understand the instructions) was not considered a factor in the choice of modalities. Since the study was performed on an online platform, there is a chance that we missed physiotherapists not well-versed with technology and only received responses from physiotherapists interested in the subject of the study.

6.2 RECOMMENDATIONS

Our study highlights modalities that physiotherapists use to treat pain after SCI, and we recommend that future studies use specific recruitment strategies (such as contacting the head of the departments of the spinal rehabilitation units in South Africa directly) to have a better national representation. This may give a clearer understanding regarding the current practises in managing pain in PWSCI. We recommend that future studies assess the effectiveness of modalities, identify barriers and facilitators to pain management and explore in depth pain management from the patient’s perspective.

6.3 IMPLICATIONS OF THE STUDY

The findings of the study may be of interest to physiotherapists practicing in SCI rehabilitation settings. Understanding the methods of treating pain in PWSCI across the country can help identify areas where greater efforts in terms of implementation are required. Our findings may assist physiotherapists in identifying other treatment modalities available to treat SCI-related pain and prompt further learning in the form of pain courses, workshops, and postgraduate qualifications.

6.4 SUMMARY

This chapter is a summarization of the findings of the research. The limitations of the study were highlighted. The recommendations for future research and implications of the study in clinical practice are mentioned in this chapter.

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ANNEXURE A – QUESTIONNAIRE

Q1 Age

Q2 Gender

- Male
- Female

Q3 Please select your most appropriate job description as a Physiotherapist.

- Clinician
- Academic
- Other

Q4 Please select your current province of practice.

- Limpopo
- Mpumalanga
- Gauteng
- North-West
- Kwazulu-Natal
- Free State
- Northern Cape
- Eastern Cape
- Western Cape

Q5 Please select your current area of employment.

- Public tertiary/academic hospital
- Public specialised rehabilitation hospital
- Public Secondary/District hospital
- Public Primary hospital /clinic
- Private hospital
- Private specialized rehabilitation hospital
- Private practice
- University
- Other

Q6 Please specify the number of years of experience as a qualified physiotherapist.

Q7 Please specify the number of years of experience in the field of spinal cord injury.

Q8 Please specify your post graduate qualification and field of practice.
(Write n/a if not applicable)

Q9 Roughly how many spinal cord injury patients with pain do you treat in a month?

Q10 Do you have any special interest in pain management in people with spinal cord injury?

- Yes
- No

Q11a Please specify your most used treatment modality to treat pain in People With Spinal Cord Injury (Write the modality name in full)

Q11b Do you select the treatment modality according to any of the following criteria?

	Yes	No
Type of pain (neuropathic / nociceptive)		
Onset of pain (sudden / gradual)		
Duration of pain (acute / chronic)		
Location of pain (above the level of injury / below the level of injury)		
Intensity of the pain (mild / severe)		
Pain interference with daily activities		
Pain interference with overall mood		
Pain interference with sleep		
Cost of treatment modality		
Duration of treatment modality		
Patients' preference		
Other treatments the patients receive, including the past medical history		
Do you consider various psychosocial factors while deciding the treatment. (e.g. cultural considerations, depression, lifestyle factors)		

12a. Please specify your second most used treatment modality to treat pain in People With Spinal Cord Injury (Write the modality name in full)

Q12b Do you select the treatment modality according to any of the following criteria?

	Yes	No
Type of pain (neuropathic/nociceptive)	○	○
Onset of pain (sudden/gradual)	○	○
Duration of pain (acute/chronic)	○	○
Location of pain (above the level of injury/below the level)	○	○
Intensity of pain(mild/severe)	○	○
Pain interference with daily activities	○	○
Pain interference with overall mood	○	○
Pain interference with sleep	○	○
Cost of treatment modality	○	○
Duration of treatment modality	○	○
Patient's preference	○	○
Other treatments the patients receive, including the past medical history	○	○
Do you consider various psychosocial factors while deciding the treatment. (e.g. cultural considerations ,depression, life style factors)	○	○

Q13a Please specify your third most used treatment modality to treat pain in People With Spinal Cord Injury (Write the modality name in full)

Q 13b Do you select the treatment modality according to any of the following criteria?

