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The development of a back pain scale for Tswana speaking individuals

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CHAPTER ONE INTRODUCTION

"For all the happiness mankind can gain, it is not in pleasure, but in rest from pain." **- John Dryden (1631-1700).**

1.1 Background and rationale for the study.

"The purpose of pain is to act as a protective mechanism for the body. It occurs whenever there is tissue damage and it causes the individual to react to remove the painful stimulus". The International Association for the Study of Pain (IASP) (2012) defines pain as "an unpleasant sensory and emotional experience which we primarily associate with tissue damage or describe in terms of such damage, or both". This definition recognises that pain is a perception and not a sensation. Another definition, which is suggested in the literature, is that of "three hierarchical levels of pain: a sensory-discriminative component (location, intensity and quality), a motivational-affective component (depression, anxiety) and a cognitive-evaluative component (thoughts concerning the cause and significance of the pain) (Evans, 2012)".

The perception of pain involves more than mere sensation. Pain has affective and evaluative components and these are often just as important as the production and transmission of the pain signal (Hansen and Streltzer, 2005). Pain perception is dependent on the context in which it occurs, the attention focused on it, the presence of anxiety or fear, the memory of pain, learned pain, the patient's expectations, beliefs and coping strategies. Pain also has psychological and emotional aspects to it. It can be a conditioned response or due to psychiatric disease.

"The perception of pain is a personal experience. It is influenced by many factors, including gender, genetic, ethnic and cultural issues (Yosipovitch, et al., 2004)". "The expression of pain differs between ethnic types depending on the way in which a culture encourages or discourages the expression of pain (Newman, et al., 2005)".Distinct anatomic and hormonal features in women and men provide clues that their pain might be modulated in a different manner by a number of biologic factors. Sex differences in the structural organization and operation of the

sympathetic nervous system may account in part, for the apparent gender differences in the perception of pain (Thuan and Le Resche, 2000).

Different models of pain perception exist. These include a bio-cultural model (Bates, et al., 1993), a cognitive-behavioural model (Evans, 2007) and a bio-psychosocial model (Dalton and Coyne, 2003). The bio-cultural model incorporates biology and cultural variables and together with other cognitive and psychosocial variables affects patients' pain perceptions (Bates, et al., 1993).The cognitive-behavioural model stresses the interdependence and interrelationship of three factors of pain perception, namely behavior (social response), thinking (cognition) and feeling (emotion). The bio-psychosocial model states that responses to nociception are modulated by bio-psychosocial factors, including individualized knowledge, beliefs and attitudes that may be mediated by variations in the pain transmission process (Dalton and Coyne, 2003).

Low back pain is one of the most common musculoskeletal complaints in the industrialised world and it is also a problem in the developing world. The lifetime prevalence of low back pain has been estimated to affect 60% to 80% of the working population in the developed world and workers are likely to experience lumbar pain related to their labour activity at some stage of their lives (Bardin, 2002; Carnes, et al., 2012; Rodrguez-Romero, et al., 2013; Roussel, et al., 2013).It is calculated that 30,000 South Africans suffer daily from back and neck problems and 10% of them will become chronic problems (van Vuuren, et al., 2007).

Assessment of back pain is made easier by using scales to measure the severity (intensity) of the pain. By doing this, the therapist has an idea as to whether the treatment employed is having an effect on the pain (worsening or improvement). Scales are a convenient, easy and quick way of determining changes in the patient's symptoms (Moffet and McLean, 2006).Subjective and objective examinations are an integral part of a manual therapist's treatment protocols. A subjective assessment (history) is carried out, followed by an objective examination. Active listening to the patient's concerns about their pain, the recording of its localization, severity and consequences are all essential for good diagnosis and management of the patient (Moffet and McLean, 2006).

Appropriate assessment tools for pain need to take the patient's psychological status into consideration when analysing the outcomes of the measurement tools especially those measuring pain (Gridley and van den Dalder, 2001). Quantifying pain provides a measure of assessing the effectiveness of treatment and also helps when assessing the behaviour of the patient's pain. It provides a baseline from which to work and can be used to compare pain episodes. The quality and level of pain can be measured and recorded for future reference and for assessing the effectiveness of pain management strategies. A better understanding of a patient's perception of pain can be obtained, leading to an understanding of the impact of pain on the bio-psychosocial aspects of the patient's life (Gridley and van den Dalder, 2001). In Africa unlike in the developed world, a paucity of research into the measurement of pain exists. Historically, Anglo-American scales have been used to measure pain in Africa. These scales are not always well understood by African patients (Jelsma, et al., 1997; Yazbek, et al., 2009).

Subjective measurement of pain is done by using pain scales or measurement tools. The Verbal Rating Pain Scale (VRS), the Visual Analogue Scale (VAS) and the Wong- Baker Faces Pain Scale (WBFPS) have been used frequently in the subjective measurement of pain. The Verbal Rating Pain measure and the Visual Analogue Scale are simple, reliable and easily reproducible methods for the assessment of pain (Carlsson, 1983). The Wong- Baker Faces Pain Scale is easy to understand and is used widely and very commonly for children (Wong and Baker, 1988). It is also used, albeit less commonly, for adults and for subjects with low educational levels (Kim and Buschmann, 2006).

It has been my experience as a physiotherapist working in the clinical situation over the past thirty three years, that my black African patients do not always understand me when they are asked to fill out their back pain intensity on the VAS or Wong-Baker Faces Pain Scale. These scales are used routinely and on a daily basis in South African hospitals, clinics and private practice. The fact that the existing pain scales are not being understood in the South African setting has worried me. This lack of understanding I feel leads to the problem of incorrect quantification of pain and brings with it the repercussions of incorrect assessment and choices of treatment. I therefore wanted to develop a pain scale "that worked" for our people. Namely, a scale which gives a true reflection of the measure of the intensity of their

back pain and one which is able to monitor whether their pain was worsening or improving.

The lack of understanding of the historically used pain scales has also led to a sense of frustration for my patients and for me as well, as we do not always understand each other. It is this understanding of the level of pain severity which is essential in the assessment, treatment and monitoring of our patients' progress or lack thereof. This understanding is also of the utmost importance in ensuring that our patients get the best treatment and care, which they deserve. By finding a pain scale better suited to our local population, I would then be able to establish a true reflection of how my patients actually felt as far as the severity of their back pain was concerned. This prompted me to try and find a more appropriate measurement tool or scale for our black African patients in South Africa.

1.2 Problem statement.

There is no reliable and valid measuring tool for back pain amongst South Africans of different cultural backgrounds and different education levels. The scales which are currently being used are those from other cultures, Anglo-American in particular. Scales which are presently being used in South Africa may not be understood by persons of varying cultures and ethnicity and more appropriate scales, for measurement of pain in this population, need to be developed (Yazbek, et al., 2009).

1.3 Significance of study.

A suitable scale needs to be developed for use in South Africa. The historically used scales are not being understood by our local population of black language speakers (Yazbek, et al., 2009).This study may develop a suitable measurement tool for non-English speaking (first language) South Africans, suffering from back pain. By finding or developing and testing scales for pain, a more suitable scale for assessing back pain will be found leading to better assessment and management of pain in this population.

1.4 Operational Definitions.

The following definitions will be used throughout this thesis:

Ends of the scales= at the left, lower end of the scale, nought depicts “no pain and at the right, higher end of the scale ten depicts “worst possible pain”.

Spread of the scales= the extent of the scale being used by the participants. This is calculated by subtracting the number marked by the participants for “no pain” (at the left, lower end of the scale) from the larger number (marked by the participants at the right, upper end of the scale), for “worst pain”. e.g. if 1 is marked for “no pain” and 9 is marked for “worst pain” , then the spread of the scale is 9-1=8 which is a good spread, as the distance between “no pain” and “worst pain” should ideally be 10 (i.e. 10 for “worst pain” minus 0 for “no pain” which equals10).

The definition of best understood scale(for Study One) = the scale on which the participants fill in “no pain” and “worst pain” most accurately i.e. when they fill “no pain” in closest to nought and “worst pain” closest to ten or on the same (corresponding) number of Coins, Injections, relevant Face or shaded area on the CAS.

The definition of a “good scale” (Study Two) = a scale which has a good “spread” (the larger the better) and where “the ends” are marked at or very close to the extremes of the scale. This would imply that the participants understand the concept of “no pain” being equivalent to nought (at the lowest end of the scale) and “worst pain” being equal to ten (at the uppermost end of the scale).

The definition of best understood scale (for Study Four) = the scale on which the participants fill their present pain perception most accurately i.e. where they fill their present pain (marked out of ten) closest to or on the same (corresponding) number of Coins, Injections, or relevant Verbal Description or relevant Face.

The definition of best understood scale (for Study Five) = the scale where the participants accurately mark their “pain perception” on the scale i.e. their “pain perception” as a number out of ten corresponding accurately with the said number of either coins or injections and where the ends are marked at or very close to the extremes of the scale.

1.5 The aim of the thesis.

To develop a pain measurement tool for Tswana speaking, back pain sufferers.

1.6 Objectives of the entire thesis (comprised of five individual studies).

Study One.

This was a cross-sectional study to evaluate and establish the understanding of new pain scales and to test existing pain scales.

The aim of this study was to assess the understanding of existing scales and newly developed pain scales in one hundred Tswana speaking individuals **without** back pain. The following are the specific objectives:

(1) to describe the understanding of new scales, modified scale and existing scales.

(2) to correlate multiple pain scales.

(3) to compare the participants' understanding of original scales with their understanding of the scales when reversed.

The selection and development of the scales took place in the following way:

Due to potential problems with literacy and language as many non-word scales as possible were needed. A total of nine scales was used, some existing scales and others which were created or adapted for this study.

There were eighteen scales which were tested by participants in **Study One**. They were comprised of the nine original scales (see below) and nine scales which were the reversed versions of the original scales. The following are the scales which were tested in Study One:

1. The VAS marked from 0 to 10 (Existing scale) (Olaogun, et al., 2003; Yazbek, et al., 2009).

2. The Colour Analogue Scale (CAS) white to red (Existing scale) (Rosier, et al., 2002; Closs, et al., 2004; Bailey, et al., 2007; Subashini, et al., 2008; Bahreini, et al., 2014).

3. A Colour Analogue Scale (CAS) marked from green, yellow, orange to red (New scale).

4. The Ascending Injection Scale marked from no injection to ten injections in ascending order (New scale).

5. The Injection Size Scale marked with injections of increasing size from nought to ten (New Scale).

6. An ascending Coin Scale marked in ascending order with no Rand coins to ten Rand coins (New scale).

7. A Coin Heap Scale marked in ascending order with no Rand coins to ten Rand, but this time with the coins in heaps (Modified scale) (Salim, 1993).

8. The Wong-Baker Faces Pain Scale with six faces (Existing scale) (Wong and Baker, 1988).

9. The Wong-Baker Faces Pain Scale with only three faces (Modified scale) (Wong and Baker, 1988).

10. The reverse of all the scales.

Study Two.

This was a cross-sectional study to evaluate and assess the understanding of new pain scales and to test existing pain scales.

The aim of this study was to assess the understanding of existing scales and newly developed pain scales in one hundred Tswana speaking individuals **without** back pain.

The same participants who participated in Study One also participated in Study Two. The scales tested were those developed in Study One. A total of nine original scales was tested in Study Two. The reversed scales from Study One were not taken further into Study Two due to the fact that the reversal of the scales made no difference to the participants' understanding of the scales. The following are the specific objectives for Study Two:

(1) to compare the understanding of the pain scales (developed in Study One) between differing education levels and between genders.

(2) to establish which scales are “good” scales, that is, which scales have the largest spread.

(3) to correlate multiple pain scales in both education groups and for both genders.

Study Three.

This was a cross-sectional study.

The aim of this study was to develop a new Verbal Descriptive Pain Scale in forty Tswana speaking participants with back pain and to validate this new Verbal Descriptive Scale.

Study Four.

This was a prospective, cross-sectional study to validate new pain scales, modified scales and to test existing pain scales in two hundred and fifty Tswana speaking individuals **with** back pain.

The aim of this study was to test the following eight scales: the VAS, the Ascending Injection Scale, the Injection Size Scale, the Coin Heap Scale, the Ascending Coin Scale, the Wong-Baker Faces Pain Scale (six faces) and the Wong-Baker Faces Pain Scale (three faces), all from the first and second study and the Verbal Descriptive Scale (VDS) developed in Study Three.

The following are the specific objectives:

(1) to determine the symmetry between current(actual) pain and the measurement(marking) of that pain on the different pain scales.

(2) to compare the marking (measurement) of present (actual) pain on all of the scales for gender, education and age.

(3) to establish which of the scales was the best understood.

Study Five.

This was a cross-sectional study to validate two pain scales developed in Studies One, Two and Four and to test a new scale in fifty Tswana speaking individuals with back pain.

The aim of this study was to test three scales namely The Ascending Coin Scale and the Ascending Injection Scale and a new scale, the Triangle Scale in fifty Tswana speaking participants with back pain. The Triangle was chosen for its shape in order to determine whether the participants truly understood the two Ascending Scales or whether they were only going according to their shape, namely increasing in size from left to right.

The following are the specific objectives:

(1) to compare the understanding of the three new scales between both genders, education levels and differing ages.

(2) to establish which of the scales was best understood.

1.7 An Outline of the Thesis .

Chapter One

Introduction.

Chapter Two

Literature Review.

Chapter Three

Study One

Development of the 18 (9 original and 9 reversed) Scales for Testing in 100 asymptomatic Tswana participants.

Chapter Four

Study Two

The testing of 9 (original) scales in 100 asymptomatic,Tswana participants(the same 100 participants from Study One).

Chapter Five

Study Three

The Development of a Tswana Verbal Descriptive Scale by 40 Tswana back pain sufferers.

Chapter Six

Study Four

The testing of 9 scales in 250 Tswana, back pain sufferers.

Chapter Seven

Study Five

The testing of 3 Scales in 50 Tswana, back pain sufferers.

Chapter Eight

Conclusion and Recommendations

References and Appendices

CHAPTER TWO LITERATURE REVIEW

2.1 Introduction.

In this chapter concepts underlying the research aim are discussed in relation to the existing literature in the field. These concepts include various aspects of pain, the psychology of pain, cognitive behavior in pain and back pain in particular. Currently used assessment tools (scales) and factors, such as non-psychometric factors, which have an influence on pain perception are also investigated. The effects of culture and the differences in education, gender and age responses to pain are also covered. In addition there are sections on the translation process, the importance of communication and language, the psychology of different shapes and colours and the differing perceptions of the value of money and the fear of pain caused by injections.

2.2 Background.

The total population of South Africa (at the most recent census, done in November 2012) is 51, 8 million. The ethnic distribution is nine percent white, eight percent coloured, three percent Indian and eighty percent black people. “The four major ethnic divisions among black South Africans are the Nguni, Sotho-Tswana, Shangaan-Tsonga and Venda. Together the Nguni and Sotho account for the largest percentage of the total Black population. The major Sotho groups are the South Sotho (Basuto and Sotho), the West Sotho (Tswana) and the North Sotho (Pedi). About four million Tswana people live in southern Africa; three million in South Africa and one million in the nation of Botswana (Lockerz, 2012)”.

In South Africa, many Tswana people live in the former homeland Bophuthatswana, as well as in the neighboring areas of the Northwest province and the Northern Cape. Sixty three percent of the population in the Northwest speaks Tswana (first language) (Lockerz, 2012) http;//www.sahistory.org.za/people-south-africa/tswana

2.3 Pain.

Pain is part of existence. It can be used as a rite of passage, a means of torture, and a source of inspiration for the artist. The human experience of pain is a unique and personal one. Pain is influenced by neurophysiology, genetics, individual history and

cultural norms. Accordingly, treatments aimed at alleviating pain are influenced by the understanding of pain processing and of the pain experience as well as by societal and political views (Turk, et al., 2010).

Pain is the common presenting symptom of most musculoskeletal conditions. It is complex and encompasses aetiology, as well as the psychological, social and economic status of the patient. Pain can be defined as an unpleasant and emotional experience associated with actual or potential tissue damage (Zanoli, et al.,2001).It is a sensual and perceptual phenomenon and is the most common experience reported by patients(Swieboda, et al.,2013). Pain can also be described in terms of damage done to tissue. It is a subjective experience (Readyard, et al.,1992) and a person's response to noxious stimuli may be affected by psychological factors such as conditioning experiences, state of mind and past experiences and also, sociological factors such as gender and culture (French, et al.,1989). Zborowski, as early as 1952 stated that "pain can be modified by neurochemistry, cognition and sensory and socio- environmental factors. He also postulated that differences in pain tolerance levels might be attributable to a learned response".

An individual's perception of pain also depends on the individual's emotional state, circumstances under which the pain is acquired and factors like arousal, attention, distraction and expectation of pain (Swieboda, et al., 2013).Agreeing that pain perception is a complex process are Fong, et al., (2014) who say that pain is not just a sensation but has a significant emotional aspect to it. This emotional dimension is influenced by one's beliefs, expectations, culture and past experience. Plazier, et al., (2014) also concur that pain is a subjective experience characterized by multiple factors. These include sensory aspects of pain, affective, cognitive, autonomic, genetic and behavioural factors which all determine overall pain perception (Maletic and Raison, 2009; Plazier, et al., 2014).

The purpose of pain is to act as a protective mechanism for the body. It occurs whenever there is tissue damage and it causes the individual to react to remove the painful stimulus. The International Association for the Study of Pain (IASP) (2012) defines pain as "an unpleasant sensory and emotional experience which we primarily associate with tissue damage or describe in terms of such damage, or both". This definition recognises that pain is a perception and not a sensation. Another

definition, which is suggested in the literature, is that of “three hierarchical levels of pain: a sensory-discriminative component (location, intensity, and quality), a motivational-affective component (depression, anxiety) and a cognitive-evaluative component (thoughts concerning the cause and significance of the pain) (Evans, 2012)”.

As a perception, pain may or may not be associated with an identifiable source of injury. The activity of our “nociceptive system”, which senses noxious stimuli and generates a physiological and behavioural response can be initiated by injury and sustained by neuroplastic changes, even after healing. Activity in the nociceptive system can also occur in the absence of injury, but in association with a recognisable disease. In some cases, pain can develop and be unrelated to any identifiable physical process. Regarding pain as a perception, indicates the potential for influences of psychological factors, emotional factors, cognition and varied events, on pain (Evans, 2012).

2.4 Different types of pain.

Tremendous progress has been made in the understanding of the neurochemistry and neurophysiology involved in the transmission and modulation of information from noxious events. There exists a great amount of knowledge, pertaining to acute inflammation and to the pathophysiology underlying most persistent pain syndromes (Willis, 2007; Schaible, 2007). There are different types of pain which can be divided into: physiological and pathological pain, acute inflammation and persistent pain nociceptive, neurogenic or neuropathic pain (peripheral evoked and or central evoked), psychogenic pain (psychological), mixed or idiopathic pain and pain syndromes. These different pain syndromes can be divided into cognitive and affective, motor mechanism or autonomic mechanism or a combination of some of them or all of them (French, et al., 1989; Evans, 2012).

Physiological Pain		Pathological Pain
Biologically useful: adaptive and protective		Maladaptive
Nociceptive Pain	**Inflammatory Pain**	**Neuropathic pain**
Physiological protective system. To minimize and avoid damage from intense, noxious stimuli (e.g. heat, cold, mechanical force and chemical irritants). High threshold pain. Pain results in immediate attention and withdrawal reflex	Heightened sensitivity after tissue injury or infection. Immune system is activated involving macrophages, mast cells, neutrophils and granulocytes. (Inflammatory soup).	Due to a lesion or disease of the somatosensory nervous system(e.g. painful peripheral neuropathy, post-stroke and multiple sclerosis) CNS dysfunctional pain In conditions where there is no such damage or inflammation (e.g. Fibromyalgia, irritable bowel syndrome and interstitial cystitis). Common features: Low threshold pain. Spontaneous pain. Imbalance between excitatory/inhibitory mechanisms. Central sensitization.

Table 2.1"Classification of Pain (Fong, et al., 2014. Adapted from Woolf, 2010)".

2.4.1 Nociceptive pain.

Nociceptive pain is caused by actual or threatened damage to non-neural tissue. It is due to the activation of nociceptors (pain receptors) and has an important protective role. This protective role is due to the evocation of a painful stimulus which in turn leads to a withdrawal reflex which prevents and protects us from further injury and tissue damage (Fong, et al., 2014). Clinically pain can be termed "nociceptive" if the pain is due to the on-going activation of the nociceptive system by tissue injury.

Nociceptive pain is presumed to occur as a result of normal activation of the sensory system by noxious stimuli. It can be remitting (acute or short-lived) or persistent (chronic or long-lived).Nociceptive pain can also be referred to areas distal from the origin of the pain e.g. pain in the hip joint may be referred to the knee joint. Nociceptive pain may involve acute or chronic inflammation. This “neurogenic inflammation” involves the release from nerve endings of compounds such as substance P, serotonin, histamine, acetylcholine and bradykinin. These activate and sensitize other nociceptors. Prostaglandins produced by injured tissues also enhance the nociceptive response to inflammation by lowering the threshold to noxious stimulation. Nociceptive pain occurs in four phases namely: transduction, transmission, perception and modulation (Chapman, 1996).

2.4.1.1 Transduction.

This is the first phase and it occurs when a noxious or painful stimulus causes tissue damage. Tissue injury activates primary afferent neurons (nociceptors).These are small diameter afferent neurons, with A-delta and C- fibres. These neurons are found in the skin, muscles, joints and some visceral tissue (Willis, 2007). These fibres have specific receptors responsible for noxious mechanical, chemical or thermal stimuli. The damaged cells release prostaglandins, bradykinins, substance P, serotonin and histamine. These released substances in turn lead to the generation of an action potential in the sensory nerves situated in the area of injury. The nociceptive signal is then transmitted up the pathway (Willis, 2007).

2.4.1.2 Transmission.

The generated action potential travels from the site of damage to the dorsal horn of the spinal cord. It then ascends the spinal cord along the spinothalamic and the spinoreticular tracts. The spinothalamic tract secondary afferent neurones decussate within a few segments of the level of entry into the spinal cord and ascend in the contralateral spinothalamic tract to nuclei within the thalamus (Fong, et al., 2014)(See figure 2.1.The basic structure of the pain pathway). Third order neurones then ascend to terminate in the somatosensory cortex of the brain. There are also projections to the periaqueductal grey matter (PAG).The spinothalamic tract transmits signals that are important for pain localization. The spinoreticular tract fibres also decussate and ascend the contralateral tract in the spinal cord and reach

the reticular formation in the brainstem. From here they project into the thalamus, hypothalamus and the cortex. This pathway is involved in the emotional aspects of pain (Serpell, 2006; Willis, 2007).

2.4.1.3 Perception.

Nociceptive information ascends to the thalamus in the contralateral spinothalamic tract (STT) and to the medulla and brainstem via the spinoreticular and spinomesencephalic tracts. The brainstem plays a role in mediating changes in pain perception (Tracey, et al., 2007). From the thalamus (ventral posterior nucleus, posterior part of the ventral medial nucleus and the ventral caudal division of the medial dorsal nucleus) the nociceptive inputs are relayed to cortical and subcortical structures.This pain processing in the brain takes place in the somatosensory cortex, the insular, anterior cingulate cortex, the prefrontal cortex and the thalamus (Serpell, 2006; Willis, 2007).During nociceptive processing a large “brain network”is accessed (Tracey, et al., 2007). This is described by Melzack (2001) as the “pain neuromatrix”. This matrix is thought to have lateral (sensory-discriminatory) and medial (affective-cognitive) neuroanatomical components. “The pain neuromatrix should be regarded, not as an entity on its own, but rather as a substrate that is significantly and actively modulated by a variety of brain regions (Tracey, et al., 2007).” This interaction largely determines the pain experience.

2.4.1.4 Modulation and descending inhibition of pain.

The stimuli from the nociceptive pathway can be changed before they reach the cortex in two different ways. There are two main types of mechanisms which inhibit pain transmission, namely, descending inhibition and spinal inhibitory mechanisms. The mechanisms which inhibit pain transmission at the spinal cord level are via descending inhibition from higher centres. Modulation or inhibition of the painful or nociceptive stimuli takes place when neurons descending from the brain release substances that inhibit the transmission of painful impulses (Serpell, 2006; Willis, 2007).

Two important areas of the brain involved in descending inhibitory modulation are the periaqueductal grey (PAG) in the midbrain and the rostral ventromedial medulla (RVM). Both these centres contain high concentrations of opiod receptors and

endogenous opiods. The descending pathways are monoaminergic, utilising serotonin and noradrenaline as neurotransmitters. Descending pathways project to the dorsal horn inhibiting pain and pain transmission (Aitkenhead et al., 2001; Serpell, 2006).