	Yes	No
Type of pain (neuropathic / nociceptive)	○	○
Onset of pain (sudden / gradual)	○	○
Duration of pain (acute / chronic)	○	○
Location of pain (above the level of injury / below the level of injury)	○	○
Intensity of the pain (mild / severe)	○	○
Pain interference with daily activities	○	○
Pain interference with overall mood	○	○
Pain interference with sleep	○	○
Cost of treatment modality	○	○
Duration of treatment modality	○	○
Patients' preference	○	○
Other treatments the patients receive including the past medical history	○	○
Do you consider various psychosocial factors while deciding the treatment? (e.g., cultural considerations, depression, lifestyle factors)	○	○

Q14 Please specify any other modalities that you use that you have not mentioned above. Kindly use full form of the modality. (Write n/a if not applicable)

Q15 What is your estimated duration (in minutes) of each pain treatment session when treating People with Spinal Cord Injury?

Q16 Is your pain management dictated by a protocol? If yes please specify.

Q17 Please recommend treatment(s) that may be used to treat the following pain conditions patients with spinal cord injury.
(Write the modality name in full)

- ☐ Acute nociceptive pain
- ☐ Chronic nociceptive pain
- ☐ Acute neuropathic pain

- ☐ Chronic neuropathic pain

Q18 Might you consider using or recommending any other conservative treatment(s) (e.g. patient education, postural correction, etc) for managing pain in people with spinal cord injury? Please specify.

Q 19 Please specify the outcome measures (e.g. VAS) that you use to assess the effectiveness of the pain treatment.

ANNEXURE B - LETTERS OF APPROVAL (SASP)

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences
Department of Physiotherapy

To : South African Society of Physiotherapy administrator
From : Mrs Bernice James (Investigator), University of Pretoria

Re : **Permission to distribute questionnaire link to members**

I, Bernice James, a Master of Physiotherapy student at the University of Pretoria, Department of Physiotherapy, am requesting permission to distribute questionnaire link to the members of SASP. The questionnaire consists of 19 items, which are questions pertaining to the participants' job description, province of practice, interest in management of pain in people with spinal cord injury, criteria that aid the choice of treatment in people with spinal cord injury, recommendations from the participant, etc.

The request is lodged with you in terms of the requirements of the Promotion of Access to Information Act. No. 2 of 2000.

The title of the study is: **Determining the management of pain in people with spinal cord injury by physiotherapists in South Africa.**

Results of the study will be disseminated as a dissertation for the requirement of my degree, and I intend to publish the findings of the study in a professional journal and/or at professional meeting like symposia, congresses or other meetings of such a nature. I intend to protect the personal identity of the participating physiotherapists by assigning each therapist a random code number.

I declare that I have not commenced the study prior to receiving approval from the Faculty of Health Sciences Research Ethics Committee, University of Pretoria. The ethics clearance certificate is attached to this letter.

I humbly request you to kindly resend the questionnaire every two weeks to those members who have not taken part in the questionnaire.

Yours sincerely

Signature of the Principal Investigator
Email: bernicelx@gmail.com
Tel: 065 307 1019

Permission to distribute the questionnaire link to members of SASP is hereby granted.

Chairperson THAMSANQA N. NKUBE
NATIONAL OPERATIONS MANAGER

Signature of the chairperson

South African Society of Physiotherapy
NPO 106 - 154

Faculty of Health Sciences
Department of Physiotherapy
Fakulteit Gesondheidswetenskappe
Departement Fisioterapie
Lefapha la Disaense tša Maphelo
Kgoro ya Fisioterapi

ANNEXURE C - LETTERS OF APPROVAL (PASA)

PHYSIOTHERAPY ASSOCIATION OF SOUTH AFRICA

Dear Sir/Madam.

I trust this letter finds you well. This serves as a notice that Bernice James of the University of Pretoria Health science department has been granted permission to utilise our platform for research purposes.

Kind regards.

Please fill free to contact us for any queries.