There are two descending inhibition pathways, namely the Lateral Inhibition pathway and the Parallel Inhibition pathway (Lau and Vaughn, 2014). According to the lateral Inhibition Model, local GABAergic interneurons tonically modulate the activity of output neurons which make up the anti-nociceptive pathway. Opiods and cannaboids indirectly excite output neurons by suppressing the inhibitory influence of neighbouring GABAergic interneurons. This leads to disinhibition of the descending PAG- RVM pathway, thereby inhibiting nociceptive transmission at the level of the spinal cord. The Parallel Inhibition-Excitation model is an alternative model put forward by Lau and Vaughn (2014). Here inhibitory and excitatory neurons form two, distinct, parallel pathways. Opiods and cannaboids act independently on these inhibitory/ excitatory neurons in order to mediate pro-nociception and anti-nociception (Lau and Vaughn, 2014).

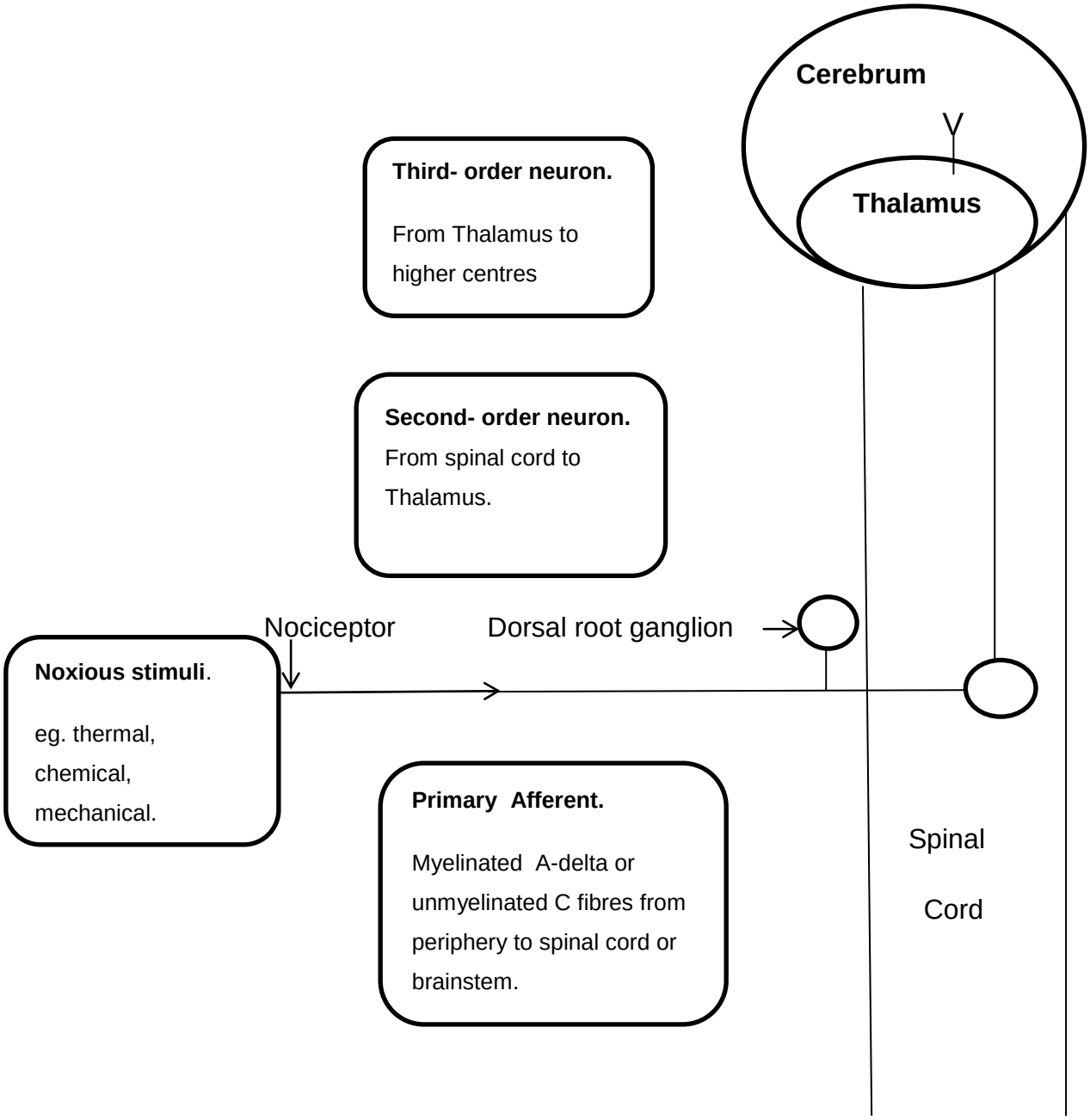


Figure 2.1 "The basic structure of the pain pathway (taken from Fong, et al., 2014)".

2.4.1.4.1 Spinal mechanisms, inhibitory mechanisms.The Gate Control theory of pain.

The Gate Control Theory is involved in the modulation of pain. This theory emphasises the significant role that psychosocial factors potentially play in the perception of pain (Gatchel, et al., 2000; Gatchel, et al., 2007). The Gate Control

theory proposed by Melzak and Wall in 1965 claimed that the substantia gelatinosa (lamina II on Rexed's laminae) located in the dorsal horn of the spinal cord, modulated the amount of afferent impulses from the periphery to transmission cells (T cells) of the dorsal horn, through inhibitory processes at the neuronal level and thereby controlling the quantity and intensity of signals to the central nervous system. The opening and closing of the gate is influenced by numerous neural pathways. The small, ascending C fibres open the gate and the large ascending and descending A-Beta fibres close the gate.

Furthermore, it was postulated that higher cortical functions contribute to this gating mechanism. This, thereby, allows for psychological phenomena to directly affect the subjective experience of pain and this contributes a great deal to treating patients with pain (Gatchel, et al., 2007). Although the Gate Control Theory revolutionized the thinking about pain, this theory oversimplifies the neural architecture of the spinal cord. Presently more is known about the "gating of pain". Stimulation of large afferent fibres which produce modulation of C fibres is now known to include descending small fibre projections from the brainstem as well (Fong, et al., 2014). The Gate Control Theory of pain formulated in 1965 by Melzack and Wall using the available physiological observations explaining behaviourial and psychosocial observations related to pain at that time, forced a re-evaluation of pain mechanisms (Mendell, 2014). In 1973 Wall wrote, evaluating the Gate Control Theory in the light of further experiments: "The least, and perhaps the best that can be said for the 1965 paper is that it provoked discussion and experiment".

2.4.2 Neuropathic or neurogenic pain.

Neuropathic pain is a complicated symptomatic disease (Yang, et al., 2012) and it may mimic the qualities of somatic pain. Neuropathic pain is the term applied to "pain syndromes inferred as a result from direct injury or dysfunction of the peripheral or central nervous system. These changes may be caused by injury to either neural or non-neural tissues (i.e. the somatosensory system) (Jarvis, et al., 2009)". This type of pain is qualitatively different from other types of pain in that neuropathic pain usually has characteristic symptoms such as hyperalgesia and allodynia (Jensen, et al., 2011).

In Germany Shaygan, et al., (2014) conducted a cross-sectional study which tested three hundred and forty four patients suffering from chronic neurological pain (neuropathy) which included post herpetic neuralgia, complex regional pain syndrome type II, polyneuropathy, trigeminal neuralgia, low back pain with and without radiculopathy. Patients had to rate their pain on a 0-5 quality of pain rating scale and on a 0-10 intensity of pain rating scale. They found that neither the intensity of the neuropathic sensory symptoms nor any patterns of these symptoms led to the reporting of a high degree of pain intensity, pain chronicity and negative affectivity. They suggest that negative emotions and maladaptive appraisals do not play a role in the reporting of sensory descriptors of neuropathic pain. In other words, a high level of neuropathic sensory symptoms does not necessarily result in a report of high intensity of pain or an increase in psychological dysfunctional features (Shaygan, et al., 2014). The researchers therefore question whether a genuine association of neuropathic sensory symptoms with high levels of pain and psychological factors actually exist.

Hyperalgesia	Increased response to a painful stimulus.
Allodynia	Pain due to a stimulus that does not normally cause pain.
Dysaesthesia	Unpleasant, abnormal sensation, whether spontaneous or evoked.
Hyperpathia	Painful syndrome characterized by an abnormally painful reaction to a stimulus, especially a repetitive stimulus, as well as an increased threshold.
Hypoalgesia	Diminished response to a normally painful stimulus.

Table 2.2 “Typical features of Neuropathic pain (Taken from Fong, et al., 2014.Adapted from Jensen, et al., 2011)”.

2.4.3 Psychogenic pain.

Many factors, besides the physiological and anatomical changes which occur during the pain process, play a role in the patient's experience of pain. These factors include emotions, patient psyche, behaviour (personality), socioeconomic issues and varying cultural perceptions (French, et al., 1989; Alvarado, 2008).

Psychogenic pain is pain that is mostly related to psychological factors. Pain can be described as psychogenic when the patient has persistent pain with evidence of psychological disturbances and without evidence of a disorder that could account for the pain or its severity. This type of pain is less common than nociceptive or neuropathic pain (Serpell, 2006; Willis, 2007). "There is considerable overlap between the neuroanatomical and neurotransmitter systems modulating pain perception and emotional state (Chapman, 1996)". A model of columnar organization from the frontal cortex, the hypothalamus, the thalamus and amygdala to the periaqueductal grey (PAG) region of the mid-brain is described by Bandler and Shipley, (1994). These connections (neuroanatomical) may provide the basis for the interaction between the cognitive and emotional states and pain perception, autonomic function and motor activity.

"There is an exceedingly complex relationship between the psyche and pain perception (Gamsa, 1994)". In certain patients, the presence of persistent pain induces disturbances in mood (reactive depression or anxiety), impaired coping (often with catastrophization) and other processes, which in turn, appear to worsen pain and pain-related distress. Other patients may have pre-morbid or co-morbid psychosocial concerns or psychiatric disorders that can evolve parallel to the pain (Francis, et al., 2000). Sometimes, the psychological evaluation of a patient may reveal that the pain itself is predominantly sustained by psychological factors.

In patients who have acute or chronic pain with no known physical source, it is important that they should not be inappropriately labelled, as this can lead to therapeutic decisions which are biased and skewed. This in turn, can lead to stigmatization and subsequently to greater suffering of the patient. When there is no positive evidence, that the aetiology of pain is psychiatric and when reasonable inferences about the sustaining pathophysiology of a pain syndrome cannot be made, then the pain is best labelled "idiopathic" (Francis, et al., 2000).

2.4.4. Idiopathic pain.

This type of pain has no apparent underlying cause. Idiopathic pain is not nociceptive, neuropathic nor psychogenic and although its origin is often not known, it is a “very real pain”. Idiopathic pain is made worse by psychological distress and is more common in people who already have a pain disorder such as fibromyalgia or temporomandibular joint pain. As is the case with psychogenic pain, idiopathic pain is often more difficult to treat (Aitkenhead, et al., 2001).

2.4.5 Somatic and visceral sources of pain.

Pain that is related to on-going activation of nociceptors innervating somatic structures such as bone, joint, muscle and connective tissue, is termed somatic pain. This pain is recognized by identification of a lesion and is usually described as a well localized pain which is aching, squeezing, stabbing or throbbing. Examples of somatic pain are arthritis and metastatic bone pain (Evans, 2012).

Visceral pain arises from the internal organs which are largely innervated by C fibres and arises from stimulation of afferent receptors in the viscera. This type of pain is often described as cramping and gnawing, with a daily pattern of varying intensity. Visceral pain can also be described as deep and dull or sharp, stabbing or throbbing when the myocardium or organ capsules are involved (Evans, 2012). “This type of pain can be associated with autonomic changes such as nausea, vomiting and changes in heart rate or blood pressure. It can also evoke strong emotional responses (Aitkenhead, et al., 2001; Serpell, 2006)”.

2.5 Duration of Pain. Acute and chronic pain.

Acute and chronic pain are different clinical entities (Swieboda, et al., 2013) Pain can be either acute or chronic or is also referred to as fast pain and slow pain. Fast pain can also be described as acute pain, sharp pain, pricking pain and electric pain and this usually lasts less than twelve weeks (Swieboda, et al., 2013).Acute pain acts as a warning-defensive mechanism. Examples of acute pain are post-operative pain, pain associated with medical procedures and pain caused by trauma. Slow pain on the other hand can be described as chronic pain, slow burning pain, aching pain, throbbing pain and nauseating pain. Acute pain usually has a clear aetiology and a

thorough patient history should give an indication of its nature and characteristics, as well as its severity, and duration (Pergolizzi, et al., 2014).

Chronic pain is regarded as pain lasting longer than twelve weeks (Bogduk, 1999; Swieboda, et al., 2013). When pain outlasts the original noxious event or injury it no longer serves its adaptive function (e.g. withdrawal of a limb which is exposed to a noxious stimulus) and it becomes chronic (Palit, et al., 2013).Therefore chronic pain unlike acute pain, does not fulfil the role of warning or defence, instead, chronic pain involves peripheral and central sensitization as well as the alteration of the pain modulatory system (Kwon, et al., 2014). The transition from acute to chronic pain is a complicated one and it involves more than just neurons. “Changes in the plasticity of neurons leads to development of sensitization (peripheral and central) and this in turn leads to chronic pain states (Mifflin and Kerr, 2014)”.

“Chronic pain is a form of dysfunctional sensation. Studies of the affective component of pain perception, combined with functional imaging, genetically manipulated animal models and new insights into pain mechanisms, offer hope for a better understanding of pain in the brain and also for other aspects of human sensation, consciousness and behaviour (Foulkes and Wood, 2008)”.

Causes of chronic pain are hard to determine as chronic pain is thought to result from not only physical injury but also from a combination of psychosocial, social and physical abnormalities (Kwon, et al., 2014; Mifflin and Kerr, 2014). Moseley and Hodges, (2004) agree with this line of thinking and continue by saying that chronic pain and back pain in particular is understood to represent a collection of psychosocial characteristics which are conceptually attached to long-lasting pain. These psychosocial factors include social exclusion, disability, depression, cognitive disruption, fear of pain and (re) injury and catastrophic thought processes.

The subjective (self-report) assessment of acute pain is done by using pain measurement tools such as the Numerical Rating Scale, Visual Analogue Scale and the Verbal Rating Scale. Objective assessment of pain includes monitoring respiratory rate, heart rate, blood pressure and observing the patient for facial expression (Fong, et al., 2014). Chronic pain on the other hand is assessed using a bio-psychosocial model which includes the evaluation of physiological, psychological

and socio-environmental factors which influence the pain experience (Fong, et al., 2014).

Variations in both pain sensitivity and susceptibility to chronic painful conditions occur between individuals in both human and animal populations (Nielsen, et al., 2005). These natural variations in tendency to having pain result from a combination of environmental and genetic influences on pain-sensing systems. Environmental factors such as early exposure to acute painful stimuli can have long-term effects on nociceptive thresholds in both animals and humans. “It therefore appears to be plausible that more subtle, quantitative differences in pain sensitivity could have their basis in the genetic make-up of the individual (Taddio, et al., 1995)”.

Characteristics	**Acute Pain**	**Chronic Pain**
Temporal features	Recent onset and expected to last no longer than days or weeks.	Remote, often ill-defined onset; duration unknown.
Intensity	Variable.	Variable.
Associated affect	Anxiety may be prominent when pain is severe or cause is unknown; sometimes irritability.	Irritability or depression.
Associated pain-related behaviours	Pain behaviours (e.g. moaning rubbing, splinting) when pain is severe.	May or may not give any indication of pain; specific behaviours (e.g. assuming a comfortable position).
Associated features	May have signs of sympathetic hyperactivity when pain is severe (e.g.tachycardia, hypertension,sweating, mydriasis).	May or may not have vegetative signs such as lassitude, anorexia, weight loss, insomnia, loss of libido; these signs may be difficult to distinguish from other disease-related effects.

Table 2.3 “Differences between Acute and Chronic pain (Taken from Foulkes and Wood, 2008. Modified from Portenoy et al., 1999).”

2.6 Responses to pain.

Of importance in the discussion of and response to pain is the way in which individuals differ in their use of coping strategies (Keogh, et al., 2000). Catastrophizing, depressive feelings and fear avoidance have been reported in patients suffering from chronic pain and from chronic low back pain in particular(Roussel, et al.,2014).Inappropriate beliefs have been associated with the development of exaggerated pain perception. “All these psychological factors, known also as yellow flags, are usually associated with poor prognosis as they may lead to the enhancement of facilitatory pathways in the central nervous system which in turn causes sensitization of the dorsal horn in the spinal cord neurons (central sensitization) and chronicity of pain(Roussel, et al.,2014)”.

2.6.1 Pain Catastrophization.

In 1994, Gamsa established that an exceedingly complex relationship between the psyche and pain perception exists. In certain patients, the presence of persistent pain induces disturbances in mood (reactive depression or anxiety), impaired coping, often with catastrophization and other processes, which in turn, appear to worsen pain and pain-related distress and will in turn also have an effect on pain perception.

Over the past twenty years, pain catastrophization has emerged as one of the most reliable and consistent psychological factors affecting pain and the prediction of the pain experience (Keefe, 2011). A patient’s pain experience and perception of pain can also be determined by personal devaluation or invalidation relating to self-esteem and pain self- efficacy. Reactions to pain may become internalised i.e. the patient may have internalised stigma which will have a negative relationship on self-esteem and will prevent the patient in pain from reporting the true extent of their pain, as they did not want to be perceived as “exaggerating or catastrophizing” their pain. Internalised stigma can also be associated with cognitive functioning in relation to pain. This can lead to catastrophizing about pain and thereby reducing the sense of control over the patient’s pain (Waugh, et al., 2014).

Pain catastrophization is described as an “exaggerated negative mental set associated with actual or anticipated pain experiences (Evans, 2007)”.Pain catastrophizing or characterizations of pain as awful, horrible or unbearable, is

increasingly being recognized as an important factor in the experience of pain (Gracely et al., 2004). Catastrophizing has been suggested as augmenting pain perception through enhanced or increased attention to painful stimuli and heightened responses to pain. Catastrophizers experience difficulties trying to control pain related thoughts. Elements associated with catastrophization of pain include rumination, magnification and / or helplessness. Examples of the aforementioned elements are “I can’t stop thinking about the pain”, “I worry they have missed something serious” and/ or “There is nothing I can do”. The problem with pain catastrophization is that it may interfere with the efficacy of assessment and treatment of patients and may interfere with coping strategies of the patient who is in pain (Evans, 2007).

Gracely, et al.,(2004)suggest that pain catastrophizing is significantly associated with increased activity in brain areas related to anticipation of pain(medial frontal cortex, cerebellum), attention to pain (dorsal anterior cingulate gyrus, dorsolateral prefrontal cortex) emotional aspects of pain (claustrum, closely connected to the amygdala) and motor control(cortex).They hypothesize that catastrophizing influences pain perception through altering attention and anticipation and heightening emotional responses to pain. Activation associated with catastrophizing in the motor areas of the brain, may reflect expressive responses to pain that are associated with greater pain catastrophizing.

Chronic pain sufferers who catastrophize are more likely to report increased psychological distress, anxiety, fear of pain and depression. This tendency to catastrophize is accompanied by a heightened display in pain-related behaviour like guarding, painful facial expressions and increased disability (Keefe, 2011).Radat and Koleck, (2011) suggest that patients in pain can employ one of two pain coping strategies namely: problem versus emotion focused strategies or cognitive versus behavioural strategies.

2.6.2 Fear of Pain.

Fear of pain is considered a core mechanism in the maintenance of chronic musculoskeletal pain and disability. There is involvement of an associative learning process in the acquisition of fear of movement-related pain (Meulders, et al., 2012). Predictable pain induces cued fear of movement-related pain, while unpredictable

pain enhances contextual pain related anxiety. Negative emotional states, including fear and anxiety can alter pain-related responses. Due to the influence of psychological factors on pain, Hansen, et al., (2005) suggest that brief psychological screening of the patient be done at the initial evaluation. This will not only assist in the evaluation of the patient, but also in the correct treatment for the patient.

Pain-related fear is an important factor influencing individuals suffering an episode of acute low back pain. This has important clinical implications, especially in the preventative strategies for chronic low back pain (Swinkels-Meewisse, et al., 2006). Fear of pain (fear avoidance) can lead to suffering and more pain. People go to great lengths to avoid pain and avoidance of pain can, ironically, be the cause of chronic pain. (See figure 2.2.The Fear-Avoidance Model of Chronic Pain. Chou and McCarberg, 2011). When a person is injured, they begin to associate the injury and the resulting pain with the activity that caused it and they will avoid the activity which caused the pain. Therefore, in the short term, fear avoidance may promote healing, but, over time, fear of pain may actually initiate chronic pain, leading to disability and depression (Chou and McCarberg, 2011; Meulders, et al., 2012). A vicious cycle may then ensue i.e. the more depressed the patient the more pain they experience and because of this, the more depressed they become.

Kinesiophobia is the term used to describe the fear of movement due to pain. The commonly observed lack of mobility, the choice of posture and or avoidance of movement of a person in pain have been interpreted as a protective mechanism to avoid further injury and pain (Galea, 2004).In a cross-sectional Swedish study of a population with specific back pain, high scores for kinesiophobia or fear of movement were associated with high pain and disability scores (Lundberg, et al., 2011). These patients with kinesiophobia were also more affected in several other variables such as pain, disability and depression. Contrary to these results, fear of movement and pain catastrophizing were not associated with recovery among patients with residual complaints at three months and twelve months following spinal surgery (Ostelo, et al., 2005).

Memory of pain can condition behaviour leading to fear avoidance and can also lead to centralization of pain. “Memory of pain often overshadows its primary experience in its impact upon pathophysiology and human suffering (Song, et al., 1999)”. Fear of

pain may lead to confrontation of pain in patients with non- catastrophizing behaviour and avoidance of pain in patients with a high catastrophizing behaviour (Vlaeyen, et al., 2000). The finding of two Dutch studies, one of which was a population based survey (Picavet, et al., 2002) and one of which included army workers (Helmhout, et al., 2010), was that pain-related fear may lead to prolonged chronic pain and disability and that this pain-related fear was also prognostic for poor success rates of recovery in patients with non-specific low back pain after six months.

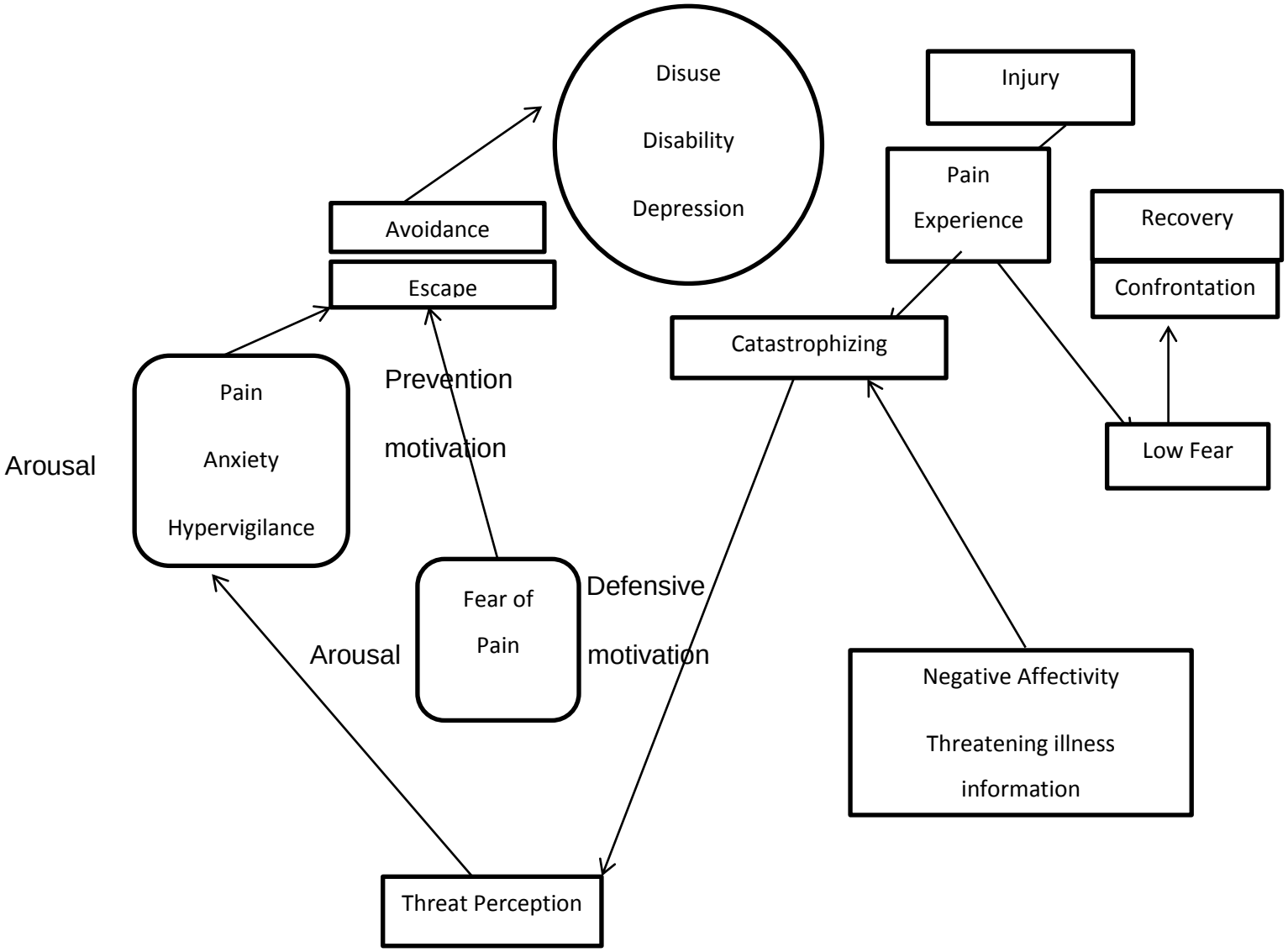


Figure 2.2 "The Fear-Avoidance Model of Chronic Pain. (Taken from Chou and McCarberg, 2011. Adapted from Leeuw, et al., 2007)".

2.6.3 Hypervigilance.

Predisposing factors like catastrophizing can lead to an appraisal model of an exaggerated threat value of pain. This in turn results in selective attention or hypervigilance, which then leads to pain intensification which is reinforced by patient beliefs, fears and attributions (Wright and Zusman, 2004). What follows are avoidance, disuse, depression and disability. Somatic preoccupation tends to happen next, causing the patient to ruminate about his pain and eventually magnify it due to this rumination. Misinterpretation of irrelevant sensations leads to increased protection of the injured part and more intense focussing on the pain in question. The patient then develops a negative self-efficacy belief and activity intolerance often ensues. Subsequently, a feeling of helplessness develops in the patients. They then hand over control of their pain to an external locus of control (the therapist or doctor) and tend to become passive in their coping style, in other words “You fix me” (Wright and Zusman, 2004).

Hypervigilance is a term used to describe individuals who are cognitively and emotionally absorbed by their pain-related stimuli and events (Hummer, et al., 2009). Hypervigilance is a risk factor for the onset of chronic pain disorders (Rollman, 2009). Disagreeing with this rationale are Tiemann, et al., (2012) who did not find hypervigilance (as would be expected in chronic pain sufferers) in their subjects suffering from the chronic pain of Fibromyalgia Syndrome (FMS). They used a behavioural paradigm to study attentional interference in twenty two healthy subjects and nineteen subjects suffering from FMS. In both groups attentional effects of pain on behavioural performance were closely related to gamma oscillations in the human brain. These effects did not differ between the control group (healthy subjects) and the FMS sufferers. The researchers therefore concluded that they could not confirm gamma oscillations as a neuronal correlate of perceived hypervigilance in FMS (Tiemann, et al., 2012). They suggest that further studies are needed.

2.7 Neural and psychosocial adaptations to pain.

An important factor which needs to be taken into consideration, when dealing with chronic pain sufferers is centralisation of pain. Central sensitization involves the inhibition of the descending inhibitory pathways. This results in an imbalance in the excitatory and inhibitory inputs which in turn contributes to changes in the intensity of

pain, alteration of pain thresholds and spreading or radiation of pain to uninjured sites (Arendt-Nielsen et al., 2011; Kwon, et al., 2014). Progressive central sensitization is also potentially involved in the transition from acute to chronic pain. The clinical course of central sensitization is largely unknown, highly individual and unpredictable. It is often reversible following the cessation of nociceptive, peripheral input. However, in some cases prolonged, peripheral, afferent barrage can result in persistent central sensitization (Baron, et al., 2013).

Central sensitization takes place within the dorsal horn of the spinal cord, the brain stem and the brain. Amplification of nociceptive input in the spinal cord produces secondary hyperalgesia. Secondary hyperalgesia is hyperalgesia adjacent to or remote from the site of injury. It is solely due to altered, central processing (English, 2014). Mechanical hypersensitivity and allodynia to light touch, after centralization, are pathologic, in that they are evoked by A-beta low threshold mechanoreceptors, which normally do not produce painful sensations. Peripheral sensitization allows low- intensity stimuli to produce pain by activating A-delta and C nociceptors. Central sensitization on the other hand allows normal, low-threshold A-beta mechanoreceptors to produce pain as a result of changes in sensory processing in the spinal cord (Song, et al., 1999).

Centralisation of pain can be identified by the following features: widespread pain with non-anatomical distribution, more severe chronic pain with high irritability or latent pain, pain persisting beyond normal healing times, disproportionate, non-mechanical unpredictable patterns of pain, maladaptive psychosocial factors such as catastrophization, anxiety, depression, fear avoidance and poor self-efficacy (Smart, 2010).A history of failed medical interventions as well as high levels of functional disability is often present in a chronic pain sufferer with pain centralization(See Figure 2.3 Flow diagram of Central Sensitization.Smart, 2010).

Peripheral sensitization on the other hand is due to local inflammatory mediators such as prostaglandins, histamine, bradykinin, potassium ions, hydrogen ions, 5-hydroxytryptamine, adenosine triphosphate and nitric oxide released from damaged and immune cells. These inflammatory mediators have an effect on the nociceptors of sensory neurones and lead to increased neuronal excitability. Peripheral sensitization therefore takes place when there is a reduction in threshold and an

increase in responsiveness of the peripheral ends of high-threshold peripheral sensory neurons (English, 2014).This type of hypersensitivity is called hyperalgesia. Hyperalgesia reduces the intensity of the stimulus required to cause activation of the nociceptors at the site of inflammation. Fortunately, primary hyperalgesia (i.e. hyperalgesia at the site of the injury) is reversible and as healing takes place, the active mediator subsides and so too does the hyper excitability (Fong, et al., 2014).

Peripheral and central sensitisation can result in hyperalgesia, allodynia, spontaneous pain, referred pain or sympathetically maintained pain. These persistent sensory responses to noxious stimuli are a form of memory of pain (Woolf and Chong, 1993). Neuro-physiological processes that “amplify” nociception produce sensitisation which is defined as “increased nociceptive output for a given input”.

Other types of sensitization such as interpersonal sensitization and cognitive-emotional sensitization are also known to occur in chronic pain sufferers e.g. fibromyalgia sufferers (English, 2014). Interpersonal sensitization is defined as “an enhanced state of awareness by significant others regarding the pain behaviours of the person in pain and a hypervigilance regarding these pain behaviours associated with solicitousness”. This means that a significant other (like the patient’s spouse) attempts to lessen the pain behaviour of their loved one in order to alleviate their own “shared pain” experience. This solicitous behaviour positively reinforces the patient’s display of pain behaviour thereby leading to a feed-forward effect. This effect elicits further solicitousness and so the cycle is perpetuated (English, 2014).

The definition for cognitive-emotional sensitization is an enhanced state of self-awareness of pain sensations and a reduction in the threshold of what constitutes pain (English, 2014). This cognitive bias regarding pain is driven by on-going anxiety. This anxiety is mediated by attributions and beliefs about the meaning of persistent pain to the person in pain (e.g. their vulnerability) (English, 2014).

CENTRALSENSITIZATION

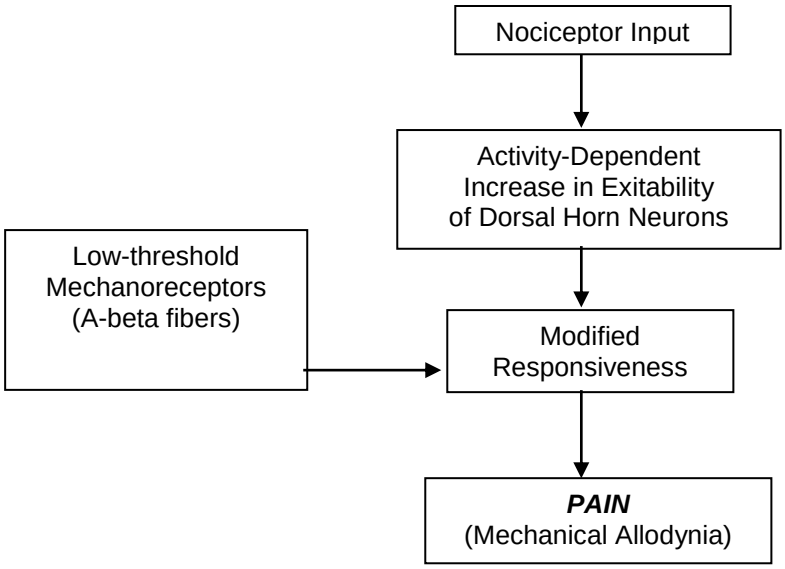


Figure 2.3 "Flow diagram of Central Sensitization (Taken from Smart, 2010.Modified from Woolf and Chong, 1993)".

2.8 "Wind-up".

"Wind-up" is not the same as central sensitisation. Central sensitisation is increased pain sensitivity with repetitive stimulation often seen in the experimental and clinical paradigm (Visser and Davies, 2009). Wind-up pain takes place when "repeated input from damaged peripheral nerves leads to central temporal integration in second-order neurons in the dorsal horn of the spinal cord, hence causing a facilitation of the input" (Vase, et al., 2013).

It is this "wind- up" of the dorsal horn which makes pain perception different in people who are in pain and those who are not (Walker and Carmody, 1998). There is neither "sensitisation" nor "wind- up" of the dorsal horn in pain-free people, it occurs only when pain is present. After pain subsides the dorsal horn "winds down" to its previous resting level (i.e. prior to pain). If this "winding down" does not take place (due to poor descending inhibition from the limbic system, leaving the "gate" wide open), the dorsal horn remains permanently "sensitised" leading to chronic pain(Walker and Carmody, 1998).

2.9 Different Models of Pain Perception.

2.9.1 The Bio-Medical Model.

Recognition that all illnesses have both physical and mental components and that a dynamic relationship exists between the components of these systems has led to criticism of the previously used bio-medical model. The latter model only takes anatomical and physiological factors into consideration when diagnosing and treating patients, especially those suffering from pain (Butler, et al., 2004).

2.9.2 The Bio-Cultural Model.

Bates, et al., (1993) suggest that a bio- cultural model (incorporating biology and cultural variables) is also an important factor to be considered in pain perception as this model together with other cognitive and psychosocial variables affects patients' pain perceptions. Furthermore, they say, that a biosocial model is designed to illuminate cultural influences in pain perception, without denying the role of numerous other factors in the complex process that is perceived pain (See Figure 2.4 The Bio-Cultural model of pain perception. Bates, et al. 1993).

2.9.3 The Bio-Psychosocial Model.

The bio-psychosocial (BPS) model was developed by George Engel, an American physician and educator in 1977. This model is used extensively in the Western, industrialized world (Domenech, et al., 2011).It stresses the importance of the interplay between biological, psychological and social factors that affect health. Physical or chemical changes to the body constitute the biological contribution, personal growth and mental health contribute to the psychological influence and social interactions and contexts contribute to the social aspect of this model (Green and Johnson, 2013). Domenech, et al., (2011) go even further by stating that many studies have observed that psychosocial factors can have a greater influence in the transition from acute to chronic pain than do biomedical and biomechanical factors.

This well-known model of pain, the bio- psychosocial model of pain (BPS) is a general model or approach, that assumes that biological, psychological (thoughts emotions, behaviours) and social factors all play a significant role in human functioning in the context of disease or illness(Santrock, 2007).Stratified care is a

new and promising direction and patients should be routinely screened for bio-psychosocial risk factors suggest Pincus, et al., (2013) who continue by saying that reliable and valid tools be used to do so. Once this has been accomplished, the patient should be sent for the specific intervention or treatments designed to target and treat their specific problem and the patient's risk profile.

It has also been suggested in the literature, that the multidisciplinary approaches to managing chronic low back pain, grant no additional advantages to management by individual physiotherapists or healthcare workers who employ bio-psychosocial principles to administer treatment (Kappa, et al., 2006). On the other hand, George, (2008) in her systematic review of the literature, says that there is clear evidence to support the effectiveness of a bio- psychosocial approach to chronic low back pain. She continues by stating that the potential for use of this model in primary care settings is great, especially in rural areas (George, 2008). The difference between the two reviews could be due to the fact that the first review done by Kappa, et al., (2006) considered studies done in the urban setting and the review done by George, (2006) looked at rural studies.

The bio-psychosocial approach provides an evidence-based framework for the prevention and management of on-going pain and disability. This popular model, recognises that pain does not strictly correlate to damage to tissues, body structures and functions. Each individual's perception of pain differs according to the influence of psychosocial factors. Therefore, effective pain and injury management should be based on the bio- psychosocial approach that considers the whole person i.e. their physical, social, psychological, social and emotional needs (Waddell and Burton, 2004).

More recently, Green and Johnson, (2013) used the bio-psychosocial (BPS) model in their study of back pain sufferers and found that although there are limitations to this model (namely by the BPS model becoming all inclusive and hence becoming more difficult to assign priority to each of the three areas i.e. bio, psycho, social), they feel that it merits application in providing a theoretical direction to the epidemiological research of pain of the spine (See Figure 2.5 The Bio-Psychosocial Theory of pain perception. Green and Johnson, 2013).

They continue by saying that this model serves as a means to view and to understand the complex association which exists between biological factors, health behaviours, environment factors and the ensuing health outcomes.

Physiotherapists recognise the importance of patients' social and psychological contexts and are fully aware of the challenges which these present. Psychosocial "obstacles" (e.g. patients' belief systems) can be viewed as potentially inhibiting patients to follow therapeutic advice (Sanders, et al., 2013).Physiotherapists interviewed in a recent British study felt that although they were equipped to treat the "bio" in the bio-psychosocial approach, they did not have adequate skills or training to deal effectively with the psychosocial aspect of their patients' care and management (Sanders, et al., 2013). The researchers therefore say that it of importance to equip physiotherapists adequately with knowledge of the psychological and social issues they will be confronted with in their care and treatment of patients. They suggest that this needs to be done at an undergraduate level (Sanders, et al., 2013).

A similar finding was presented by Nielsen, et al., (2014) who interviewed eight physiotherapists over one year. The physical therapists in this study cited a lack of knowledge about psychosocial issues and interventions as being a barrier to using the bio-psychosocial model in clinical practice. The therapists suggested that bio-psychosocial training and education about its role in the treatment and diagnosis of painful conditions should be taught within entry-level (undergraduate) programmes. The physical therapists however felt that training in the cognitive-behavioural approach should be done at the post-graduate level. Their reasoning for this was that the therapists needed clinical experience in order to correctly use this model and they suggested that this model should preferably be used under the guidance and mentorship of a psychologist to build confidence and basic skills prior to adding this complex model to the practice of physical therapy (Nielsen, et al., 2014).

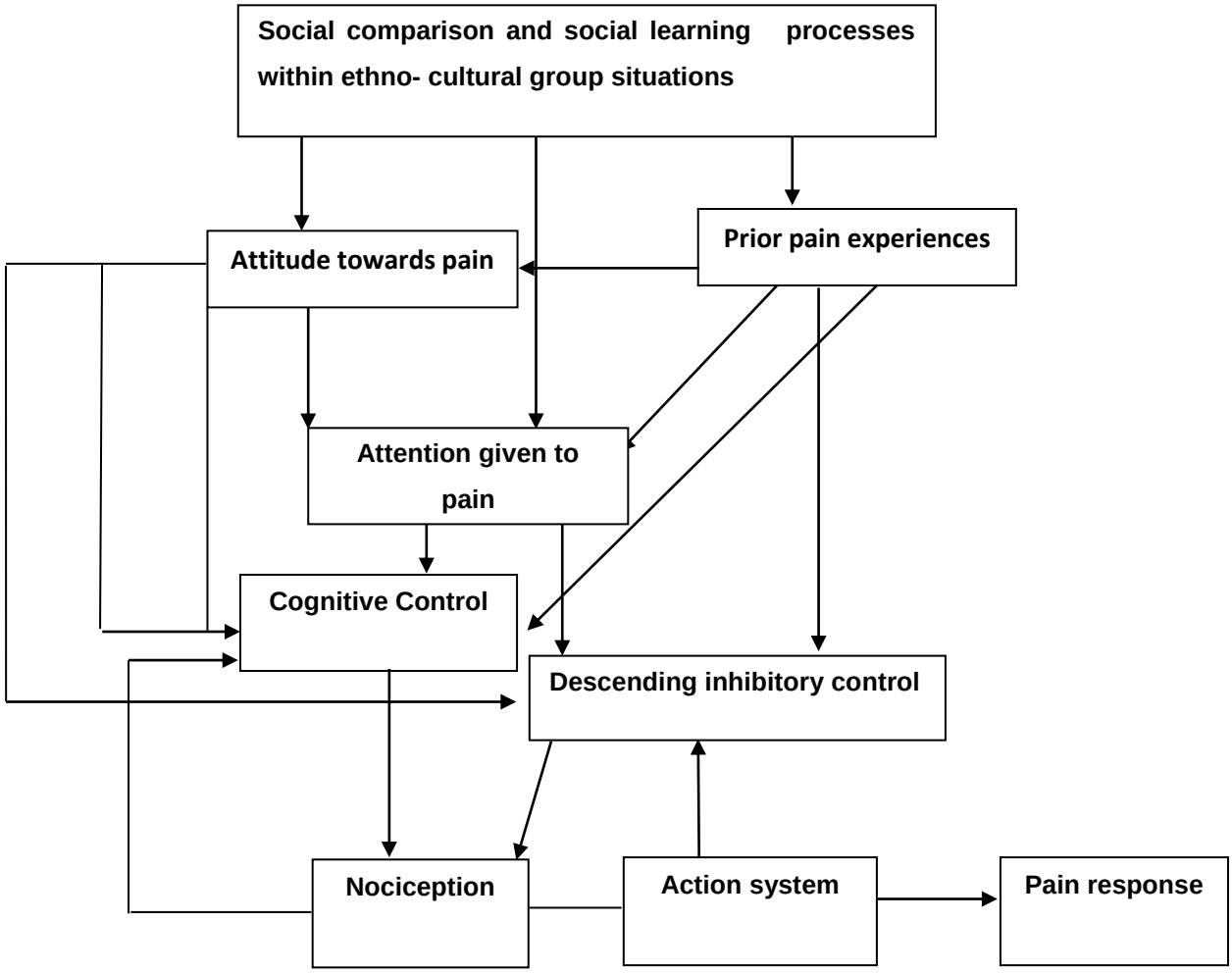


Figure 2.4 "The Bio-Cultural model of pain perception".

"(Modified from Bates, et al., 1993)"

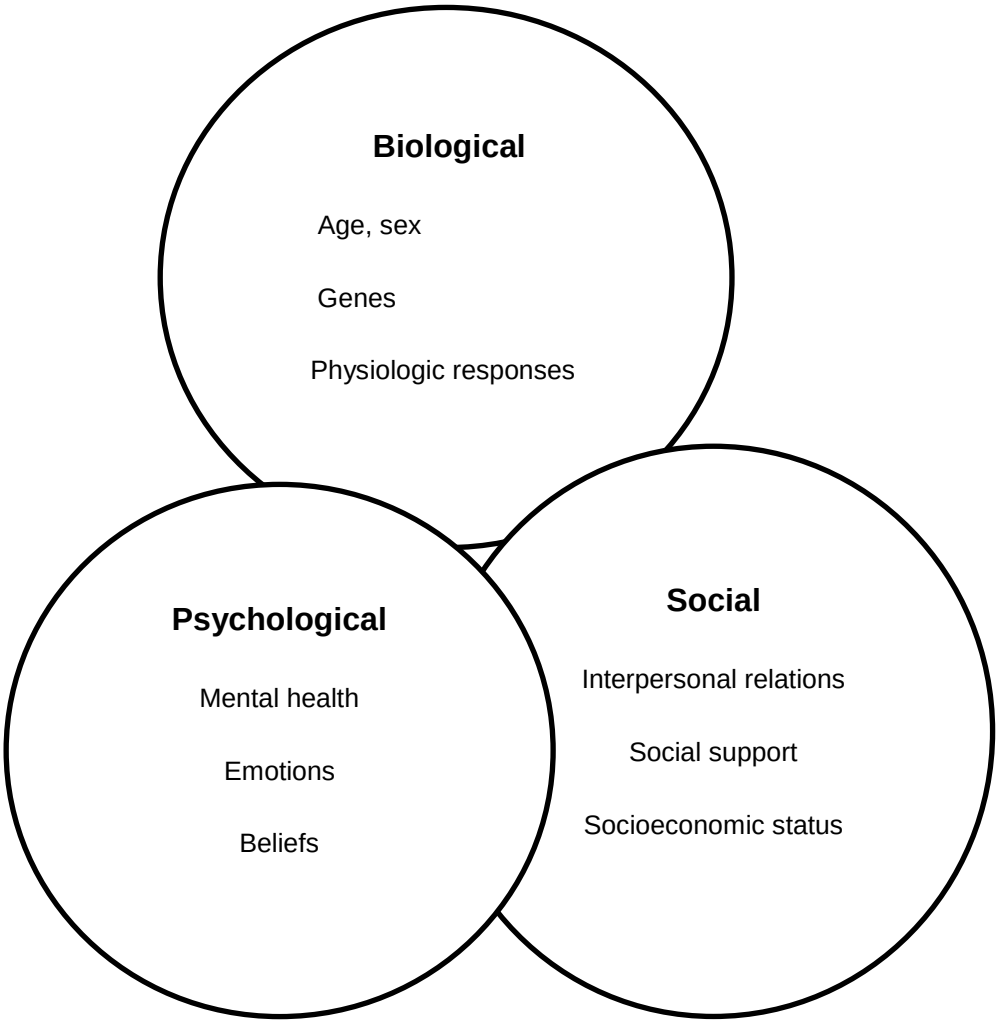


Figure 2.5 “The Bio-Psychosocial Theory of pain perception. This relates how various factors may intervene to affect physical and mental health. The experience of pain is influenced by interactions among the biological, psychological and sociocultural factors (Adapted by Green and Johnson, 2013)”.

2.9.4 The Cognitive- Behavioural Model.

Many of the variables that influence pain intensity and psychosocial disability are of a cognitive nature (Adams, et al., 2006). In the Cognitive-Behavioural Model the mind-body concept needs to be taken into consideration. Cognitive-behavioural components of the pain experience concentrate on the emotional, behavioural and social responses of patients (Dalton, et al., 2003).

The Cognitive Behavioural Model stresses the interdependence and interrelationship of three factors namely, behaviour, thinking and feeling is Evans, (2007). She continues by stating that discussing cognitive problems and emotional changes following a painful experience, in a group environment, helps with reducing a sense of isolation and helps lead to structured goal setting which in turn helps improve self-action (enabling the patient in pain) and mastery (of their pain). Communication sessions help with improved emotional coping and a reduction of pain behaviours ensues as communication improves. Restructuring of specific catastrophic thoughts and fears help in pain reduction, as does practicing skills to monitor or modify self-defeating thoughts. Evans, (2007) also suggests family support group sessions for the patient in pain (especially chronic pain syndrome sufferers) and their families.

Adams, et al., (2006) concur that cognitive strategies like problem solving and cognitive re-structuring, attempt to modify pain by cognitive processes. Behavourial strategies on the other hand attempt to modify behaviour (attitude to pain) through goal setting, pacing and operant conditioning or a combination of the aforementioned factors. Individuals can use four main types of cognitive strategies to cope with health problems and pain namely; distraction, palliative, instrumental and emotional preoccupation (Adams, et al., 2006). Distraction coping involves thinking or engaging in activities unrelated to the individual's pain or health problem. Palliative coping includes soothing strategies aimed at alleviating the unpleasantness of pain or of the health problem. Instrumental coping is similar to problem-focused coping and task-orientated coping for example finding out more about the illness or pain and seeking medical advice. Emotional preoccupation involves focusing on the emotional consequences of the illness or pain (Adams, et al., 2006).

Little is known about how individuals can, of their own volition and also by endogenously attenuating central sensitization, alter their affective and cognitive

responses to ongoing noxious inputs (Salomons, et al., 2014).They exposed thirty four healthy, pain- free participants to repeated thermal pain in eight sessions. Half of the participants received Cognitive Behavioural Therapy (CBT) during the research process and the other half did not receive any CBT. Their findings were that CBT modified pain perception and reduced central sensitization (reflected by secondary hyperalgesia). The reduction in secondary hyperalgesia was associated with reduced pain catastrophizing. This finding, they conclude, is suggestive of the fact that pain- related cognitions are related to changes in central sensitization (Salomons, et al., 2014).