Physiotherapy association of South Africa

Contact- 0681357832

Pheladi@physioassociationsa.co.za

Lutendo Phaswana- Chairperson

ANNEXURE D - LETTER OF STATISTICAL SUPPORT

Date: 7 / 8 /20 19

LETTER OF CLEARANCE FROM THE BIOSTATISTICIAN

This letter is to confirm that,

Name(s): MS BERNICE JAMES

from the University of PRETORIA

discussed with me the study titled _____

_____

_____

I hereby confirm that I am aware of the project and also undertake to assist, if possible, with the Statistical analysis of the data generated from the project.

The analytical tool(s) that will be used is (are) Descriptive Statistics (discrete & continuous), association tests, multivariable regression techniques.

to achieve the objective(s) of the study.

Name: PJ Becker (Tel: 012-319-2203)

Signature _____

Research Office,

Faculty of Health Sciences, UP

BIOSTATISTICS
Faculty of Health Sciences
Research Office
2019 -08- 0 7
UNIVERSITY OF PRETORIA

ANNEXURE E - DATA STORAGE

Protocol No. 785/2019

Principal Investigator(s) Declaration for
the Storage of Research Data and/or Documents

I, **Bernice James**, the Principal Investigator of the following trial/study titled: **The management of pain in people with spinal cord injury by physiotherapists in South Africa** will be storing all the research data and/or documents referring to the above-mentioned trial/study at the following address:
PHYSIOTHERAPY DEPARTMENT, UNIVERSITY OF PRETORIA

I understand that the storage for the abovementioned data and/or documents must be maintained for a minimum of 15 years from the commencement of this trial/study.

Start Date of Trial/Study: November 2019

End Date of Trial/Study: April 2021

Until Which Year Will Data Will Be Stored: 2035

Principal investigator: Ms B James

Signature 

Date 09/04/2021

Supervisor: Ms MK Mashola

Signature 

Date **09/04/2021**

Co-Supervisor: Prof. DJ Mothabeng

Signature: 

Date **09/04/2021**

ANNEXURE F - DECLARATION OF HELSINKI

Special Communication

World Medical Association Declaration of Helsinki Ethical Principles for Medical Research Involving Human Subjects

World Medical Association
Adopted by the 18th WMA General Assembly, Helsinki, Finland, June 1964, and amended by the:
29th WMA General Assembly, Tokyo, Japan, October 1975
35th WMA General Assembly, Venice, Italy, October 1983
41st WMA General Assembly, Hong Kong, September 1989
48th WMA General Assembly, Somerset West, Republic of South Africa, October 1996
52nd WMA General Assembly, Edinburgh, Scotland, October 2000
53rd WMA General Assembly, Washington, DC, USA, October 2002 (Note of Clarification added)
55th WMA General Assembly, Tokyo, Japan, October 2004 (Note of Clarification added)
59th WMA General Assembly, Seoul, Republic of Korea, October 2008
64th WMA General Assembly, Fortaleza, Brazil, October 2013

Preamble

1. The World Medical Association (WMA) has developed the Declaration of Helsinki as a statement of ethical principles for medical research involving human subjects, including research on identifiable human material and data.
The Declaration is intended to be read as a whole and each of its constituent paragraphs should be applied with consideration of all other relevant paragraphs.
2. Consistent with the mandate of the WMA, the Declaration is addressed primarily to physicians. The WMA encourages others who are involved in medical research involving human subjects to adopt these principles.

General Principles

3. The Declaration of Geneva of the WMA binds the physician with the words, “The health of my patient will be my first consideration,” and the International Code of Medical Ethics declares that, “A physician shall act in the patient's best interest when providing medical care.”
4. It is the duty of the physician to promote and safeguard the health, well-being and rights of patients, including those who are involved in medical research. The physician's knowledge and conscience are dedicated to the fulfilment of this duty.
5. Medical progress is based on research that ultimately must include studies involving human subjects.
6. The primary purpose of medical research involving human subjects is to understand the causes, development and effects of diseases and improve preventive, diagnostic and therapeutic interventions (methods, procedures and treatments). Even the best proven interventions must be evaluated continually through research for their safety, effectiveness, efficiency, accessibility and quality.
7. Medical research is subject to ethical standards that promote and ensure respect for all human subjects and protect their health and rights.
8. While the primary purpose of medical research is to generate new knowledge, this goal can never take precedence over the rights and interests of individual research subjects.
9. It is the duty of physicians who are involved in medical research to protect the life, health, dignity, integrity, right to self-determination, privacy, and confidentiality of personal information of research subjects. The responsibility for the protection of research subjects must always rest with the physician or other health care professionals and never with the research subjects, even though they have given consent.
10. Physicians must consider the ethical, legal and regulatory norms and standards for research involving human subjects in their own countries as well as applicable international norms and standards. No national or international ethical, legal or regulatory requirement should reduce or eliminate any of the protections for research subjects set forth in this Declaration.
11. Medical research should be conducted in a manner that minimises possible harm to the environment.
12. Medical research involving human subjects must be conducted only by individuals with the appropriate ethics and scientific education, training and qualifications. Research on patients or
healthy volunteers require the supervision of a competent and appropriately qualified physician or other health care professional.