2.9.5 Melzack's body-self Neuromatrix Model of Pain.

Previous concepts about pain perception are that pain is a sensation produced by injury, tissue pathology and inflammation. Melzack, (2001), states that pain is produced by a widely distributed, neural network in the brain and thus pain is a multidimensional experience. The pain experience and the behaviour of pain, according to Melzack, (2001), involve extensive areas in the brain including the sensory thalamus, the cortex, the limbic system and somatosensory projections. He continues by saying that because our body perceptions include visual and vestibular mechanisms as well as cognitive processes, widespread areas of the brain must be involved in pain. This widely distributed neural network he calls the "body-self neuromatrix". This "body-self neuromatrix" is genetically determined and has input and output patterns. The input patterns are comprised of sensory, affective and cognitive neuromodules (See figure2.6.Melzack's body-self Neuromatrix Model of Pain. Melzack, 2001).The output patterns from the neuromatrix produce the multiple dimensions of the pain experience and also produce behavioural and homeostatic responses following injury, pathology or chronic stress.

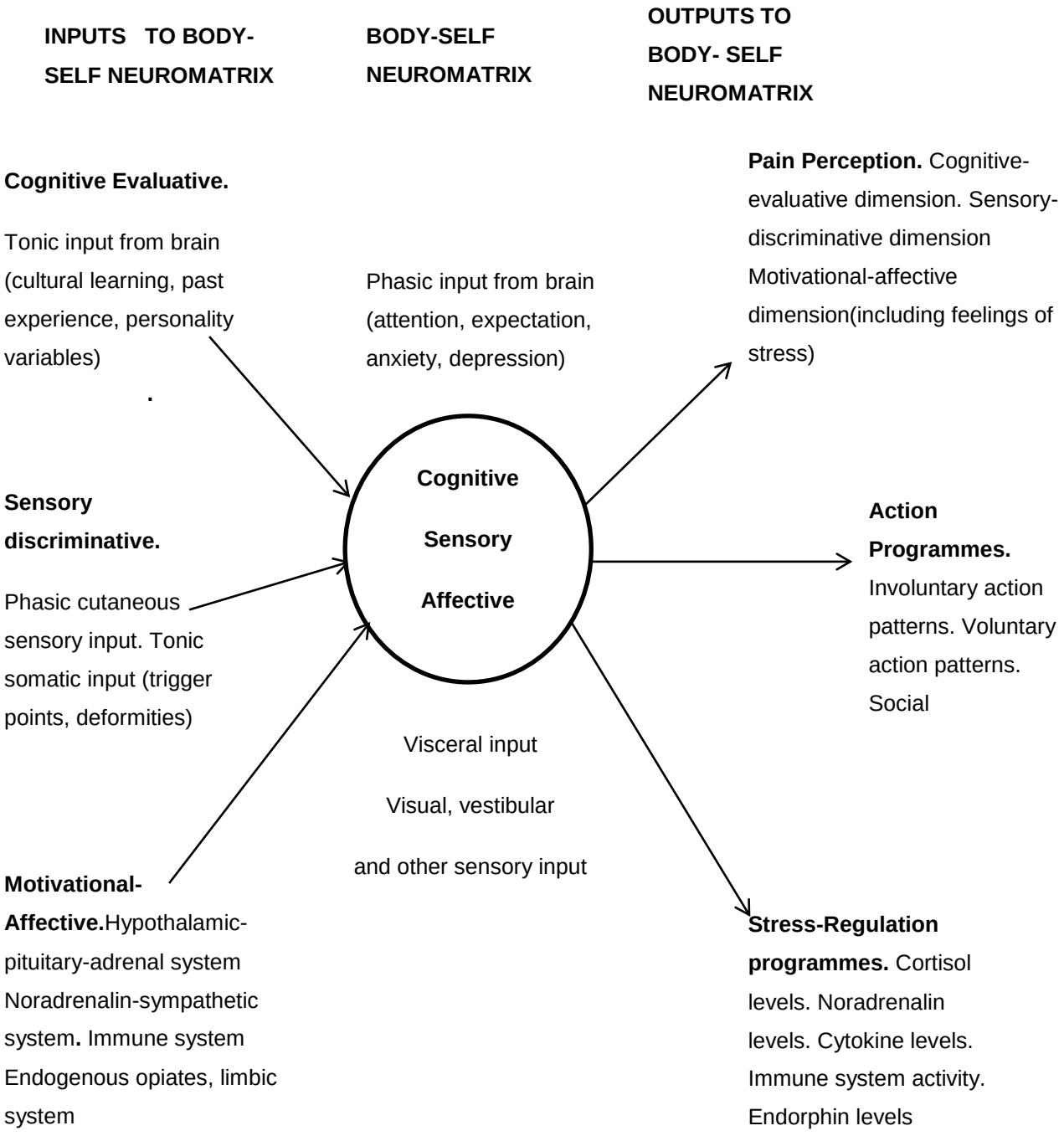


Figure 2.6 "Melzack's body-self Neuromatrix Model of Pain" "(Taken from Melzack, 2001.Adapted by Gatchel, et al., 2007)".

2.10 Factors to be considered when measuring pain.

2.10.1 Pain Intensity.

The measuring of pain intensity is considered to be important in the assessment and treatment of painful conditions. The pain-intensity scores obtained from different pain measuring tools or scales need to be translated into a common metric value instead of making assumptions about what various intensity levels actually represent (Jones, et al., 2007).

The use of pain assessment tools or scales is a fundamental indicator in the assessment and quantification of pain both in the clinical and research setting (Caraceni, et al., 2009).Most pain scales used are numerical scales ranging from nought to ten. Li, et al., (2007) grouped the pain rating of cancer patients into mild, moderate and severe. They say that this is useful for informing treatment decisions and for interpreting study outcomes. The patients in their study had to report their worst, average and current pain intensity on the Brief Pain Inventory (BPI) as well as their degree of functional interference due to their pain severity. The cut off points which they established for mild pain were 1 to 4, for moderate pain 5 to 6 and for severe pain 7 to 10. In an earlier study done by Collins, et al., (1997), the VAS was used to test pain intensity in 1,080 patients suffering from differing types of pain. They established that mild pain on the VAS was 2cm (mean score), moderate pain 4.9 cm (mean score) and the mean score for severe pain they established at 7.5 cm.

The pain levels across three measurement scales namely a Numerical Rating Scale (NRS), a Verbal Descriptor Scale (VDS) and the Bieri Faces Pain Scale were tested and correlated highly in the 135 elderly nursing home residents tested by Jones, et al., (2007). They found that for the NRS: 0 = No pain, 1 to 3 = Mild pain, 4 to 6 = Moderate pain and 7 to 10 = Severe pain. For the VDS the following was found: No pain. Slight and mild pain = Mild pain. Moderate pain. Severe pain, very severe pain and most intense pain possible all = Severe pain. For the Bieri FPS: Face1= No pain, Faces 2 to 3 = Mild pain, Faces 4 to 5=Moderate pain and Faces 6 to 7 = Severe pain. The analysis of these three pain scales showed extensive variability in the individual responses to pain which could be attributed to the difference in individual interpretation of the different verbal descriptors, numbers or faces describing pain. Regardless of which pain measurement tool or scale is used it is

important to categorize intensity of pain into mild, moderate and severe and to assign numerical values to each of these descriptions in order to quantify pain effectively (Jones, et al., 2007).

2.10.2 Pain Tolerance and Pain Threshold.

Although the intensity of pain is difficult to assess and measure, pain severity can be measured by the individual's pain tolerance (Swieboda, et al., 2013). Pain threshold as defined by Buchanan and Midgely in 1987 is "the first barely perceptible pain to appear in an instructed subject under given conditions of noxious stimulation" and they defined pain tolerance as "the greatest level of stimulus at which the subjects request stimulus cessation". Mersky and Spear, (1967) stated that pain threshold is more dependent on physiological factors and pain tolerance is more dependent on psychological factors and in their earlier (1964) study they showed that the reporting of the pain depends a great deal upon factors such as attitude, sex and cultural role.

Variations in pain thresholds depend on age, disease, anatomical region tested and a perceptive component which is affected by gender, genetic determinants, personality determinants, cognition and by psychological variables as well as by temperamental variables and cultural (previous pain experience and its meaning) and familial factors (Fischer, 1987; Pabis, et al., 2010; Mathews, 2011). Pain Tolerance testing and the reporting thereof can also be influenced by other factors such as the gender of the investigator (Park, et al., 2011).

2.10.3. Factors affecting Pain Perception and Pain Tolerance.

2.10.3.1. The presence of pain and its effect on pain perception.

There is a difference in pain perception in symptomatic (presence of pain) and asymptomatic (pain-free) individuals (Walker and Carmody, 1998). "Wind- up" of the dorsal horn or "dorsal horn sensitization" takes place when pain is present. This leads to a difference in pain perception between people who are in pain and those who are not (Walker and Carmody, 1998; Giesecke, et al., 2004).

2.10.3.2 The presence of pain and its effect on pain tolerance.

The presence or absence of pain also affects pain tolerance. Pain tolerance is lower in symptomatic individuals (those in pain) compared with the pain tolerance of asymptomatic individuals. This can be attributed to peripheral and central sensitization (Imamura, et al., 2013; Ramalho, et al., 2014; Giamberardino, et al., 2014). Bisogni, et al., (2014) found that the pain tolerance does differ between individuals who are experiencing pain and those who are not experiencing a painful episode. They established that patients suffering from chronic, painful diseases had a lower pain tolerance than a control group of individuals who were not in pain.

2.10.3.3 Cognition, age and pain perception.

“The prevalence and impact of pain increases with age” says Fillingim, (2005). Older adults tend to report a greater number of painful body sites, appear to expect more pain and have greater levels of pain-related interference of activities of daily living.

Age is an important factor in the relationship between pain and cognitive function. Executive function and memory are inversely correlated with pain rating in younger individuals (19- 40 years) (Oosterman, et al., 2013). On the other hand, in older individuals (50-80 years) a positive relationship between pain rating and executive function exists. This positive relationship between pain rating and cognitive function as seen in older individuals is they say, possibly due to age related reduced integrity of the shared neural substrate.

The effects of age and mild cognitive impairment on pain perception were assessed by Kunz, et al., (2009).In the mild cognitively impaired group no significant difference was found between their rating of pain and the age of the patient. An Indian study done by Saramma, et al., (2013) tested pain perception in patients following craniotomy. The researchers used a self-prepared validated questionnaire and the Wong Baker faces Pain Scale. They also found that there was no significant difference between pain perception and age or gender of the patient. The different results seen in the study done by Oosterman, et al., (2013) and the studies done by Kunz, et al., (2009) and Saramma, et al., (2013) could possibly be due to the participants’ differing levels of cognitive function impairment. Namely, Oosterman, et

al., (2013)'s study dealt with participants with severe cognitive impairment and the other two studies had mildly affected, cognitively impaired participants.

Age related and sex related differences should be considered when assessing pain perceptions suggest Nishimura, et al., (2014). A difference in pain perception between younger and older men existed in their study. This difference in perception of pain they relate not to an age difference but to reflex peripheral vasoconstriction which was better in the younger participants in their study.

Age is an important factor in the relationship between pain and cognitive functions and pain and cognition are closely linked (Oosterman, et al., 2013).Pain can negatively affect cognitive performance and tasks which are cognitively demanding may reduce pain perception. The cognitive-evaluative dimension of pain includes memory retrieval of previous painful experiences, adaptive learning as well as active decision-making (Moriarty and Finn, 2014).

There is a possible link between the neural substrates involved in cognition and those involved in pain processing and that these two systems moderate each other reciprocally. Ageing results in a reduced connectivity between the insula and the dorsal anterior cingulate cortex (highly involved in cognitive processing) in older individuals. Pain interferes with executive cognitive control or problem solving ability and poor attention control may restrict the ability to detract attention away from pain. This in turn can contribute to chronic pain and to the maintenance of the clinical symptoms related to chronic pain (Moayedi, et al., 2012; Landro, et al., 2013; Ceko, et al., 2013).

Cognitive impairment seen in patients suffering from chronic pain has been associated with emotional distress and mood changes. Other cognitive factors like increased somatic preoccupation(vigilance), fatigue, sleep disturbances and perceived interference with activities of daily living have also been associated with chronic stress and chronic pain (Martelli, et al.,2004).

2.10.3.4 Cognition, age and and pain tolerance.

Cognitive changes also have an effect on pain tolerance. Patients with cognitive impairment have higher levels of pain tolerance than cognitively intact elderly people (Scherder, et al., 2001). Patients with early onset Alzheimer's disease (AD) report

less intense pain, (have higher pain tolerance) than cognitively intact elderly people (Scherder, et al., 2001). Concurring that pain perception and tolerance does change with the advancement of age are Gibson and Helme, (2001) and Kerns, et al., (2011) who found that although older adults have a slight increase in pain threshold when compared with younger adults and older adults have moderate to large reductions in pain tolerance.

Pain tolerance tested by pressure algometry was assessed by Jensen-Dahm, et al., (2013). They found that pain tolerance is significantly lower in cognitively impaired elderly participants compared with cognitively intact elderly participants. This could possibly be due to impaired modulation of pain by the descending inhibition system in the cognitively impaired participants (Ceko, et al., 2013). Similar results were found by Koenig et al., (2013) who evaluated the cold pressor task (CPT) (a cardiovascular test), as a measure of pain threshold and pain tolerance. They found that age is significantly associated with pain tolerance. Statistical significant differences in pain tolerance were seen between the older males and the younger females in their study. The younger females had lower pain tolerance than the older males in their study. This could be due to the fact that women seem to show lower pain thresholds and have a lower tolerance for pain (Vallerand, et al., 2000).

There are other studies which have found that pain tolerance (pressure testing and the cold pressor test) showed no systemic differences between cognitively impaired and cognitively intact individuals. However, for mechanical pain, pain tolerance assessed showed a significant difference between the cognitively impaired and the cognitively intact group i.e. the more impairment the less the pain tolerance (Jensen-Dam, et al., 2013).Kunz, et al., (2009) tested pain tolerance in two groups of participants one group of participants had no cognitive impairment and another group had mild cognitive impairment. No significant difference between the two groups was found as to the effect of pain rating and pain tolerance in response to electrical stimulation. From these different studies, it appears that pain tolerance in elderly participants depends on the type of clinically induced pain and not so much on the level of cognitive impairment.

2.10.3.5 Cultural factors and pain perception.

A definition of culture is *"The way of life of a group of people, the complex of shared concepts and patterns of learned behaviour that are handed down from one generation to the next through the means of language and imitation"* (Barnouw, 1985).

Although race and ethnicity have been used interchangeably and are considered by many to mean the same thing, they are not (Kerns et al., 2011). Race they define as distinguishing population groups related by biological characteristics of common descent or hereditary. Ethnicity on the other hand refers to belonging to a group defined by shared beliefs, national origin, heritage and culture. "Several reviews of the literature have examined and acknowledged the ethnic disparities and inequalities in perception of pain in both clinical and experimental settings (Anderson, et al., 2009; Kerns, et al, 2011)".

"Culture provides the individual with ways of coping with the world. Learned patterns are only relatively fixed because culture can be distinguished by plasticity and change. When people live in a new culture, they adapt in various ways to that culture. Culture is a well-known influence in the expression and perception of pain in the individual. It also affects the way in which we view the pain of others due to our own system of beliefs (Weber, 1996; Alvarado, 2008)".

Certain factors need to be taken into consideration when assessing pain in patients of differing cultures. These include the specific characteristics of the patient's individual culture, their view of pain and their differing experiences of pain. Some individuals are stoic and rarely report pain whereas others tend to express pain more freely, depending on their cultural perception of pain (Im, 2006). The relevance of race and ethnicity of the patient and the healthcare worker as well as the interpersonal impact of the healthcare worker conducting the interview and assessment of the patient and the patient's pain were tested by Reid, (1992). Patients felt more comfortable being interviewed by a healthcare worker from a similar ethnic background to theirs as they felt that they better understood their cultural perceptions about pain.

Gender and ethnic differences in pain have been widely reported and this also needs to be taken into consideration when assessing pain in patients from different cultural backgrounds (Vallerand, et al., 1995; Payne 1998; Ramer, et al., 1999; Vallerand, et al., 2000; Alvarado, 2008). Nuhr, et al., (2004) propose that clinical intervention research in back pain would be greatly facilitated if a small number of relevant, patient centred measurement tools became internationally used. They say that some tools are more particularly suited to cross-cultural adaptation than others.

The belief that ethnic background affects pain perception is widespread among health professionals and lay people alike. “An understanding of the variations in the experience of pain is important in order to ensure a high quality of medical care for patients of different cultures in whom pain forms a part of their clinical picture (Greenwald, 1991)”.Few studies of pain and ethnicity have so far used quantitative measures of pain combined with multivariate methods of data analysis. In Greenwald’s 1991 study, pain was assessed in an immigrant population in the USA. The McGill Pain Questionnaire and a Graphic Rating Scale were used. No statistically significant relationships were observed between ethnic identity and measures of pain sensation (Graphic Rating Scale) but when using the McGill Pain Questionnaire in which affective terms are used to describe pain, there was variation in the response of the differing ethnicities suggesting that the way in which pain is expressed does therefore differ from culture to culture (Greenwald, 1991

When looking at pain-related cultural beliefs, Wong, et al., (2011) state that the Survey of Pain Attitudes (SOPA) is a good way of assessing cultural beliefs about pain. Beliefs about pain are hypothesized to influence the patient’s attitude towards their pain. The SOPA has been used extensively in Western society (Jensen, et al., 2003; Tan, et al., 2006). Wong, et al., (2011) found that the direction of relationship of emotion, medication and solicitude scales with pain intensity was the opposite to that seen in the Western population. The Chinese sample strongly believed in their ability to control pain and weakly believed that they were disabled. They also tended not to favour (Western) medication as an appropriate treatment strategy for pain control preferring instead more traditional control of pain such as acupuncture.

The Chinese sample therefore had a better adjustment to pain than the previously tested American samples (Jensen, et al., 2003; Tan, et al., 2006). The Westerners

tended to have the belief that the control of pain was out of their hands (that they were unable to control their pain) and they tended also to believe that they were more disabled by their pain. The Western sample strongly favoured medication as a treatment of pain and as far as solicitude was concerned, unlike the Chinese, they were less likely to seek help from family members this being suggestive of a "hopelessness response" say Wong, et al., (2011). They propose that these differences in pain beliefs and perceptions between the two different cultures, suggests that culture may predispose certain interpretive responses to pain experiences and that this may in turn influence adaptive reactions to pain.

Ethnic differences in pain description, pain tolerance and pain expression do exist. Rabow and Dibble, (2005) reported that ethnic minority cancer patients in the USA reported more pain than white cancer patients. African American cancer patients had significantly higher pain intensity, more pain-related stress and reported more pain-related interference with function than white cancer patients (Vallerand, et al., 2005; Rabow and Dibble, 2005). The opposite is seen in Chinese patients who preferred not to complain about their pain and who did not want to "bother" the nursing staff by asking for pain medication (Chin, et al., 2005).On the other hand, Mexicans who were interviewed about their pain experience complained about their pain and indicated that they wanted pain relief as quickly as possible. They also said that they preferred using words to describe their pain instead of using numbers to do so as they felt words could describe their pain far better than just measuring their pain severity by means of a number (Guarnero, 2005; Alvarado, 2008).

In Chinese society silence is valued in women suffering from the pain of childbirth. Chinese women feel that they will dishonour themselves and their families by wild or loud responses to pain (Chin, et al., 2005).The Chinese women get support and encouragement from their families but if the woman becomes overwrought with pain, she will land up being scolded or restrained (Chin, et al., 2005).Many South American, Central American and certain African cultures, see pain as important during childbirth and they believe the more intense the pain the stronger the love towards the infant (Guarnero, 2005). Pain is freely vocalised in these cultures and the women are not chastised for expressing their pain loudly. Beseeching Allah in prayer during childbirth is not uncommon practice in Muslim women. Some Muslim women believe that the more vociferous they are and the more obvious their

suffering, the more solicitous their husbands will be in the postpartum period (Guarnero, 2005).

Understanding how pain varies from person to person of different cultural backgrounds helps the health worker deliver a better and more appropriate (effective) service (Bates, et al., 1993). Differences in pain perception in a group of "old Americans" (Anglo- Saxon Americans) and American citizens of Irish, Polish, Hispanic and Italian extraction as well as French speaking Canadian immigrants was compared by Bates et al., in 1993. The "old" Americans and the Irish immigrants had the highest pain tolerance followed by the French Canadian, Italian, Polish and Hispanic immigrants. The different culturally prescribed styles of describing pain may have affected the patients' reports of pain severity. If one's cultural background either prohibits and discourages or accepts and encourages an outward (emotional) expression of pain or if the cultural environment in which one is raised causes one to focus one's attention on the pain as either being an inappropriate response or an appropriate one, these acquired patterns of culture will lead to differing styles of reporting pain and will also affect the actual perception of pain (Bates, et al., 1993).

The types of descending pain modulating mechanisms may differ across ethnic groups and this could contribute to the differences in pain perception and the response to pain. Psychological stress and stress due to the anticipation of pain also have an influence on pain perception (by increasing hypervigilance and fear of pain). There is a clear difference in ethnicity regarding sensory and pain responses and the motor responses to pain also differ between different ethnic groups (Komiyama, et al., 2009).Differences in pain modulating mechanisms in differing ethnicities were also established in a more recent American study conducted by Palit, et al., (2013). The pain processing of Native Americans (Cherokee, Creek and Choctaw) and their non-Hispanic, white counterparts was tested. They found that pain perception was reduced in Native Americans when compared to the results for the non-Hispanic whites. The researchers propose that this is due to an ethnic difference in the descending pain modulating mechanisms.

Other studies have compared pain perception and pain tolerance between American whites and African Americans (Mechlin, et al., 2011). Mechlin, et al., (2011) examined spinal cord sensitization in African Americans using temporal summation

of pain. Their findings were that African Americans had greater sensitization or enhanced CNS hyperactivity than the group of non-Hispanic, white Americans. This, they explain, leads to enhanced perception of pain (in the group of African Americans) due to the enhanced central sensitization. The researchers speculate that the differences between the pain perception and spinal cord sensitization in these groups could be explained by differences in descending inhibition (Palit, et al., 2013; Komiyama, et al., 2009).The enhanced pain sensitivity seen in African Americans could be explained by an under-activation of the descending inhibition pathways. They postulate that over-activation of the descending inhibition pathways could be responsible for the Native Americans dampening of pain and reduced spinal cord sensitization (Mechlin, et al., 2011). Another possibility put forward by Palit, et al., 2013 concurring with the findings of Mechlin, et al., (2011) is that psychosocial factors (e.g. perceived discrimination, ethnic identity) would certainly affect pain perception and the reporting thereof.

2.10.3.6 Cultural factors and pain tolerance.

Cultural perceptions are also known to have an effect on pain tolerance. Zborowski, (1952) compared the pain tolerance of Italian, Jewish, Irish and native born Anglo-Saxon, Americans. All the participants were patients in a large veteran hospital in New York. He found heightened expression of pain and a greater emotional response in the Italian and Jewish patients than in the Irish and “old”, Anglo-Saxon American patients. A significant racial difference in the pain tolerance of patients exists between White Americans and African- Americans. White Americans show a higher pain tolerance than African-Americans for heat pain, cold pressor pain and ischaemic pain (Reid, 1992; Campbell, et al., 2005). The African-Americans in Reid’s 1992 study came from a lower socio-economic background and had different cultural perceptions of pain compared with the views and beliefs of their white counterparts.

Differences in sensory pain responses and reflex responses, following pressure tolerance testing was established in Caucasian and Japanese university students by Komiyama, et al., (2009). The Japanese participants were more sensitive to pain than their Caucasian counter-parts. The researchers seem to think that the type of skin plays a role in pain perception and pressure tolerance. They suggest that there is a difference in skin properties between different ethnic groups, making certain skin

types more sensitive to pain than others. Ethnic groups with different skin types may vary with respect to dermal and epidermal nociceptors (Reed, et al., 1995).

The presence of culture differences, in pain thresholds and pain tolerance levels, was also evaluated by Dawson and List, in 2009. The main findings of their study were that differences in thermal and pressure pain threshold levels were significant between Swedes and Middle Easterners. They suggest that what needs to be considered, when carrying out this type of study, is the acculturation which takes place when a group of citizens from a different culture(for example, Middle Eastern) live in another country for some time and may have assimilated the other country's(for example, Swedish) lifestyle, values, culture and beliefs. Concurring that acculturation affects pain tolerance and perception of pain are Deyo, et al., (1985) who demonstrated that the lower the level of acculturation the more likely it is that cultural and ethnic factors will explain the differences between perceptions and tolerance of pain in immigrants and individuals born in the host country.

2.10.3.7 Gender factors and pain perception.

"There are two major classes of living organisms- male and female. In many cases, they are so different in form and habit that one might well be excused the thought that males and females are different species." Darcy B. Kelly (Walker, et al., 1998).

Psychosocial factors like sex role beliefs, pain coping strategies and pain related expectancies all contribute to gender differences in experiencing pain (Lund, et al., 2008)."Gender differences in functional status related to cancer pain exist (Im, 2005). Men are more stoical and tend to have higher physical functions despite their pain, than women. Gender differences also existed in the help-seeking behaviour of cancer pain sufferers as men are more likely to seek information regarding their pain and women are more likely to seek encouragement and support in dealing with their pain (Im, 2005)". Agreeing that females willingly reveal their pain and receive reinforcement, whereas males, on the other hand, are not encouraged and are sometimes even punished for expressing their pain are Nayak, et al., (2000) and Kröner-Herwig, et al., (2012).

Unruh, (1996) suggests that what may very well explain the pain perception differences between the sexes could be hormonal level fluctuations and neurological

differences. Gender role socialization could also contribute to gender differences in experimental pain perception because men and women have different learning histories regarding pain behaviour. African men tended to rate their pain as less painful than African women because African men are expected to be more stoical than African women and this stoicism is learnt from a very early age. “Big Boys don’t cry!” (Fillingim and Maxiner, 1996; Nayak, et al., 2000; Sheffield, et al., 2001).

A review of the literature on gender and clinical pain reveals a disproportionate representation of women receiving treatment for many pain conditions and suggests that women report more frequent pain, more severe pain and pain of longer duration than do men (Thuan and Le Resche, 2000;Nayak, et al., 2000;Albarran, et al., 2007). Systematic investigation of gender differences in pain is a relatively new field. “Although evidence for sex differences in pain has not been established beyond a doubt, distinct anatomic and hormonal features in women and men provide clues that their pain might be modulated in a differential manner by a number of biologic factors (Thuan and Le Resche, 2000)”. There are a number of hypotheses related to the role of oestrogen, progesterone and testosterone in the response to pain, in men and women (Hellstrom and Lundberg, 2000;Thuan and Le Resche, 2000).These hypotheses, namely that biological differences do exist between men and women, in the way in which pain is processed have been substantiated with clinical and experimental data on the interactions of the gonadal hormones with various neuroactive agents and on their effect on opioid and non-opioid analgesia (Hellstrom and Lundberg, 2000;Thuan and Le Resche, 2000).

Thuan and Le Resche, (2000) continue by saying that inarguably males and females do differ in aspects of their reproductive biology and sex differences in the structural organization and operation of the sympathetic nervous system and these may account, in part, for the apparent gender differences in pain (Thuan and Le Resche, 2000).Pain associated with the menstrual cycle (i.e. during ovulation and menstruation) is well documented and many non-pathologic disorders have been associated with the menstrual cycle e.g. headaches and low back pain. Some studies reported greater sensitivity to pain during ovulation, the premenstrual, menstrual and luteal phases (Fillingim, et al., 1997; Giamberardino, et al., 1997). Concurring with the former and later studies is Wiesenfeld-Hallin, (2005) who says that sex hormones do influence sensitivity to noxious stimuli and that pain threshold

and pain tolerance do vary with the different stages of the menstrual cycle, namely they both decrease during the premenstrual and menstrual part of the menstrual cycle (Wiesenfeld-Hallin, 2005). However, in contrast, there are other studies which have failed to show significant changes in the pain thresholds of females over the entire menstrual cycle (Hapidou and Rollman, 1997).

Gender differences in the forebrain cerebral activation patterns of the brain during pain perception, do exist according to Paulson, et al., (1998) who compared the PET scans of male and female brains, in patients suffering from irritable bowel syndrome (IBS), after the application of a painful stimulus (rectal distension). Their findings were similar to those of Suyenobu, et al., who in 2003, noticed that “the female brain showed greater activity in the limbic regions (emotion –based centres). The males, on the other hand, showed greater activity in the cognitive or analytical centres. The reasons for these gender differences have been widely explored and the focus of these differences being mainly on the biological aspects of pain perception, including the role of anatomical and physiological factors, hormones and neurotransmitters”.

Imaging of the brain showed differences in men and women in the spatial pattern (females showed greater activity in the emotion-based, limbic regions and males greater activity in the cognitive-based analytical centres) and intensity of response to acute pain (female response was more intense than that of males) (Wiesenfeld-Hallin, 2005). “Pain experienced in the research situation and in the clinical situation is fundamentally different” say Walker, et al., (1998).These differences exist due to an absence of inflammation in experimental pain and the presence of inflammation (which is usually involved, especially in the types of pain for which non-steroidal anti-inflammatory drugs are prescribed) in clinical pain. Gender differences in sensitivity to pain do exist. Females and males have similar thresholds for cold and ischaemic pain. However, pressure pain thresholds are lower in females than in males and females also tolerate less thermal (heat) pain than males (Walker, et al., 1998).

Part two of a systematic review of the literature, done by Racine, et al., (2012) was a review of results of ten years of laboratory research on pain and sex/ gender. Various bio-psychosocial factors were examined. These bio-psychosocial factors may contribute to differences in pain sensitivity between healthy women and men. The results reveal that the involvement of hormonal and physiological factors is

either inconsistent or absent. Some studies suggest that temporal summation, allodynia and secondary hyperalgesia may be more pronounced in women than in men. There is evidence to support less efficient endogenous pain inhibitory systems in women. This evidence however is mixed and does not necessarily apply to all types of pain. With regard to psychological factors, depression may not mediate sex differences in pain perception, while the role of anxiety is ambiguous. Cognitive and social factors appear to partly explain some sex-related differences. Whereas, past individual history may have an influence on female pain responses, they do not however, have an influence on male pain responses.

Gender differences in the words and patterns of language used, the focus of pain descriptions and the reported emotional response to pain were identified by Strong, et al., (2009). The language used by men and women when reporting pain may affect the way in which their pain is understood and evaluated by health professionals. Women tend to use more words, more pain descriptors and more graphic language than men do (Albarran, et al., 2007). Women also tend to focus more on the sensory aspect of their pain. Men on the other hand, use fewer words, less descriptive language and focus more on events and emotions. Common themes seen in both men and women were the functional limitations of pain and the dual nature of pain. Men and women also highlighted both emotional and physical aspects of their pain. It has been suggested in other studies (Unruh, 1996) that men are more likely to perceive emotional pain as less credible and less respectable than physical pain. The gender and status of the assessor can also change the subject's responses when reporting pain directly to another person (Leaper, et al., 2007). Women are reported to be more willing to disclose pain, provide more somatic symptoms, have higher emotional content and have a stronger social and holistic focus in their symptom reports. The reasons for these communication differences are often attributed to psychosocial aspects, gender role expectations and social roles in pain discourse (Strong, et al., 2009).

Recent literature indicates that there is growing evidence to support a gender difference in language and communication styles in the medical context. The reporting of pain sensitivity (measuring pain subjectively) and the perception of pain are also determined by education levels and the proficiency in the use of language

i.e. the better the education level and the proficiency in language, the easier and the better the reporting of the pain (Bernards, et al., 2008).

2.10.3.8 Gender factors and pain tolerance.

Gender differences have been reported in several studies of pain tolerance and the reporting of pain severity. Experimental pain studies found that women generally exhibit lower pain thresholds (PTs) and pain tolerance levels (PTLs) for pressure, electrical and thermal stimuli than men (Fischer, 1987; Unruh, 1996; Fillingim, et al., 1998; Walker, et al., 1998; Chesterton, et al., 2003; Komiyama, et al., 2005; Garcia, et al., 2007; Dawson and List, 2009). Ellermeier and Westphal, (1995) attribute the gender differences in pain sensitivity to secondary factors such as criterion effects, differences in body measures such as body size and skin thickness, sex-role expectations, basic sensory differences, sex hormones and criterion differences such as a greater willingness on the part of the female subjects to admit to high levels of experienced pain.

Garcia, et al., (2007) say that there are possibly three mechanisms responsible for this difference in pain threshold tolerance between males and females. These are:

1. Effects of the gender of the experimenter. The gender and status of the experimenter has shown to influence experimental pain thresholds and can change the participant's response when reporting pain directly to another person. Men would more than likely not want to show pain in the presence of an attractive woman researcher (Gijsbers, et al., 2005; Leaper, et al., 2007).

2. Gender differences of a hormonal nature. The menstrual cycle affects pain tolerance. Females are more sensitive to pain, have lower pain tolerance and lower pain thresholds during ovulation, pre-menstruation, menstruation and the luteal phase of their cycle (Fillingim and Maxiner, 1996; Fillingim, et al., 1997; Giamberardino, et al., 1997; Wiesenfeld-Hallin, 2005).

3. Gender differences in central modulation of pain. Pain perception takes place in the limbic regions or emotion–based centres of females and in males this takes place in the cognitive or analytical centres (Suyenobu, et al., 2003).

There are other studies however which have found no differences in pain tolerance between the genders (Isselee, et al., 1998).The majority of studies from ten years of research, show that measured pain intensity and unpleasantness showed no sex difference in many types of pain (Racine, et al., 2012).

2.10.3.9 Education levels and pain perception.

Functional health literacy is defined as a person's ability to function in the health care setting using their skills in literacy and numeracy. "Low functional health literacy may limit a patient's ability to comprehend, retain, recall and act on written health care measures (scales or questionnaires) of both literary and numerical content (Teutsch, 2003)".

There is a need for developing and implementing scales and instruments for all reading levels including those of low literacy levels. Health education materials have previously been written at levels far above what the general population can understand and they greatly exceed what people of a low literacy level can understand (Triffiletti, et al., 2006).Recent work suggests tailoring of cultural variables such as spirituality, time orientation and racial pride when developing a new outcome measure. All these variables can enhance the effectiveness of health communication (Triffiletti, et al., 2006).

Similar points of view are held by Salim, (1993) who agrees that the objective measurement of pain is difficult cross-culturally and what makes this measurement even more difficult is that the use of language varies amongst individuals. This leads to "the comparison of pain experiences varying from one individual to another, as the way in which one expresses and describes pain verbally. It is dependent on the individual's use and command of their language (Salim, 1993)". We can all describe the same emotion or express pain quite differently, due to our unique perception of pain.Language is a universal human phenomenon that shares an intimate relationship with culture. Language is a very powerful tool that can allow individuals to communicate with one another; however, language can also create barriers to communication (Shames, et al., 1998).

Education levels do play a role in patients' perception of pain say Shrestha, et al., (2013). They carried out their study of 300 patients in labour who rated their pain on

the VAS and found that those with higher education levels (secondary and tertiary education) perceived labour pain as more severe (scoring between 7 and 10 on the VAS) than did those of lower education (primary). This difference in pain perception they attribute to the fact that those women of higher education levels were perhaps less stoical due to their easier lifestyles and that those women with little or no formal education being used to more difficult lifestyles and were therefore more stoical and able to tolerate more pain (physical and emotional). In support of this difference in pain perception between differing education levels are Ozdemir, et al, (2013).Their study assessed the effects of both slow and fast intramuscular injection of Methylprednisolone in twenty five Turkish patients attending a dermatology clinic. They established that the participants in the higher education groups reported more severe pain and pain of longer duration than did those in the lower education groups.

Pain perception does vary among people with different educational backgrounds (Soares, et al., 2004; Dawson and List, 2009). They posit that perception of pain is higher in the better educated patient due to the fact that the better educated individual is “more in tune” with their bodies i.e. more aware of their health and their bodies. They are also more aware of the possible side effects of medical procedures and are better at expressing their pain than their lower educated counterparts.

Contrary to the belief that patients from lower socioeconomic levels and with lower literacy levels have higher tolerance for pain is the research done by Omulecki, et al.,(2009).They say that pain perception has a strong correlation with patient cooperation (during surgery to the eye) which in turn is dependent on level of education. Their study tested pain perception in two hundred and three patients following cataract surgery. Females in the higher education category were more cooperative and had higher levels of pain tolerance than their male counterparts and those patients with lower literacy levels. This result could possibly be due to the fact that this study tested levels of cooperation as well as pain perception. The females were perhaps more willing to cooperate due to the fact that females tend to more readily seek medical attention and are generally “more in tune” with their bodies than males are. Perhaps the females were better able to tolerate pain due to the fact that they were better prepared for the testing process (due to better levels of cooperation) and they were therefore less fearful (Nayak, et al., 2000; Kröner-Herwig, et al., 2012).

In a Zimbabwean context Jelsma, et al.,(1997) concluded that both numerical and verbal pain rating scales could be used in the better educated Zimbabwean population and they recommend that alternate methods of pain measurement (pictorial scales) be used for Zimbabweans of limited education. In another Southern African study carried out by Yazbek, et al., (2009), they state that understanding how the measurement tools or scales work can be problematic. Although the measurement tools (VAS 1, VAS 2, a Verbal Descriptor Scale and the Wong-Baker Faces Pain Scale comprised of six faces) were cross-culturally adapted to suit the Tswana participants in their study, they found that not one of the scales tested was best understood. However, participants in the higher education group (grade$\geq$9) fared better than their less educated counterparts (grade$\leq$8) as far as all of the aforementioned scales were concerned. Pictorial scales are better suited to participants of lower literacy and local beliefs and customs affect interpretation of written material. Low literacy levels will affect the interpretation of the various pain scales (Werner 1998).Lack of correct information, fear of what is strange or different often leads to misunderstanding. Werner suggests that in order to make materials better understood by low literacy groups, pictures should be used.

In a more recent Chinese study, low back pain (LBP) related beliefs and attitudes towards pain among a group of four hundred and thirty two Chinese health care professionals (with LBP) was tested by filling in of questionnaires (Back Beliefs Questionnaire and the Fear Avoidance Belief Questionnaire) and was found to be influenced by age, education level, location of work (rural or urban) and level of LBP disability (Tan, et al., 2014). The younger Chinese held more negative attitudes and beliefs about their LBP. The higher educated health care professionals and the older professionals had more positive attitudes towards their LBP. The researchers attribute this to the fact that the older participants showed a resilience which came with time and life experience and the better educated participants who tended also to be better educated as to the nature of their condition, were less fearful and had also lower levels of fear avoidance (and hence less disability) when compared with their lower educated counterparts. The participants in the urban setting showed similar results to those of the higher educated group and this finding, the researchers attribute to better levels of education in the aforementioned group (Tan, et al., 2014).

2.10.3.10 Education levels and pain tolerance.

Education levels are predictive of patients' pain perception, pain tolerance and pain intensity (Haase, et al., 2012). Ozdemir, et al, (2013) found that the participants in higher education groups reported more severe pain, pain of longer duration and had poorer tolerance for pain than did those in the lower education groups. Contrary findings were those of Reid, (1992) who found that participants with higher education levels display a higher pain tolerance. The fact that the higher education level participants showed a higher pain tolerance could be due to the fact that the higher education group better understood the entire research process and understood what was expected of them and were therefore less fearful when filling out the objective pain scales (Reid, 1992).

2.10.3.11 Psychosocial factors affecting pain perception and pain tolerance.

"The appraisal of pain in terms of loss, injustice, incomprehensibility or changes (primary appraisal) and in terms of control (secondary evaluation) determines how the subject will cope with pain (Radat and Koleck, 2011)". Rapidly developing areas of research are improving our knowledge of the interrelationship between pain, motor function and emotional state. Pain has affective and evaluative components and these are often just as important as the production and transmission of the pain signal itself. Pain perception is dependent on the context in which it occurs, the attention focused on it, the presence of anxiety or fear, the memory of pain, learned pain and the patient's expectations, beliefs and coping strategies (Hansen, et al., 2005).

Social cognition is the manner in which we interpret, analyse, remember and use information. The influence of effect on cognition is such that our moods can affect our reactions to stimuli such as pain. In other words, pain perception is affected by one's mood. If we are in a good mood we can handle pain better than if we are in a bad or depressed mood (Baron, et al., 2002). Pain perception is also affected by one's personality. Different personalities respond differently to pain. Personality traits like hardiness, optimism and neuroticism all affect pain perception and tolerance (Baron, et al., 2002). There is a definite link between positive personality traits such as hope, optimism and self-efficacy and pain perception. There also exists an inverse relationship between positive personality traits and pain "catastrophizing".In

other words, the more positive the patient's outlook on life and views on pain, the less likely they are to catastrophize and the less likely they were to exhibit "fear of pain" (Pulvers and Hood, 2013).Dispositional optimism can also contribute to an individual's resilience and acceptance of pain. "Acceptance of pain" is a result of a positive attitude and this acceptance of pain will in turn affect the perception and tolerance of pain positively (Pulvers and Hood, 2013).

There is considerable overlapping between neuroanatomical and neurotransmitter systems modulating pain perception and those controlling emotional states (Grieve, 2004). Anxiety and depression may increase pain severity (Davies, et al., 1993). This is especially true in females. However, a paradox does exists, as depression and anxiety are thought to be caused by deficiencies in serotonin also known as 5-hydroxy tryptamine (5-HT) and 5-HT is a pain producing neuromodulator. Antidepressants (5-HT uptake inhibitors) are successfully used as analgesic adjuncts in pain therapy.

Emotions do influence pain, its perception and tolerance. Specific beliefs namely that one is disabled due to pain, (disability), that emotions influence pain (emotion) and that others should be solicitous when responding to someone expressing pain (solicitude)were all significantly associated with greater levels of pain interference (how pain affects normal activities of daily living) and manipulating emotional aspects of a patient can definitely alter the self-report of pain perception by that patient (Osborne, et al., 2007; Salomons, et al., (2014)).

Pain perception and the reporting of pain are affected by socioeconomic status (Thomten, et al., 2012; van Hecke, et al., 2013). People living in adverse socioeconomic circumstances not only experience more pain they experience more severe pain, increased distress (mental) and increased incidence of disability related to their pain (Brekke, et al., 2002; Latza, et al., 2004; Carr, et al., 2005; Valencia et al., 2011; van Hecke, et al., 2013).Neighbourhood deprivation, low levels of education and (perceived) income inequalities all affect pain perception and the onset of pain interfering with daily activities. Chronic pain prevalence is inversely related to socioeconomic status. In the USA, higher socioeconomic status was associated with lower reporting of arthritic pain and better chronic pain outcomes than that for lower socioeconomic status (van Hecke, et al., 2013).

2.11 The importance of understanding a person's pain.

Crook in 1985 stated that pain is a form of communication. *"Whatever the cause of the pain, it takes on secondary characteristics of a communicative, behavioural or symbolic nature".*

In South Africa communication is at times problematic as we have eleven official languages which are not all spoken by all of the people in South Africa (Ross, et al., 2004).Communication is essential in the process of assessment and correct diagnosis of a patient. Successful communication and hence better assessment will lead to more accurate diagnosis and better treatment of a patient. In clinical practice, communication works both ways. The patient experiencing pain is affected by the clinician's attitude towards him and the clinician in turn is influenced by the patient's pain expression (Davitz, et al., 1985).Communication problems often occur in a multi-cultural practice. These problems include: impaired verbal communication related to cultural differences, impaired social interaction related to social dissonance, non-compliance related to the patient's value system i.e. health beliefs and cultural influences(Weber, 1996; Guarnero, 2005).

The ethnicity and culture of the healthcare worker may be as important as the patient's culture in determining the impact of pain and how it is treated (Davitz, et al., 1985). Their findings were that different culture and religious background were both important determinants of nurses' inference of patients' pain and suffering. This result therefore supported the hypothesis that nurses from different countries, differ in their inferences of physical pain and psychological distress in their patients (Davitz, et al., 1985).

In clinical practice the health worker must remember that, although communication may at times be very frustrating due to cultural differences and language problems, warmth and respect are characteristics that can always be communicated regardless of language ability (Davitz, et al., 1985; Weber, 1996). When verbal communication is a problem, non-verbal messages increase in importance. It is important to focus on the patients' non-verbal communication when dealing with pain and painful conditions. Besides taking note of the patients' non-verbal behaviour and signals, we

as clinicians and therapists, must also be aware of our body language and the subtle messages we may be giving our patients through our facial expressions and posturing (Weber, 1996; Guarnero, 2005).The healthcare worker's knowledge of specific cultural facts, like whether to make or to avoid eye contact with the patient or whether to touch the patient or to avoid physical contact completely, may prevent some pitfalls of non-verbal interactions (Galanti, 1991).

2.12 Back pain.

Low back pain is one of the most common musculoskeletal complaints in the industrialised world and it is also a problem in the developing world. The lifetime prevalence of low back pain has been estimated to affect 60% to 80% of the working population in the developed world and workers are likely to experience lumbar pain related to their labour activity at some stage of their lives (Bardin, 2002; Albert, et al., 2012;Rodrguez-Romero, et al., 2013).Agreeing with this are Roussel, et al., (2013), who go on to say that low back pain is one of the most common musculoskeletal disorders in the industrialized world and that 42% to 75% of patients still experience low back pain after the initial onset. This accounts for major expenses in the health care and disability systems. Also concurring that there is a growing worldwide burden of chronic conditions including chronic back pain are Carnes, et al., (2012).

It is calculated that 30,000 South Africans suffer daily from back and neck problems and 10% of them will become chronic (van Vuuren, et al., 2007). The prevalence of mid and upper back, chronic pain, is extremely low when compared to the prevalence of lower back and neck pain. This is likely due to the relative immobility and support of the thoracic region in contrast to the other regions of the spine. One report of back pain being of thoracic origin is 15% compared with 44% neck pain and 56% low back pain. Other reported prevalence is 5% thoracic pain versus 24% cervical pain and 33% lumbar pain (Benyamin, et al., 2012).

Low back pain is a widespread problem experienced by up to two thirds of the American population during their lifetime (Slater, et al., 2012). The claim that back pain is a short-term problem (Manchikanti, in 2000), denies the evidence of recent research (Enthoven, et al., 2004; Mc Kenzie, 2010; Mehling, et al., 2012; Slater, et al., 2012).They concur, that contrary to the earlier claims, many recent studies show

that over fifty per cent of back pain sufferers have recurring attacks, or persistent or chronic pain following their initial period of disablement.

2.12.1 Risk factors for low back pain.

The percentage of the work force affected by low back pain varies from country to country and the resultant number of hours lost in the work place is great (Manchikanti, 2000).The most common cause of low back pain is postural stress (McKenzie, 2010) and poor sitting posture and prolonged sitting due to our modern sedentary lifestyle all contribute to back pain. Working in a stooped position and incorrect lifting techniques also lead to back pain (Nachemson, 1992; Xu, et al., 1997).Symptoms arising from disorders of the lumbar spine are more difficult and complicated to diagnose and treat and it is this area of the spine that causes the greatest loss of work time (Maitland, 2007). Other risk factors for back pain include causal, probable (lifting, vibration, psychosocial factors, gender, obesity, heavy physical work, static work postures, back pain history, job dissatisfaction, levels of physical activity) and anatomical factors such as body height, scoliosis, kyphosis, leg-length discrepancy (Diamond, et al.,2006).

Days taken off for sick leave due to back pain are related not only to frequent mechanical exposure, but also to psychological and social work factors. Factors such as psychological demands, high job strain, high job dissatisfaction, perceived low co–worker and supervisory support, perceived lack of a pleasant and relaxing or supporting and encouraging culture in the work environment can all contribute towards back pain (Krause, et al., 1997; Vingard, et al., 2000; Eriksen, et al., 2004). Thomten, et al., (2012) concluded that socioeconomic components including poverty, education levels and employment, as well as financial strain and occupational level were also identified as risk factors for the incidence of pain. These factors, they say, can also be interpreted as increasing physical and psychological stress. This in turn would predispose the individual to pain and to the perpetuation of painful conditions.

2.12.2 Assessment of back pain.

Pain is a complex sensation (see section 2.3 on Pain) and it is dependent on many factors, the following factors must be taken into consideration when assessing a patient’s pain: social, psychological, cultural, environmental, neural, motor control,

genetics, articular system, memory of pain, central control (the brain) and central sensitization of pain (Hall, 2012).The importance of pain assessment is demonstrated by referring to pain as the fifth vital sign (Martelli, et al., 2004).

What makes pain more complex to understand and assess, is the fact that pain is subjective and the measurement of pain relies primarily on report back by the patient. The report back can be either verbal or written i.e. filling in of suitable questionnaires or scales. Due to the wide variation in the pain experience in different individuals, there is a similar variation in pain scale ratings in individuals experiencing similar episodes of pain. Pain scale measurements can also be interpreted in different ways by researchers and clinicians; depending on the criteria they select (Farrar, et al., 2000).Concurring with Farrar, et al., (2000) are Martelli, et al., (2004) who state that due to the fact that pain is subjective, the cornerstone of assessment of pain is the patient's self-report and that assessment of important aspects of pain should include nature(type) of pain, location of the pain, duration of pain, severity of pain, frequency of pain, the effect of the pain on activities of daily living (ADL) and factors relieving and exacerbating the pain. Pain related distress associated with sensory disturbances, cognitive interpretations, affective distress and behavioural avoidance should also be taken into consideration when assessing the patient in pain (Martelli, et al., 2004).

It is also important to look at the patient's belief system and their attitude to their condition when assessing pain and back pain in particular (Hall, 2012). The patient may have inappropriate attitudes and beliefs about low back pain such as high expectations about treatment of back pain and poor active participation in the treatment of their pain. They may also have inappropriate pain behavior such as fear avoidance and catastrophization.Understanding the impact of fear, expectations and attention to pain, will contribute greatly to the assessment and ultimately to the management of the patient suffering from pain, both acute and chronic (Hansen, et al., 2005).Work related problems and compensation issues as well as emotional problems and psychiatric co- morbidities need to be taken into consideration as well (Hall,2012).Agreeing that pain management depends on a comprehensive assessment and that appropriate assessment tools therefore need to take the patient's psychological status into consideration when analysing their outcomes are Hansen, et al., (2005).