ANNEXURE G - DECLARATION OF PLAGIARISM

Full names of student : **Bernice James**

Student number: **19330988**

Topic of Work: **The Management of Pain in People with Spinal Cord Injury by Physiotherapists in South Africa**

Declaration

1. I understand what plagiarism is and am aware of the University's policy in this regard.
2. I declare that this dissertation is my own original work. Where other people's work has been used (either from a printed source, Internet or any other source), this has been properly acknowledged and referenced in accordance with departmental requirements.
3. I have not used work previously produced by another student or any other person to hand in as my own.
4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

Bernice James

ANNEXURE H – ETHICS CERTIFICATE

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences

Institution: The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

- FWA 00002567, Approved dd 22 May 2002 and Expires 03/20/2022.
- IORG #: IORG0001762 OMB No. 0990-0279 Approved for use through February 28, 2022 and Expires: 03/04/2023.

22 January 2021

Approval Certificate
Annual Renewal

Ethics Reference No.: 785/2019
Title: DETERMINING THE MANAGEMENT OF PAIN IN PEOPLE WITH SPINAL CORD INJURY BY PHYSIOTHERAPISTS IN SOUTH AFRICA

Dear Mrs B James

The **Annual Renewal** as supported by documents received between 2021-01-04 and 2021-01-20 for your research, was approved by the Faculty of Health Sciences Research Ethics Committee on 2021-01-20 as resolved by its quorate meeting.

Please note the following about your ethics approval:

- Renewal of ethics approval is valid for 1 year, subsequent annual renewal will become due on 2022-01-22.
- Please remember to use your protocol number (785/2019) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.

Ethics approval is subject to the following:

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

Dr R Sommers
MBChB MMed (Int) MPharmMed PhD
Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes, Second Edition 2015 (Department of Health)

Research Ethics Committee
Room 4-60, Level 4, Tswelopele Building
University of Pretoria, Private Bag x323
Gezina 0031, South Africa
Tel +27 (0)12 356 3084
Email: deepeka.behari@up.ac.za
www.up.ac.za

Fakulteit Gesondheidswetenskappe
Lefapha la Disaense tša Maphelo

ANNEXURE I - INFORMED CONSENT

The management of pain in people with spinal cord injury by physiotherapists in South Africa

Dear Participant

You are invited to volunteer for a research study as a practicing physiotherapist in the various clinical and non-clinical institutions in South Africa. This information leaflet is to help you to decide if you would like to participate in the study. Before you agree to take part in this study you should fully understand what is involved. If you have any questions, which are not fully explained in this leaflet, please do not hesitate to ask the investigator.

This study you are invited to participate in aims to determine how physiotherapists in South Africa manage pain in people with spinal cord injury. We invite you to share and describe the modalities you use, the factors that influence the selection of the modalities as well as the outcome measures you use when evaluating and treating pain in people with spinal cord injury. The questions require 15 minutes to complete. Participation in this study is anonymous and your name will not be identified from the online questionnaire.

The study will receive ethical clearance from the Faculty of Health Sciences Research Ethics Committee, University of Pretoria. If you have any questions concerning this study, you should please contact:
Researcher: Ms Bernice James (Tel: +27653071019 / bernicelx@gmail.com)
Supervisor: Ms Kholofelo Mashola (Tel: +27123563229 / kholofelo.mashola@up.ac.za)

I hereby volunteer to take part in this study. I understand that once I submit the completed questionnaires, I will be indicating consent to participate in the study.

Bernice James