Assessment of back pain is made easier by using scales to measure the severity (intensity) of the pain. By doing this the therapist has an idea as to whether the treatment employed is having an effect on the pain (worsening or improvement).Scales are a convenient ,easy and quick way of determining changes in the patient's symptoms (Moffet and McLean, 2006). Assessment of chronic back pain moves from focusing on identifying pain pathways and pain triggers to examination of the patient and assessment of their reactions to enduring pain or to coping with the pain (Martelli, et al., 2004). Assessment of pain also depends on functional health literacy. A person's ability to function in the health care setting using their skills in literacy and numeracy is defined as functional health literacy. A patient's ability to comprehend, retain, recall and act on written health care measures like scales or questionnaires(of both literary and numerical content), may be limited by low functional health literacy (Teutsch, 2003).

2.13 Language and the translation process.

Over the past ten years, patient-oriented evaluations using questionnaires and measurement tools have become an important aspect of clinical spinal outcome studies. Any measurement tool must be translated and culturally adapted in order to be used in different language groups. It is advisable that the translated version be evaluated for reliability and validity, which are fundamental attributes of any measurement tool (Padua, et al., 2002).

"A poor translation may lead to an instrument that is not equivalent to the original scale (Padua, et al., 2002)". Adaptation of scales for use for a new setting is time consuming and costly. It is however, of great benefit for subjects who are not English speaking (first language) and who because of this would otherwise have been excluded from studies. In this way selection bias can be avoided. A poor translation of a measurement tool (scale) may also lead to patients not understanding what is expected of them when presented with such a tool or scale. They will therefore also not be able to give a true reflection of their pain perception or intensity nor of whether there is an improvement or worsening in their pain over time (Padua, et al., 2002).

By adapting outcome measures to suit the target group (e.g. participants from differing cultural or language groups), selection bias can be avoided and a better understanding of the outcome measures can hopefully be achieved. The following

procedure, according to Ostlund, et al., (2006), should be followed when translating and culturally adapting pain scales. Two teams independently translate the scale (instrument) and two other teams produce the back- translations. The pre-test interviews done by them allowed the subjects verbal responses to be analysed and used for a second revision. They established that “the initial translations varied in words, expressions and grammar, shown in a lack of equivalence to the original instrument after back-translation”. In order to establish semantic equivalence, the teams had to change some grammar and some words needed to be replaced in order for experiential and conceptual equivalence.

2.14 Cross-cultural adaptation.

According to Mannion, et al., (2006), the adaptation of the instrument or scale in question has to undergo cross-cultural adaptation for the chosen target language before it is used in a study. If measures are to be used cross-culturally, the items must be translated well linguistically and more importantly must be adapted culturally to maintain the content validity of the instrument (scales) at a conceptual level across different cultures. Cross-cultural adaptation of pain scales therefore encompasses a process which looks at language and cultural adaptation of the scales which are to be used in a different setting (Beaton, et al., 2000; Ostlund, et al., 2006).

South Africa is a vibrant tapestry of diverse language groups and cultures (Ross, et al., 2004). Knowledge of a patient’s cultural milieu is necessary in order to understand culturally different individuals as well as how they perceive their life situations and how they go about problem solving. Beyond the differences in socioeconomic backgrounds in South Africa, differences also occur in life experiences in the different racial groups in our country. Western cultures for example emphasise self-reliance over dependency and achievement of personal goals over collective ones. African cultures embody the philosophy of *ubuntu*, which emphasises connectedness, relatedness and interdependence in relation to other people, the earth and one’s ancestors. Western culture is viewed as emphasising individualism and non-Western cultures are viewed as emphasising collectivism (Pinquart, et al., 2005).

Different cultures assign different meanings to disability, health, wellness and pain perception and cultural perceptions are known to affect interpretation of pain severity

(Battle, 1997). There are social norms or rules indicating how individuals are expected to think and behave in certain situations. Our culture and upbringing determine who we are and how we react to certain situations and stimuli (Smith and Bond, 1993).Other studies have found that cultural affiliations have an important influence on both acute and chronic pain (Bates, et al., 1993).Concurring that culture does affect the perception of pain are Yosipovitch, et al., (2004) who state that perception of pain is a personal experience which is influenced by many factors, including genetic, ethnic and cultural issues.

Newman, et al., (2005), state that cross-racial validity of pain scales has been studied in certain ethnic minorities in the West and to a lesser extent in non-Western countries. Results from these studies are conflicting and further research is necessary for proper cross-cultural validation of the culturally adapted scales Recognition and understanding of the association between culture and health are important in patient care, as cultural issues impact on the presentation, assessment and management of patients (Chang, et al., 2006).

2.15 The Pain Measurement tools.

As pain is a subjective, highly individual experience it does not lend itself to direct quantification by physiological or behavioural parameters (Vallerand, 1995; Cleeland, et., al 1997).Therefore a patient's self-report of pain is regarded as the single most reliable indicator of pain (Portenoy and Lesage, 1999). The assessment of a measure of chronic pain should be reliable, valid and sensitive to change (Ferraz, et al., 1991).

In clinical studies, clinicians rely on data as accurate and meaningful indicators of behaviour or attributes (Portney and Watkins, 2010).The first prerequisite is validity and the second is reliability. Whether a scale or measurement tool measures what we want it to measure and how well it does so, depends on its validity. When developing a new scale or measurement tool we need to take the following into consideration: Face Validity (namely the extent to which a scale is subjectively viewed as covering the concept it purports to measure) is important when establishing the validity of a new scale. So too are internal and external validity which are important in establishing a scale's overall validity. Does the scale cover all the aspects which we want to measure? (Content Validity).Does it have Construct

Validity? (Our scale may look right and cover the right things but does it have the property of having appropriate relationships with other variables?) (Portney and Watkins, 2010).The test-retest reliability of scales or measurement tools, is a means of indicating whether the same results are obtained on repeated administration of the given measurement tool or scale (Mannion, 2006).

A German study done recently (2013) by Rothaug, et al., compared the answers about pain severity given by patients after undergoing surgery. Their pain severity was measured on a Numerical Rating Scale (NRS) and on a binary scale (yes/no). Both formats were found to be reliable and valid, however when questioned as to their preference of scale, the patients said that they preferred the binary scale due to the fact that it was easier for them to understand as they were confronted with fewer choices. The researchers suggest that when measuring pain intensity, both types of scales should be compared in order to give better results and to promote better understanding of the scales thereby also improving the health worker's understanding of the clinical relevance of the patients' answers regarding their pain severity.

Rothaug, et al., (2013) also suggest that measurement tools be simplified to suit the target population and that in participants where there are low levels of cognition or where the participants are emotionally labile(anxious or depressed), simplified questionnaires are better suited. They also found that mean pain intensity levels differed substantially between the two scales which they tested (namely a Binary Scale and a NRS) particularly for "least pain" and "worst pain". There was a deviation between the binary zero and the NRS zero. They put this down to the fact that patients have different latent constructs of acute pain. They continue by saying that when faced with only two choices for "least pain" and "worst pain" in the binary scale (yes or no) the patients had to perhaps consider very carefully if their pain was worth mentioning and therefore getting the attention of the clinician or not. In other words they had to consider carefully whether their pain level was high enough to warrant mentioning and the ensuing attention it would procure.

2.15.1 The Visual Analogue Scale (VAS).

The VAS is one of the most commonly used scales measuring pain intensity. According to Terai, et al., (1998), the VAS is valid, reliable and is a simple and

sensitive means of pain assessment. The VAS is also good at detecting small changes of pain over time (Clark, et al., 2003).The absolute VAS is preferable to the comparative VAS because the comparative VAS is influenced by the effects of expectancy and deficient memory of pain (Carlsson, 1995; Clark, et al., 2003). The horizontal VAS has been found to be of a higher sensitivity than the vertical VAS (Ogon, et al., 1996) and the researchers suggest that a short written explanation of how the scales work is sufficient and that oral explanations are not essential in a population of literate participants. Testing the VAS and the (PBAPI) Pain Beliefs and Perceptions Inventory (which is a widely used instrument to assess pain beliefs) was done by Herda, et al., in 1994. The VAS and the PBAPI were translated into German. Both scales were found to be reliable and valid in this group of participants suffering from pain.

The validity and reliability of the VAS 1 (nought and ten only), the VAS 2 (nought through to ten) and the Verbal Rating Scale (VRS) was compared by Ferraz, et al., (1991) in participants who were literate and illiterate. Their findings show that the VAS 2 (numerical rating scale) had the higher validity and reliability in both groups of participants. The latter finding was similar to the findings of a South African study testing Tswana speaking participants suffering from low back pain (Yazbek, et al., 2009). Here too, the validity and reliability of the VAS 2 was found to be better than that of the VAS 1 in both literate and illiterate participants. In another African study done by Olaogun, et al., (2003), in Nigeria, to determine the reliability and validity of the VAS and a modified VRS of pain assessment found that there was a good correlation between the VAS and the VRS and that the McGill Pain Questionnaire (M.P.Q.) was not easily understood in a low literacy setting. In Zimbabwe, Jelsma, et al., (1997) found that although the Verbal Rating Scale (VRS) and the Visual Analogue Scale (VAS) were most widely used, a pictorial pain scale was found to be easier to use for subjects who have limited education. This finding was similar to that of Yazbek, et al., (2009).

Age-related patterns in three pain scales were analyzed by Gagliese and Katz in 2003. They used the VAS, PPI (present pain intensity) and the McGill pain questionnaire to determine pain following radical prostatectomy in younger (56 years) and older (67 years) men. Age differences in pain were found to be dependent on the type of scale used and all three scales had comparable sensitivity

within an age group. The VAS however, was found to be not sufficiently sensitive to detect age differences. They therefore recommend that in order to determine age differences in pain intensity, verbal descriptions of pain qualities are more reliable than non-verbal measures of intensity. The consistency between the scores of five scales (The Verbal Rating Scale, a Horizontal Numeric Scale, the Faces Pictorial Scale, the Colour Analogue Scale (CAS) and a Mechanical Visual Analogue Scale) tested in a participants with cognitive impairment was good for those with no cognitive impairment and also for those with mild cognitive impairment. Consistency was however poor for those participants with poor cognitive status (Closs, et al., 2004). An eleven point Numerical Rating Scale (NRS-11) was preferred over the VAS by elderly patients suffering from chronic pain due to the fact that the elderly patients preferred the NRS-11 over the VAS as they found it easier to understand (Kremer et al., 1981).

Patient preference of different pain scales was determined in a study done in 2014 in Turkey by Sayin, et al. They tested the Faces Pain Scale (FPS), VAS, Numerical Rating Scale (NRS), Verbal Descriptive Scale (VDS translated into Turkish), the Thermometer Pain Scale (TPS), the McGill Pain Questionnaire (MPQ) and its short form or SFMPQ and the Brief Pain Inventory (BPI). Patient preference for the scales was: FPS (97.4%), NRS (88.6%), VDS (84.1%), TPS (60.1%), SFMPQ (37%), BPI (11.4%), VAS and MPQ (10.5%).Sayin, et al., (2014) continue by mentioning that evidence from other studies shows that pain scales which take a long time to complete are not practical in the clinical setting. They also suggest that not using the VAS might lead to more accurate pain assessment. Also not in support of using the VAS to measure pain intensity are Pengel, et al., who, in 2004, found that the Patient Specific Functional Scale (PSFS) is a better scale to use, than the VAS and the Roland-Morris Disability Questionnaire, for the assessment of low back pain in Australian back pain sufferers.

When comparing pain scales in patients, Clark, et al., (2003) and Lund, et al., (2005), found that patients preferred the Verbal Rating Pain Scale (VRS) to the VAS. The VRS was easier to use and the patients were more comfortable using words to express their pain, than numbers. They also found that the VAS tended to over or under estimate the patient's perceived pain. The Visual Analogue Scale, the Verbal Descriptor Scale and the Faces Scale although valid and reliable, were found to be

preferred by the healthcare provider but were not useful for the patients themselves (Im, 2006).A patient's self-report of pain is regarded as the single most reliable indicator of pain (Portenoy and Lesage, 1999).The question about how the (subjective) pain experience could be objectified (measured) can also be raised (Im, 2006). Some of the participants in their study said that they felt humiliated when their pain was assessed by using the Faces Scale (used mostly in paediatrics) in the healthcare settings. Others said that their pain report was "corrected" by the healthcare providers during the interview. This raised questions about the objectivity of the pain assessment tools (Im, 2006).

Different pain scales have, in the past been used interchangeably. In their study Freeman, et al, (2001) concluded that there was high reliability between the Visual Analogue Scale and the Wong-Baker Pain Scale for assessment of pain in populations with diminished verbal and abstract thinking abilities. More recently, Belgian researchers found the VAS correlated highly with the disability questionnaires. They concluded that the VAS is not only an objective quantification of pain but that it also provides a good evaluation of the overall pain syndrome(i.e. pain and its disabling effect) (Plazier, et al., 2014).

2.15.2 The Wong-Baker Faces Pain Scale.

The Wong- Baker Faces Pain Scale is easy to understand and is used widely and very commonly for children (Wong and Baker, 1988). The Wong-Baker Faces Pain Scale (WBFPS) has been used historically in paediatric studies and clinical situations (Wong and Baker, 1988). It is also valid and reliable for use, albeit less commonly, for adults and for subjects with low educational levels (Kim and Buschmann, 2006).

In the Chinese setting, Li Li, et al., (2007), rated pain intensity in adult, Chinese patients. Recalled pain and anticipated postoperative pain were rated preoperatively. Pain Intensity was also rated on the pain scales postoperatively. "Worst pain", "least pain" and "average daily pain" were all scored. All of the scales tested had good reliability and validity. Almost half (48.1%) of the participants favoured the FPS-R, followed by the NRS (24.4%), the VDS (23.1%) and lastly the VAS (4.4%).Most of the patients in this study found the VAS difficult to understand. These results are similar to those found by Stuppy, (1998) and Herr, et al., (1998) who found that older

adults preferred the FPS followed by the NRS to the VAS. They attributed this finding to diminished cognitive ability and not to age.

In favour of using the Faces Pain Scale-Revised (FPS-R) to measure pain intensity are Huang, et al., (2012) who tested the Swahili version of the Numerical Rating Scale (NRS) and the FPS-R. The FPS-R was found to be the preferred scale. The participants found the faces easy to understand and they said that it was easy to see the difference in pain severity from looking at the faces. The only discrepancy seen in the results for the FPS-R was for the face for “no pain”. Some participants marked “no pain” at the first face and others marked it at the second face. The researchers say the reason for this could possibly be due to cultural perceptions i.e. some of the patients were being stoical or were too afraid of being considered “weak” to admit that they were feeling pain. The reason why the participants found the NRS more difficult to understand could be due to lower levels of education and difficulties in literacy, say the researchers.

2.15.3 The Verbal Rating Scale.

When comparing pain scales in patients Clark, et al., (2003) found that patients preferred the Verbal Rating Pain Scale (VRS) to the VAS. The reason given for this preference was that the patients found the VRS easier to use and were more comfortable using words to express their pain, than numbers. In another study, done by Lund, et al., (2005) the authors favoured the VRS over the VAS as they found that the VAS tended to over or under estimate the patient’s perceived pain.

In their review of three pain scales namely the VAS, the Verbal Rating Scale (VRS) and the Numerical Rating Scale (NRS), Williamson and Hoggart, (2005), also found that the VAS, although valid and reliable, has more practical difficulties and is difficult to understand. They continue by saying that the VRS and NRS are valid, reliable and easier to use. They say that the NRS has good sensitivity and generates data that can be statistically analysed but the VRS lacks sensitivity and the data it produces can be misunderstood. This finding is also true for the study done by Hawker, et al., a few years later, in 2011. They found that the NRS is easy to administer, to complete and to score. Another factor which makes the NRS easier to use they say, is the fact that it can be administered verbally and in writing. The agreement between a Verbal Rating Scale (VRS-4), an 11-point numeric rating scale (NRS-11) and the

VAS was examined by2000, Breivik, et al., (2000) who found that for acute pain, the VRS-4 was less sensitive than the VAS. The NRS-11 had similar sensitivity to that of the VAS and they say that for acute pain measurement, either the VAS or the NRS-11 can be used.

From this review of the literature it can be seen that the VAS, the Wong-Baker Faces Pain Scale and the VRS are valid and reliable measurement tools which have been used extensively, mostly in the developed world. There are fewer studies done in Africa and those done seem to favour Pictorial Pain Scales especially for participants of lower literacy levels (Jelsma, et al., 1997; Yazbek et al.,2009).

2.16 Scales tested in this thesis.

2.16.1 Money and Pain.

The relationship between money, social exclusion and physical pain was tested by Zhou, et al., in 2012. They found that “interpersonal rejection and physical pain caused the desire for money to increase. Handling money compared with handling paper reduced distress over social exclusion and it also diminished physical pain”. Being reminded of having spent money, however, intensified both social distress and physical pain. The loss of money could be equated with pain and distress. They theorize that money is a social resource that provides a broad capability to deal with problems and secure benefits. The idea of having money should therefore help buffer against social rejection and physical pain.

Money is a secondary re-enforcer that acquires its value through cultural perceptions, social communication and interaction (Delgado, et al., 2006). Money has been shown to influence reward learning. In their 2006 study Delgado, et al., experimented with averse conditioning. Their study concluded that money loss was as effective in driving aversive conditioning, as was the pain of mild electric shock. They state that money is a powerful incentive and that the loss of money can be equated with the pain of a safe electrical shock. Money is a powerful incentive which activates the same neural circuits as the rewards from physiological needs, such as food and sex. The meaning of and the value of money depends largely on personal experience and cultural perceptions (Tallon-Baudry, et al., 2011).

In this review of the literature, only one study could be found were coins were used to measure pain, namely pain intensity and pain relief. This study was done by Salim in 1993 and used the local currency of Pakistan, namely the Rupee. He translated the VAS, the VRS, the Numerical Rating Scale (NRS) and the McGill Pain Questionnaire into the local languages spoken in Pakistan. They were all found to be not sensitive, reproducible, valid, nor easy to use. The participants tested were local Pakistanis, mostly (90%) uneducated. This prompted the researcher to devise the PCPS (Pakistani Coin Pain Scale).This scale although similar to the VAS and the VRS, was found to be easy to understand and was simple to use for local, uneducated Pakistani. The way in which the scale works is the following: the patient is asked to describe their pain in colloquial language. Pain intensity is described in Rupees (Pakistani local currency with a subdivision of 100 paisas or 16 annas) (Salim,1993).For example, relief of pain after treatment can be equated with 50 paisa or 8 annas and this would translate as 50% relief of pain. If the patient indicates that he/she has 10 or 25 paisas relief this would equate to 10% or 25% relief respectively. The PCPS is a useful tool to use in developing countries, where 80-90% of rural populations have a low literacy rate (Salim, 1993).

Money can be defined as the ultimate objectifier, homogenizing all qualitative distinctions into an abstract quantity according to Zelizer, (1989). She continues to say that money can transform items, values, sentiments and experiences (good and bad) into numerical cash equivalents. Cultural perceptions and social structure determine the value and the meaning of money in different societies and cultures. Despite the importance of money in everyday modern life, the psychology of money has until recently received relatively little attention (Burgoyne, et al., 2006). “The study of money is not only necessary but it is also important as money matters (Burgoyne, et al., 2006)”. Money plays a very large part in the lives of anyone who lives in a modern economy. The way in which we respond to money is determined by the value placed on money by the society we live in. Our modern day society is very “me orientated” and materialistic. The amount of money we possess or earn is often equated with success in the eyes of the world. Money is seen as a means of achieving our goals and fulfilling our dreams. The more we have the happier we should be (Kluger, 2013).Contradicting the above theory are Burgoyne, et al., (2006)

who say that money does not necessarily bring happiness. They equate more money and materialism with unhappiness and “pain”.

2.16.2 Injections and Pain.

Injections are used to administer medication, to assist in making us healthy and to relieve pain. Ironically injections can also cause pain whist being administered to relieve pain and the symptoms of illnesses.Injections do cause pain (Chae, et al., 2011). Injections of microemulsion propofol used to induce anaesthesia causes intense and frequent pain and a suggested pretreatment of patients undergoing anaesthesia with Remifentanil would significantly reduce the incidence and severity of injection pain (Chae, et al., 2011).Concurring that injections cause pain are Rah, et al., (2012) who say that ironically, injections of corticosteroids, which are often used for the treatment of joint pain and are also one of the most commonly used modalities for treatment of chronic low back pain, are also known to be painful (Brown, 2012; Parr, et al., 2012).

The issue of pain, in children and infants, caused by injections in the immunization procedure, was addressed by Thomas, et al., in 2011. They say that newborns and infants often experience many painful procedures such as venipuncture, intramuscular injections, heel lancing and immunization. All of these procedures involve needles. They claim that newborn pain is not momentary as has been previously cited. Infants are capable of developing a physiological memory of pain and it may be manifested for months in an exaggerated form or activity. Pain associated with the immunization process (injections) is a source of great anxiety for the infant and the parents alike.

Venipuncture, intravenous cannulation and intramuscular injection are some of the commonly used methods of treatment, in medical practice today, involving the use of needles. In a study done on Indian children, Subashini, et al., (2008) undertook to compare the effectiveness of two pain assessment scales after the patients received some form of needle prick. The Faces Pain Scale and Colour Analogue Scale were compared in Indian children undergoing selected procedures which were painful. The painful procedures included venipuncture, intravenous cannulation, intramuscular injection, bone marrow aspiration and lumbar puncture. All of these procedures involved the use of needles. The Faces Pain Scale and Colour Analogue Scale were

used to compare the procedural pain in a child as perceived by the child, the parents and the health care professionals.

Pain originating from intramuscular injection should not be underestimated (Ozdemir, et al., 2013).Pain caused by an injection could cause the patient to become fearful which may in turn prevent the patient from seeking medical help. In their 2013 study, Ozdemir, et al., determined the severity and duration of pain after intramuscular injection in participants belonging to different education groups (participants with no formal education or primary education compared with participants who had either secondary or tertiary education). They found that the participants in the higher education groups reported more severe pain and pain of longer duration than did those in the lower education groups.

Pictures of injections could therefore represent pain. These pictures of injections could be used to represent the cause of pain (being painful) or as the relief of pain (taking pain away). In this review of the literature, no literature was found where pictures of injections were used to measure intensity of pain.

2.16.3 Colour, Pain and Emotion.

In view of the paucity of data in Indian children, Subashini, et al., (2008) undertook their study to compare the effectiveness of two pain assessment scales namely the Faces Pain Scale and a Colour Analogue Scale. The Colour Analogue Scale (CAS) used was comprised of only white and red. (White representing “no pain” and red “worst pain”) (Rosier, et al., 2002; Closs, et al., 2004; Subashini, et al., 2008).These two scales were compared in Indian children undergoing selected procedures which were painful (venipuncture, intravenous cannulation, intramuscular injection, bone marrow aspiration and lumbar puncture). The Faces Pain Scale and Colour Analogue Scale were used to compare the procedural pain in a child as perceived by the child, the parents and the health care professionals. Both scales were found to be suitable for use in the assessment of pain in Indian children. The CAS was also found to be valid and reliable in another paediatric study done in Canada by Bailey, et al., (2007).The VAS and the CAS tested in the latter study were found to have acceptable agreement. In a more recent, adult study, Bahreini, et al., (2014) compared three self-report pain scales in adults with acute pain. The scales tested were the VAS, the CAS and the NRS. The findings of their study were similar to

those of the paediatric studies, namely that there was close inter-scale agreement and that all three of these pain scales could be used interchangeably for adults suffering from pain.

In an earlier study, Rosier, et al., (2002) used various shades of gray to rate the pain caused by heat stimuli in their research. The paler gray colours represented “no pain” or “moderate pain” and the darker gray was representative of “severe pain” and “worst pain”. The participants were also asked to remember the worst physical pain of their lives and were asked to rate its intensity and unpleasantness. Both perception and measurement of pain were rated on the gray pain scale. Ratings obtained by this scale were found to be sensitive to small differences in stimulus intensity and had statistically indistinguishable session-to-session differences.

Choice of colour or preference of colour is often dictated by circumstances and culture (Lüscher, 1970). The symbolism of colours varies from culture to culture. People of different cultures respond to colour in varying ways on a subconscious and emotional level. Colour can be used to express emotions and can be used to describe pain. The cooler colours like blue, yellow and green can be equated with “minimal or moderate pain” and the orange and red spectrum of colours (the colours of fire and flames) can depict moderate to “severe pain” (Sato, et al., 2000;Ou, et al., 2004).

The colours blue, red, yellow and orange have common symbolism in both Western and African cultures (Heller, 1989).Blue and green are regarded as passive colours and represent calmness, coolness or the absence of heat. Red, yellow and orange are all considered to be active colours. Red symbolizes passion, heat, fire, extreme activity and in our South African culture it can also mean mourning as it is the colour of blood i.e. blood having been shed in battle (http:// www. find-health-articles.com/ rec pub 2009/05/03)Yellow and orange are warm colours but not as warm as red. Yellow is symbolic of a hazard and can also depict danger, but not as severely as red. When looking at the colours used in traffic lights, green represents safety, amber or orange represent caution and red represents danger (Lüscher, 1970).

Emotional association with colour was established by Boyatis and Vargese in 1993. A difference in response to colour was noted between the sexes. Males were more likely than females to have positive emotional reactions to dark colours and females’

emotional response to dark colours were more negative (Boyatis and Vargese, 1993). Hempill, (1996) described similar findings. Women responded more positively than men to bright colours and they also responded more negatively than men to dark colours. Colour preferences in humans were also investigated by Dittmar in 2001. She states that colour preferences change during the course of adult life and this changing preference is a multidimensional process that might combine various psychological and biological aspects. Tergwot, et al., (2001) had similar findings. They reached the following conclusions. Colour and emotion preferences change with age and at all ages colour and emotions are consistently related to each other.

2.16.4 Shapes and Pain.

Shapes can be seen as a means of communicating moods or feelings. *"I found I could say things with colour and shapes that I could not say any other way". Georgia O' Keeffe (1887-1986).* In my review of the literature of studies done on pain, I could not find any studies where shapes were used to measure pain. A triangle has not been used previously to measure pain as was established in this review. The Triangle could be used to describe pain of varying intensity if it were placed on its side with the apex facing to the left and the "right angle" facing to the right. The apex end would represent "no pain" (lower end of the scale) and the "right angle" end (upper end of the scale) would represent "worst pain". An increment in the size of the triangle is seen as going from left to right and this would correspond with an increment in pain intensity, going from left to right as well.

Shapes have an endless variety of characteristics which communicate different meanings and moods. There are three basic types of shapes. Geometric shapes, natural shapes and abstract shapes. Triangles belong to the group of geometric shapes. They are stable when sitting on their base or unstable when not. An inverted triangle can also have negative connotations (Watson, et al., 2012). Triangles have energy and power and are balanced. They can also direct movement based on which way they point. Triangles can be used to convey progression, increment or decrement (depending on the way in which they are facing) direction and purpose.

2.17 Conclusion.

Pain is subjective and is difficult to measure or quantify. The Visual Analogue Scale (VAS), the Verbal Rating Scale (VRS) and the Wong-Baker Faces Pain Scale (WBFPS) have all been used successfully to quantify pain subjectively in developed countries. Anglo-American scales and questionnaires have been used extensively throughout the Western World. Few studies have researched whether these scales are suitable for the African continent.

From a review of the literature it becomes apparent that when one develops a new scale or modifies a scale for a new setting, the culture of the target group, its literacy level, language, age, gender and education level, need to be taken into consideration. Correct translation and cross-cultural adaptation is required to ensure that the scale developed is both valid and reliable. Communication is also important in ensuring that the scales are understood and therefore used correctly. Appropriate assessment tools (scales and questionnaires) also need to take the patient's psychological status into consideration when analysing their outcomes. Understanding the impact of fear, expectations and attention to pain, will contribute greatly to the assessment and management of the patient suffering from pain. Adaptation of scales for use in a new setting is time consuming and costly. This adaptation is however, of great benefit for subjects who are not English speaking (first language) and who would otherwise, because of this fact, be excluded from studies. The relevance of a poor translation of a measurement tool (scale), in clinical practice, is that it may lead to patients not understanding what is expected of them when presented with such a tool or scale. They will therefore not be able to give a true reflection of their pain perception nor of their pain intensity. An improvement or worsening in their pain over time will also therefore not be measured accurately. This will adversely affect treatment choices and outcomes.

The following chapter, Chapter Three will discuss the development of the scales which were tested in this thesis.

CHAPTER THREE STUDY ONE

THE DEVELOPMENT OF THE SCALES FOR TESTING

3.1 Introduction.

The aim of this study was to establish the validity and assess the understanding of existing scales and newly developed pain scales in one hundred Tswana speaking individuals without back pain. The following are the specific objectives:

(1) to describe the understanding of new scales, modified scale and existing scales by the Tswana speaking participants.

(2) to correlate multiple pain scales.

(3) to compare the participants' understanding of original scales with their understanding of the scales when reversed.

This chapter deals with the selection and development of all the scales used in the studies described in the following chapters. Study One tested participants who were presently not experiencing pain. This was done due to the fact that when in a person is in pain, the perception of pain is different from when a person is not currently experiencing a painful episode (Walker and Carmody, 1998; Giescke, et al., 2004; Bisogni, et al., 2014).

As described in Chapter One, **the definition of best understood scale** for this study is: the scale on which the participants fill in "no pain" and "worst pain" most accurately i.e. when they fill "no pain" in closest to nought and "worst pain" closest to ten or on the same (corresponding) number of Coins, Injections, relevant Face or shaded area on the CAS. **The definition of "the spread of the scale"** is: the extent of the scale being used by the participants. This is calculated by subtracting the number marked by the participants for "no pain" (at the left, lower end of the scale) from the larger number (marked by the participants at the right, upper end of the scale), for "worst pain". e.g. if 1 is marked for "no pain" and 9 is marked for "worst pain" , then the spread of the scale is 9-1=8 which is a good spread, as the distance between "no pain" and "worst pain" should ideally be 10 (i.e. 10 for "worst pain" minus 0 for "no pain" which equals 10).

The selection and development of the scales took place in the following way: Due to potential problems with literacy and language as many non-word scales as possible were needed. A total of nine scales was used, some existing scales and others which were created or adapted for this study. The nine scales which were tested by participants in Study One were:

1. The VAS marked from 0 to 10 (Existing scale) (Olaogun, et al., 2003; Yazbek, et al., 2009).

2. The Colour Analogue Scale (CAS) white to red (Existing scale) (Closs, et al., 2004;Bailey, et al., 2007; Subashini, et al., 2008; Haung, et al., 2012; Bahreini, et al., 2014).

3. A Colour Analogue Scale (CAS) marked from green, yellow, orange to red (New scale).

4. The Injection Scale marked from no injection to ten injections in ascending order (New scale).

5. The Injection Scale marked with injections of increasing size from nought to ten (New Scale).

6. A Coin Scale marked in ascending order with no Rand coins to ten Rand coins (New scale).

7. A Coin Scale marked in ascending order with no Rand coins to ten Rand, but this time with the coins in heaps (Modified scale) (Salim, 1993).

8. The Wong-Baker Faces Pain Scale with six faces (Existing scale) (Wong and Baker, 1988).

9. The Wong-Baker Faces Pain Scale with only three faces (Modified scale) (Wong and Baker, 1988).

10. The reverse of all the scales.

The Visual Analogue Scale (number 1 above).There are a few differing versions of this scale ranging from a single line between two anchors to a series of numbers (usually 1 to 10 in integer spacing)(Ferraz, et al., 1991; Clark, et al., 2003). Both

scales have pros and cons (see section 2.16.1 in chapter two) and due to evidence in the literature that having the numbers below the scale was more easily understood, this is the format I chose to use in this study (Figure 3.1) (Ferraz, et al., 1991) in order to determine the spread used on the scale, the distance in millimeters was measured between the two points given for “no pain” and “worst pain”.

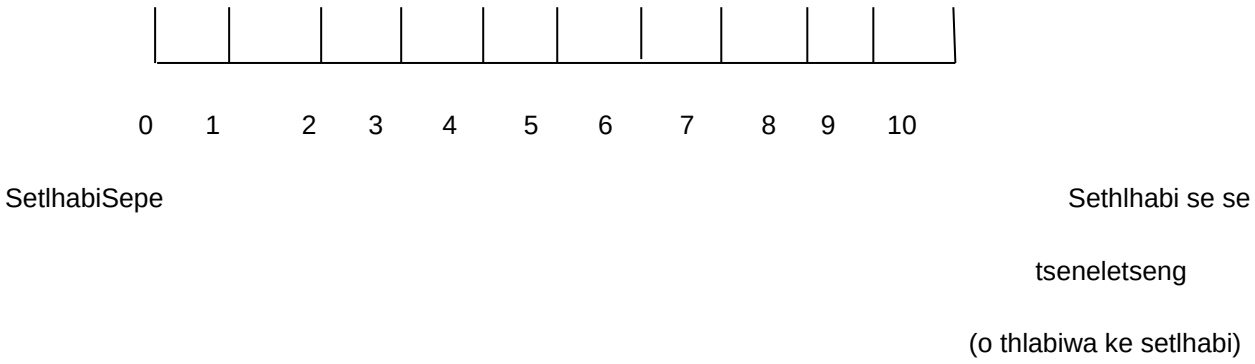


Figure 3.1 The Tswana version of the Visual Analogue Scale (VAS) used in this study.

The Colour Scales (numbers 2 and 3 above).A graded white to red Colour Analogue scale (CAS) has been described previously (Closs, et al., 2004; Subashini, et al., 2008). The colours in this scale are white (signifying “no pain”) and red (signifying “severe pain”). This scale has been used in many paediatric studies (Subashini, et al., 2008) and has also been used for the assessment of pain in adults (Bahreini, et al., 2014).

As well as using the red-white Colour Analogue Scale I designed a new version of a Colour Analogue Scale which uses the colours red, orange and green instead of white and red. This scale has not been previously used nor validated. The colours were selected from the literature as representative of degrees of “coolness” or “warmth”. Green was chosen to represent “no pain” and yellow and orange being warmer colours were selected to represent “mild” and “moderate pain” respectively. Red reminds us of fire, danger, intense heat and we tend to associate red with alarm and danger (Ou, et al., 2004). Red was therefore chosen to represent “severe pain”.

The white-red Colour Analogue Scale was drawn along a 20cm horizontal line with white fading into a light red which then darkens into a deeper red (figure 3.2). The green-red Colour Analogue Scale was drawn along a horizontal line 20 cm in length graded in colour from green (0 to 5cm), yellow (5 to10cm), orange (10 to 15 cm) to red (15 to 20 cm) (Figure 3.3).In order to determine the spread used by the participants on the scale, the distance in millimeters was measured from the mark they made for “no pain” to the mark they made for “worst pain”.

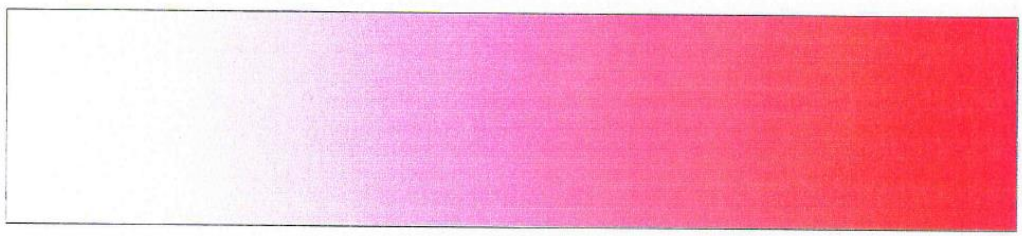


Figure 3.2 The Colour Analogue Scale (white to red) used in this study.



Figure 3.3 The Colour Analogue Scale (green to red) used in this study.

The Injection Scales (numbers 4 and 5 above).The Injection scales were both new scales based on the common association with pain- either causing or relieving pain (Cluett, 2010; Wheeler, 2011). Pain is caused by the needle of the injection and pain can also be taken away by the medicinal contents in the injection. My rationale behind doing this was that more, or larger injections caused more pain due to the length of time taken to inject all the medicinal contents. On the other hand, the more

pain one has, the more medication would be required to eliminate the pain. Both ways of looking at the injection number or size, equate less, or smaller, injections with less pain and more, or larger, injections with more pain. I used two differing concepts in developing the injection scales namely,the injections could either stay the same size and increase in number (Ascending Injection Scale) or remain as one injection which increased in size (Injection Size Scale). Thus for the Ascending Injection Scale, the injections were placed in incremental, ascending order along a 10cm horizontal line going from no injection on the extreme left to a maximum of ten injections on the extreme right of the line. The picture of the injections was placed above the relevant number on the horizontal axis (Figure 3.4).

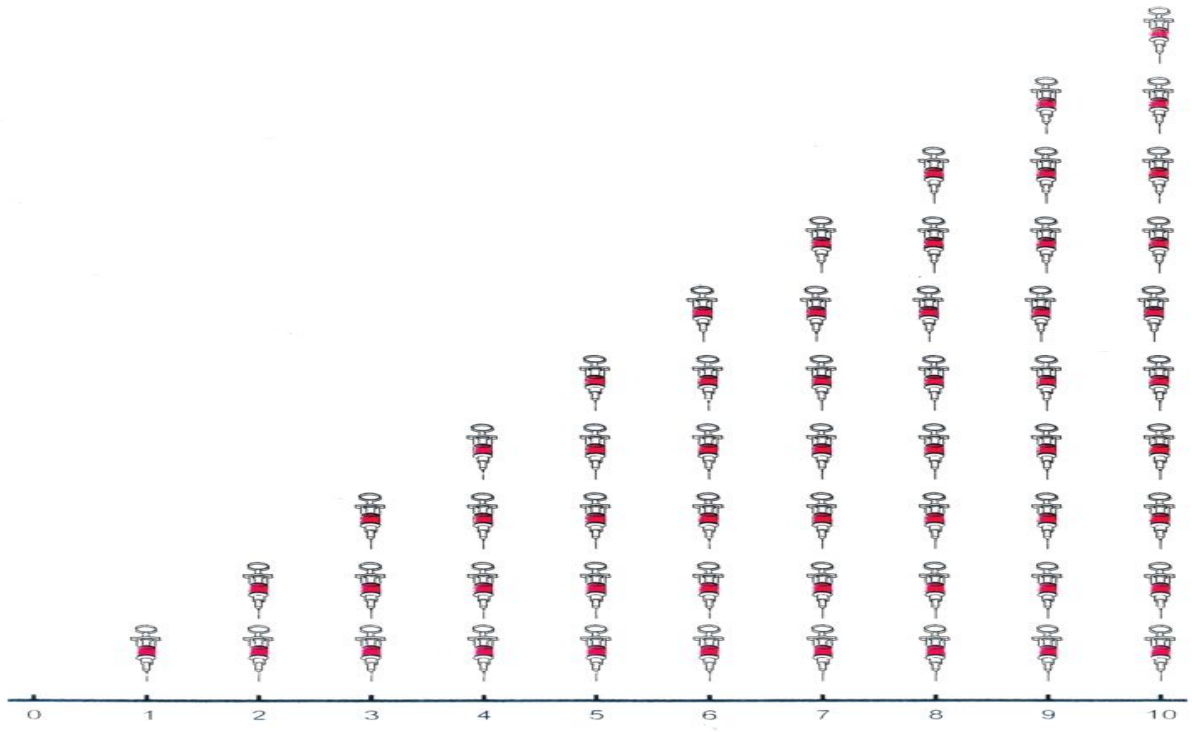


Figure 3.4 The Ascending Injection Scale used in this study.

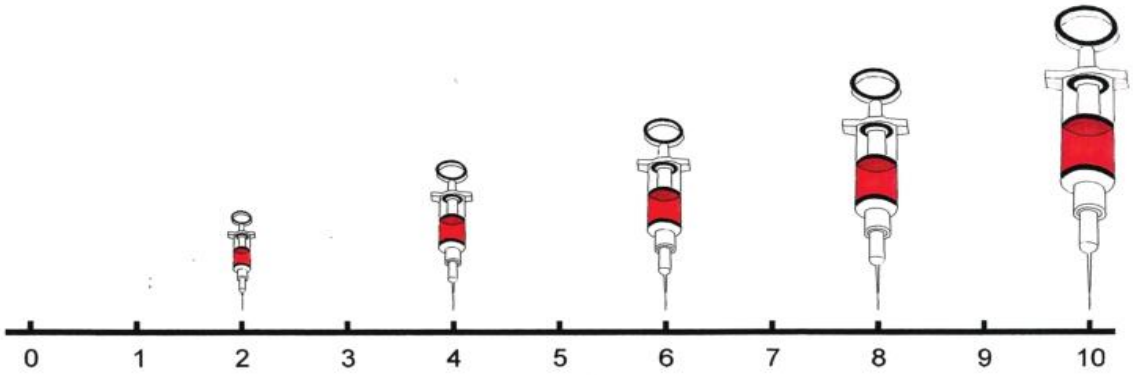


Figure 3.5 The Injection Size Scale used in this study.

The Injection Size Scale was marked with injections of increasing size from nought to ten with the horizontal axis of 10 cm marked like a VAS from nought to ten(Figure 3.5). The injections of increasing size were placed above the even numbers only. Participants were not restricted to only choosing even numbers but were also allowed to choose an injection of increasing size (above an even number) or a number (odd number) in between the injections. Here the increase in the size of the injection depicts an increase in pain intensity i.e. the smaller injections depict less pain and the larger injections depict more pain. In order to depict the spread used by the participants, the difference in the numbers under the injection number or size selected for “no pain” and “worst pain” was used.

The Coin Scales (numbers 6 and 7 above).The original Coin Scale was created and used by Salim in a study done in Pakistan and reported in 1993. He placed coins (Rupees) in heaps along a horizontal line. He found that the more pain his participants experienced, the more money they were willing to pay in order to rid them of their pain. For the use of this Coin Scale in South Africa, the currency was changed to Rands. An Ascending Coin Scale was created which had single coins which were marked from 0 to 10 Rand above a 10cm horizontal line. Again, as in the other pictorial scales, the pictures of Rand coins were placed above a VAS marked

from nought to ten. One Rand coin was placed above the number one and two one Rand coins were placed above the number two and so on all the way up to ten (Figure 3.6).

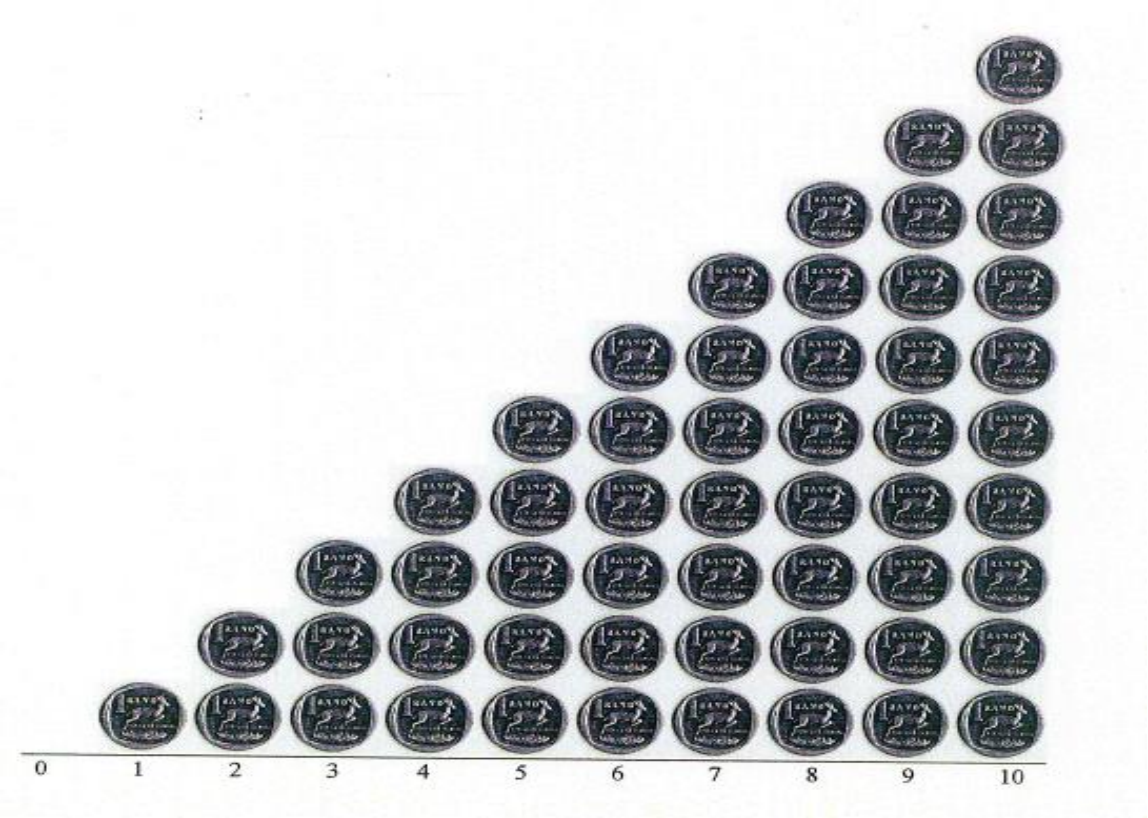


Figure 3.6 The Ascending Coin Scale used in this study.

The Coin Heap Scale also used differing amounts of money but instead the single coins were placed in heaps or piles (Figure 3.7).

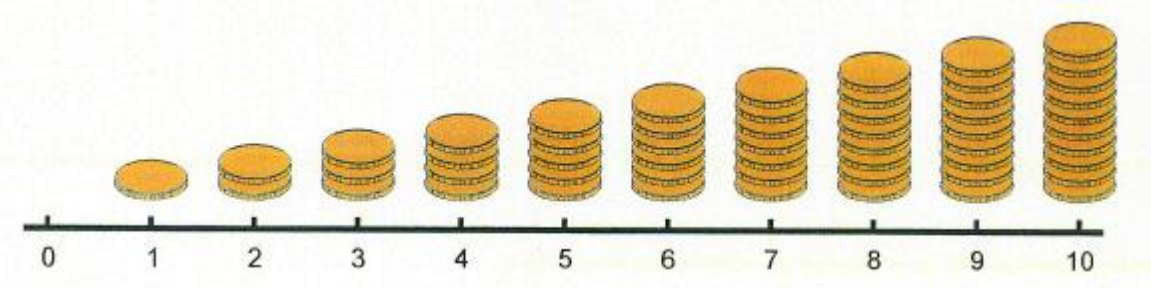


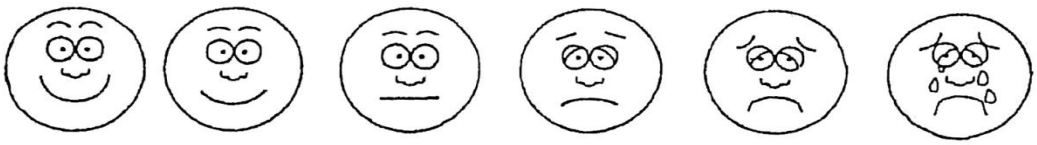
Figure 3.7 The Coin Heap Scale used in this study.

The Wong-Baker Faces Pain Scale (numbers 8 and 9 above).

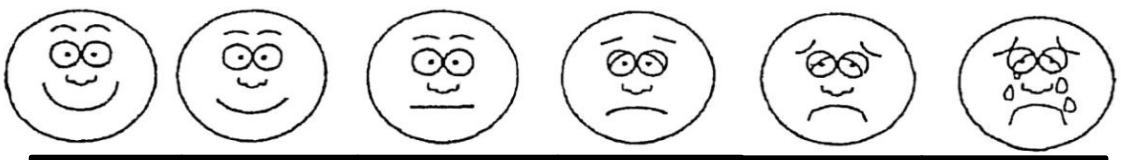
The Wong-Baker Faces Pain Scale (WBFPS) with six faces (Figure 3.8) is an existing scale (Wong; Baker 1988). The scale depicts an array of expressions starting with a happy face representing “no pain” all the way up to a crying face depicting the “worst possible pain”. In my scale, numbers were not written underneath the faces, instead, the faces had the following Tswana words underneath them: “No hurt” (Se tlhabisa sepe). “Hurts little bit” (Se tlhabisa go le gonnye). “Hurts little more” (Se tlhabisa go le gonnye go feta). “Hurts even more”(Se tlhabisa go fetisa). “Hurts worst” (Se tlhabisa mo go feteletseng).The translation process is described in Yazbek, et al., 2009.

For the purpose of this study I also created a Wong-Baker Faces Pain Scale with only three faces (Figure 3.9). Here only three faces were shown. “No pain” (Se tlhabisa sepe). “Hurts little more” (Se tlhabisa go le gonnye go feta) and “Hurts worst” (Se tlhabisa mo go feteletseng). It was hoped that this simplified scale would be easier to understand by the participants in this thesis.For analysis purposes the faces in the six-face scale were weighted from nought in increments of two up to ten i.e. nought, two, four, six, eight and ten, and those in the three-face scale at nought, five and ten in order to determine the spread of the scales used by the participants in this study.

Figure 3.8 The Wong-Baker Faces Pain Scale (six faces). (English and Tswana).



No hurt. Hurts little bit. Hurts little more. Hurts even more. Hurts whole lot. Hurts worst.



Se tlhabisa sepe	Se tlhabisa go le gonnye	Se tlhabisa go le gonnye go feta	Se tlhabisa go feta	Se tlhabisa go fetisa	Se tlhabisa mo go feteletseng



Figure 3.9 The Wong-Baker Faces Pain Scale (three faces).

The reversal of all of the scales in this study was also done to eliminate guessing and to ensure that the simple left to right sense of increasing pain was not the only reason for the participants choice of increase in pain intensity i.e. reversal of the scales was done in order to make sure that the participants were actually looking at the numbers, colours or pictures to decide on pain levels. Participants were therefore forced to think and to consider their choices carefully.

3.2 Method.

The scales were tested in one hundred Tswana speaking individuals of differing genders and education levels who do not have back pain. Twenty five participants from each of the following groups were identified and invited to participate: nurses, teachers, gardeners, domestic workers and builders. The nurses who participated were from the Anncron Clinic and the Wilmedpark Private Hospital situated in Klerksdorp, in the North West province of South Africa. The teachers were selected from the Matlosana Secondary School situated in Jouberton, fifteen kilometres north of Klerksdorp. The gardeners and domestic workers were employed in the northern suburbs of Klerksdorp. The builders all worked for a local construction firm, PCP Construction, in Klerksdorp, South Africa. Participants were all questioned as to their general health and special questions (regarding the presence of red flags) were asked (as I normally do in my clinical practice). The participants were selected according to the inclusion criteria stipulated below and they were not included in the study if they had pain less than 30 days prior to participation in the study.

3.2.1 Inclusion Criteria.

- Females and males.
- Age 18 years and above.
- Not suffering from back pain.
- Tswana speaking (first language).

3.2.2 Sample size.

According to Jensen and Turner, (2003) when testing the validity and reliability of pain scales, ten participants per item of each scale are required. There are ten items per scale hence a total of one hundred participants is sufficient (Jensen and Turner, 2003).

3.3 Ethical Considerations.

Participants were all invited to participate in the study and once confirmed that they met the inclusion criteria, were asked to sign informed consent. Permission was obtained from the management of two hospitals selected for this study, namely, the Anncron Clinic and the Wilmedpark Private Hospital which are both situated in Klerksdorp, in the North West province, South Africa. These were where the nurses were employed. Permission was also obtained from the management of the school where the teachers were employed and from the employers of the domestic workers, gardeners and builders. Ethics approval was obtained from the Human Research Ethics Committee, of the University of the Witwatersrand (Ethical Clearance certificate number M091121) (See Appendix). Participants were all allocated a study number which was written on the top of the questionnaires in order to guarantee confidentiality.

3.4 Translation of the scales.

This process had been previously completed and followed the process of cross-cultural adaptation (Yazbek, et al., 2009). Both of the Wong-Baker Faces Pain Scales and the VAS were translated from English into Tswana and passed the translation process. The translation process took place in the five stages of cross-cultural adaptation recommended by Beaton, et al., (2000) and Ostlund, et al., (2006).

3.5 Detail of Pain Scale completion.

The participants were all interviewed separately and were asked to complete all the scales. Each participant required approximately 15 minutes to complete the entire process. The participants were asked to mark on each scale where they would perceive “no pain” to be and where they would perceive “the worst possible pain” to be. The distance (either in number or millimetre) between the actual end of the scale (both for “no pain” and “worst pain”) was used as the measurement for each end of the scale. The difference between the lower mark and the upper mark was called “the spread” of the scale and represented the amount of the scale that was used by the participants between the two extremes of pain which could be perceived, as described above. On completion of all scales, the participants were asked which scales they found easy to understand and which ones they found most difficult to understand and to give their input as to how the scales could be improved. None thought that the scales needed to be changed. They were also questioned as to which scales they preferred.

3.6 Data Analysis.

In order to compare the scales, the Colour Scale measurements were halved to be out of a maximum of ten instead of twenty. The Mann- Whitney U test (for skewed data) was used to compare the spreads of the scales comparing the standard scales to the reversed version. Spearman’s correlation coefficients were used to determine the correlations between the multiple scales in their original and reversed versions. Spearman’s correlation coefficient was employed as some of the scales are ordinal scales and therefore the conservative route of the non-parametric approach was taken. The significance for the study was set at $p<0.05$.

3.7 Results.

The demographics of the hundred participants are as follows: the average age was 37.8(10.7) years. The gender split was 44:56 females to males. The comparisons between the spread marked on the original scales to those marked on the reversed scales are indicated in table 3.7.1.

Table 3.7.1 Comparison between the spread on original and reversed scales (n=100).

Scales	Spread Original Scale	Spread Reversed Scale	p-value
VAS	9	9	0.84
CAS white to red	8.65	8.73	0.55
CAS green to red	6.65	6.50	0.82
Ascending Injection	9	10	0.41
Injection Size	9	9	0.85
Coin Heap	10	10	0.63
Ascending Coin	10	9.5	0.86
WBFPS 6	10	9.32	0.31
WBFPS 3	9.6	9.30	0.42

The Mann-Whitney U-test was used to compare the spreads. The values for the spreads are calculated in centimetres.

There are no significant differences between the spread measured on any of the original versus the reversed scales. Thus analysis from this point on only looked at the original, non-reversed scale.

Table 3.7.2 The correlations between the spread, indicated by the participants, of all of the original scales (n=100).

Scale	CAS white-red	CAS green-red	Ascending Injection	Injection Size	Coin Heap	Ascending Coin	WBFPS 6	WBFPS 3
VAS	0.33	0.39	0.50	0.44	0.32	0.38	0.30	0.20
	0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01	0.05
CAS white-red		0.44	0.32	0.29	0.18	0.21	0.11	0.17
		<0.01	<0.01	<0.01	0.01	0.04	0.30	0.10
CAS green-red			0.02	0.01	0.29	0.28	0.07	0.04
			0.24	0.25	0.11	0.11	0.18	0.20
Ascending Injection				0.79	0.41	0.44	0.43	0.41
				<0.01	<0.01	<0.01	<0.01	<0.01
Injection Size					0.40	0.46	0.48	0.37
					<0.01	<0.01	<0.01	<0.01
Coin Heap						0.84	0.38	0.27
						<0.01	<0.01	<0.01
Ascending Coin							0.42	0.32
							<0.01	0.01
WBFPS 6								0.57
								<0.01

The top value in each cell is the r value and the bottom value is the p-value. Spearman's correlation was employed as some of the scales are ordinal scales and therefore the conservative route of the non-parametric approach was taken.

The correlations for the scales using similar concepts are strongly correlated namely, the two Injection Scales($r=0.79$; $p<0.01$) and the two Coin Scales($r=0.84$; $p<0.01$). The WBFPS are moderately correlated ($r=0.57$; $p<0.01$) (Sim and Wright, 2002). Overall the CAS using green to red showed the worst correlations with the other

scales and both Colour Analogue Scales showed weak correlations with both of the Wong-Baker Faces Pain Scales.

3.8 Discussion.

In one hundred Tswana speaking participants without back pain clear differences in the perception and correlation between pain scales was observed. The reason I decided to test the scales in participants without back pain was in order to see if the scales could be used, that is to see if they measured increasing severity of pain. The symptomatic participants are to be tested later in Study Four and Study Five.

The definition of best understood scale for this study is: the scale on which the participants fill in “no pain” and “worst pain” most accurately i.e. when they fill “no pain” in closest to nought and “worst pain” closest to ten or on the same (corresponding) number of Coins, Injections, relevant Face or shaded area on the CAS. “The spread” of the scales was measured in order to establish how much of the scale the participants were using. This is important as the larger the spread of the scales (the larger the extent of the scale used by the participants) the better their understanding of the scale. The Coin Heap Scale was the only scale where the spread was measured at ten for both the original and the reversed scale. This was followed by the next best scale the Ascending Coin Scale, then the WBFPS, the Injection Scales , the VAS and lastly by the CAS. “The spreads” for all of the scales, excepting that for the CAS, were large, varying from values of 9 to values of 10, when looking at the results for “the overall spread”. Both of the Colour Scales were not well understood by most of the participants.

It was important to reverse the scales in order to see if any difference in the understanding of the scales would be evident once the scales were presented to the participants, in both their original form (ascending order of pain intensity) and reversed form (descending order of pain intensity).Reversal of the scales resulted in no statistical difference between “the spread” of the original and “the spread” of the reversed scales. The same result pertains to the correct marking of “the ends” of the original and those of the reversed scales. The relevance of this finding is that, no matter whether the scales are presented in their original or reversed form, they are equally well understood by the participants. Either the original or the reversed scale therefore can be used to measure pain intensity of increasing severity. I therefore

decided to further test the scales in their original form only. One of the objectives of this study was to see whether all the scales used were understood by the population tested and to determine whether all of the scales were measuring perception of pain in increments of severity of pain. The participants appear to understand the association between injections and pain i.e. either pain caused by the injections or the number (or size) of injections required to take away pain. In the review of the literature, injections are depicted as both causing and relieving pain. Most people avoid injections due to the fact that the injection process is a painful one. In support of this are Chae, et al., (2011), who in their study, state that injections cause pain and Rah, et al., (2012) who found that injections of corticosteroids often used for the treatment of joint pain, are also known to be painful. The issue of pain caused by injections, in children and infants, during the immunization procedure, was addressed by Thomas, et al., (2011). The fact that needles cause pain was addressed by Subashini, et al., (2008), who undertook to compare the effectiveness of two pain assessment scales namely the CAS and the WBFPS (six faces) after the patients received some form of needle prick. The painful procedures included venepuncture, intravenous cannulation, intramuscular injection, bone marrow aspiration and lumbar puncture. All of these aforementioned procedures involved the use of needles.

The participants seem to understand the direct relationship which exists between coins (money) and pain. It appears not to make a difference in their understanding of these two scales whether the coins are drawn in heaps or in ascending order. The coins can represent either increasing pain or the amount of money required to take away the pain i.e. the amount of money required to pay the health professional to take away the pain. Supporting this view point that money can be associated with pain are Delgado, et al., who in their 2006 study experimented with averse conditioning. Their study concluded that money loss was as effective in driving averse conditioning, as was the pain of mild electric shock. The relationship between money, social exclusion and physical pain was tested by Zhou, et al., in 2012. They state that the loss of money could be equated with pain and distress. They also theorize that money is a social resource that provides a broad capability to deal with problems and secure benefits. The idea of having money should therefore help buffer against social rejection and physical pain. Contradicting the latter theory are

Burgoyne, et al., (2006) who say that money does not necessarily bring happiness. They equate more money and materialism with unhappiness and “pain”. The relevance of the finding that the two Injection Scales can be used in lieu of each other and that both Coin Scales can be used interchangeably to measure the perception of pain of increasing severity, is that, no matter how these Injection Scales or Coin Scales are drawn, it does not influence the participants’ understanding of any of these scales. Although the Injection Scales correlate well with each other and the Coin Scales correlate well with each other, the correlation between both of the Injection Scales and both of the Coin Scales is poor.

The results for both WBFPS show that the two Wong-Baker Faces Pain Scales have moderate to strong degrees of association with each other ($r=0.57$; $p=<0.01$). These two scales can therefore be used interchangeably to measure increments in severity of pain for this group of participants. This is more than likely due to the fact that the two WBFPS are similar in appearance hence making them easy to compare with each other. The participants were able to see the similarities between these two scales. The fact that the WPFPS did not correlate well with the other scales could be attributed to the fact that some of the participants possibly viewed these two scales as portraying emotion and not quantity of pain. The crying face possibly portraying sadness and not pain and the smiling face possibly portraying happiness and not a pain-free state (Pulvers and Hood, 2013).Perhaps the same explanation holds true for both CAS which did not correlate well with any of the other scales. Once more, as with the WBFPS, the participants could be equating colour with emotion and not with increments in pain intensity (Boyatzis and Vargese, 1993; Hempil, 1996; Ou, et al., 2004; Tergwot, et al., 2001). There are no similarities in appearance between both WBFPS and both the CAS. On the other hand there are similarities between the Injection Scales and the Coin Scales as they are both comprised of a horizontal VAS with pictures of injections or coins increasing in number or size. The latter reason could explain why there was a low degree of association between the VAS and the Ascending Injection Scale ($r=0.50$; $p<0.01$) and the VAS and the Ascending Coin Scale($r=0.38$; $p<0.01$).

The differences in the understanding of these scales in both genders and different education levels are reported on in Study Two.

CHAPTER FOUR STUDY TWO

Method

4.1 Introduction.

This chapter describes the statistical analysis and the results of Study Two. It also includes the discussion of the results. Due to the fact that the analysis was done on the same participants as in Study One, the study design and method are not described again.

4.2 The Aim of the study.

The aim of this study was to assess the understanding of existing scales and newly developed pain scales in one hundred Tswana speaking individuals without back pain.

The scales tested were those developed in Study One. A total of nine original scales was tested in Study Two. The reversed scales from Study One were not taken further into Study Two due to the fact that the reversal of the scales made no difference to the participants' understanding of the scales. The following are the specific objectives for Study Two:

(1) to compare the understanding of the pain scales (developed in Study One) between different education levels and between genders.

(2) to establish which scales are "good" scales, that is, which scales have the largest spread.

(3) to correlate multiple pain scales in both education groups and for both genders.

The definition of "the spread of the scale" is the same as that for Study One. In Study Two the spread of the scales in education and gender will be compared.

The definition of a "good scale" is a scale which has a good "spread" (the larger the better) and where "the ends" are marked at or very close to the extremes of the scale. This would imply that the participants understand the concept of "no pain" being equivalent to nought (at the lowest end of the scale) and "worst pain" being equal to ten (at the uppermost end of the scale).

4.3 Data Analysis.

Descriptive statistics including means, standard deviation and medians were used to summarize the continuous data. As all of the scales were assumed to be non-parametric, the median was calculated to illustrate the central tendency. Frequencies and percentages were used to summarise the categorical data. The Student's t test was used to compare continuous data. The Fisher's exact test was done on the gender and education split of the groups. Spearman's correlation coefficients were used to determine the correlation of the scales between the genders and the differing education levels. The Wilcoxon's rank sum test (also known as the Mann-Whitney U test) was used to compare the spread of the scales in both genders and was also used to compare the marking of the ends of the scales in both genders. The significance for the study was set at $p<0.05$. To compare the scales, the Colour Scale measurements were halved to be a maximum of 10 cm instead of 20cm.

4.4 Results.

The results are presented in tabulated form. The tables are representative of the demographics of the participants, as well as tables depicting data of the correlation between all of the scales, differences in the participants' perceptions of the "ends" of the scales and the "spread" of the scales in both education groups and in both genders. On completion of all the scales, the participants were asked which scales they found easiest to understand and which ones they found most difficult to understand. The participants were also asked to give their input as to how the scales could be improved. None of the participants thought that the scales needed to be changed. They were all happy with the scales as they were. The participants were questioned as to which scales they preferred.

The following table represents all the participants who took part in the study. It shows their average ages, their gender and the education group which they belonged to.

Table 4.4.1 Demographic data for pain-free participants in Study Two (n=100).

Group	Participants	Gender Split(m:f)	p-value	Age(years) Mean(SD)	p-value
Whole group	n=100	44:56		37.82(10.7)	
Educated >grade12	Nurses(n=25) Teachers(n=25)	4:21 9:16	0.20	33.5(8.7) 43.6(8.8)	**<0.01**
Entire group >grade12	n=50	13:37		38.6(11.5)	
Educated≤grade12	Domestic workers(n=25) Builders(n=25)	6:19 25:0	**<0.01**		**<0.05**
Entire group ≤grade12	n=50	31:19		37.1(10.0)	

The domestic worker group includes gardeners. The p- value was calculated from Fisher's exact test on gender and education split of groups and by the Student's t-test for age differences.

The distribution of the sample by education group, gender and age is given in table 4.4.1 above. The total group was split overall for gender and education. There were significant differences within the groups when split by education level ($p<0.05$). There were significantly more males in the builders' group when compared to the domestic workers' group ($p<0.01$). There were significant differences in age within the groups with the teachers significantly older than the nurses ($p<0.01$) and the domestic workers significantly older than the builders ($p<0.05$).

The following table shows the correlation of the spread of all the scales in the lower educated group ≤ grade 12(n=50).

Table 4.4.2 Correlations between the spread of the scales for participants with an education level grade ≤12 (n=50).

Scale	CAS white-red	CAS green-red	Ascending Injection	Injection Size	Coin Heap	Ascending Coin	WBFPS 6	WBFPS 3
VAS	0.33	0.15	0.45	0.32	0.41	0.51	0.20	0.19
	0.02	0.31	<0.01	0.02	< 0.01	<0.01	0.17	0.18
CAS white red		0.45	0.35	0.37	0.29	0.37	0.11	0.23
		0.01	0.01	0.01	0.04	<0.01	0.44	0.11
CAS green red			0.09	0.21	0.25	0.23	0.30	0.35
			0.55	0.14	0.08	0.11	0.04	0.01
Ascending Injection				0.82	0.51	0.67	0.37	0.41
				<0.01	<0.01	<0.01	0.01	<0.01
Injection Size					0.60	0.65	0.36	0.33
					<0.01	<0.01	0.01	0.02
Coin Heap						0.82	0.50	0.47
						<0.01	<0.01	<0.01
Ascending Coin							0.50	0.48
							<0.01	<0.01
WBFPS 6								0.47
								<0.01

Top value in each cell is the r value and the bottom value is the p value. Spearman's correlation was employed as some of the scales are ordinal scales and therefore the conservative route of the non-parametric approach was taken.

The two CAS have a low degree of association with each other (r=0.45; p=0.01).This means that both CAS cannot be used in lieu of each other in order to measure perception of pain of increasing severity. Furthermore, the two CAS do not correlate well with most of the other scales as correlation coefficients range from no association to low association. Both Coin Scales have a very strong degree of association (r=0.82; p<0.01). Both Coin Scales may therefore be used to measure perception of pain of increasing severity for this education group (grade≤12).The Injection Scales also correlate strongly with each other. Their degree of association is also very strong(r=0.82; p<0.01). Here too, as with the Coin Scales, both of the Injection Scales may be used to measure perception of pain in increments of severity

for this education group (grade≤12).Both of the Injection Scales correlate significantly well ($p<0.05$) with both of the Coin Scales and with correlation coefficients ranging from r=0.51 to 0.67 (reflecting moderate to strong degrees of association). These scales can therefore be used interchangeably to measure perception of pain of increasing severity for this education group. The two WBFPS do not correlate well with each other as their association is low(r=0.47; $p<0.01$).The two WBFPS cannot be used instead of each other i.e. they cannot be interchanged.

The following table shows the correlation of the spread of all of the scales in the higher educated group >grade 12.

Table 4.4.3 Correlations between the spread of all the scales for participants with an education level grade >12 (n=50).

Scale	CAS white-red	CAS green-red	Ascending Injection	Injection Size	Coin Heap	Ascending Coin	WBFPS 6	WBFPS 3
VAS	0.40 <0.01	0.63 <0.01	0.25 0.09	0.66 <0.01	0.11 0.47	0.20 0.16	0.40 <0.01	0.07 0.65
CAS white-red		0.50 <0.01	0.23 0.11	0.35 0.01	0.09 0.55	0.06 0.67	0.04 0.80	0.23 0.07
CAS green-red			0.32 0.03	0.34 <0.01	0.03 0.84	0.06 0.68	0.16 0.27	0.05 0.75
Ascending Injection				0.54 <0.01	0.15 0.30	0.10 0.48	0.37 0.01	0.40 <0.01
Injection Size					0.06 0.67	0.15 0.31	0.59 <0.01	0.35 0.01
Coin Heap						0.85 <0.01	0.11 0.46	0.02 0.87
Ascending Coin							0.02 0.92	0.01 0.93
WBFPS 6								0.69 <0.01

Top value in each cell is the r value and the bottom value is the p value. Spearman's correlation was employed as some of the scales are ordinal scales and therefore the conservative route of the non-parametric approach was taken.

The VAS has moderate to strong degrees of association with the Injection Size Scale($r=0.66$; $p<0.01$) and also with the CAS green to red ($r=0.63$; $p<0.01$).This means that, for this education group these scales could be used interchangeably i.e. in lieu of each other, to measure pain perception of increasing intensity or severity. The CAS white to red has low degrees of association with the CAS green to red and the Injection Size Scale. These three scales do not correlate well with each other. They cannot therefore be used in lieu of each other to measure perception of pain of increasing severity. The CAS green to red also has a weak association with both of the Injection Scales ($p=0.03$; $p<0.01$). These three scales can therefore, also not be used interchangeably, to measure perception of increments in pain.

The two Injection Scales have moderate to strong degrees($r=0.54$; $p<0.01$) of association with each other. This means that either of these two scales can be used to measure perception of pain of increasing severity in this education group. The Ascending Injection Scale has a low degree of association with both of the WBFPS ($p=0.01$; $p<0.01$).This means that the two WBFPS cannot be used instead of the Ascending Injection Scale to measure the perception of pain of increasing intensity. The Injection Size Scale has a moderate to strong degree of association ($r=0.59$; $p<0.01$) with the WBFPS 6 and has a low degree of association with the WBFPS 3($r=0.35$; $p=0.01$). This implies that the Injection Size Scale can be used interchangeably with the WBFPS 6 but not with the WBFPS 3. The two Coin Scales correlate very strongly with each other($r=0.85$; $p<0.01$) they can therefore be used in lieu of each other to measure pain of increasing intensity.

The next table shows where the participants in the two education groups marked "no pain" and "worst pain" on each of the scales. "No pain" should be marked at nought and "worst pain" at ten.

Table 4.4.4 Differences in perception of the ends of the scales for the two education groups (n=100).

Scale	Grade≤12 n=50	Grade>12 n=50	p-value	Grade≤12 n=50	Grade>12 n=50	p-value
	No pain mean(SD)			Worst pain mean(SD)		
VAS	2.34(2.63)	0.6(1.16)	**<0.01**	8.96(1.83)	9.03(1.67)	0.84
CAS white-red	1.74(2.12)	1.16(1.09)	0.09	9.02(1.84)	8.79(2.29)	0.22
CAS green-red	4.46(3.44)	3.65(3.91)	0.22	8.74(2.53)	8.77 (3.46)	0.91
Ascending Injection	0.96(1.75)	0.36(0.60)	**0.02**	9.02(2.28)	8.75(2.41)	0.57
Injection Size	1.26(1.77)	0.76(1.32)	0.11	9.18(2.17)	8.99(1.94)	0.65
Coin Heap	1.04(2.08)	3.03(4.34)	**<0.01**	9.24(2.33)	7.06 (4.32)	**<0.01**
Ascending Coin	1.0(2.12)	3.35(4.49)	**<0.01**	9.6(1.36)	6.87(4.44)	**<0.01**
WBFPS6	0.28 (1.07)	0.24(0.87)	0.84	9.88(0.48)	9.56(1.23)	0.09
WBFPS3	0.24(0.96)	0.16(0.79)	0.65	9.56(1.82)	9.44(1.98)	0.75

The Student's t-test was used for these calculations. The standard deviation is in brackets ( ). The **bold** p values show where there are differences in pain perception between the two groups.

Neither of the education groups measured "no pain" and "worst pain" at the extremes of any scale. There were significant differences between the two groups of participants in the site of "no pain" for the VAS. The higher educated group

understood the VAS better than the lower educated group as far as “no pain” is concerned as can be seen by the significant difference($p<0.01$) between the two groups. The higher educated group marked “no pain” closer to nought (0.6) than did the lower educated group (2.34).There were also significant differences between the two groups of participants in the site of “no pain” for the Ascending Injection Scale ($p=0.02$).The “no pain” end of the Ascending Injection Scale was better understood by the better educated group (0.36 compared to 0.96 for the less educated group).

For both “no pain” and “worst pain”, the two Coin Scales were significantly different between the two education groups ($p<0.01$) namely, “no pain” and “worst pain” were less well understood by the better educated participants than by the lower educated participants for both Coin Scales. For “no pain”, 1 was marked on the Ascending Coin Scale and 1.04 was marked on the Coin Heap Scale by the participants in the lower education level grade$\leq$12 compared with 3.35 on the Ascending Coin Scale and 3.03 on the Coin Heap Scale marked by the participants in the higher education level grade>12. For “worst pain” 9.6 was marked on the Ascending Coin Scale and 9.24 was marked on the Coin Heap Scale by the participants in the lower education level, grade$\leq$ 12 compared with 6.87 marked on the Ascending Coin Scale and 7.06 marked on the Coin Heap Scale by the participants in the higher educated group, grade >12.Both of the Injection Scales and both of the WBFPS are marked close to the extremes of the scales by both education groups.

The next table, Table 4.4.5 shows how well the participants from both education groups marked their pain perception. The larger the spread of the scale is, the better the participants’ understanding of the scale.

Table 4.4.5 Differences in perception of the spread of the scales, between the two education groups (n=100).

Pain Scale	Grade≤12(n=50) mean (SD)	Grade>12(n=50) mean (SD)	p-value
VAS	6.62 (3.23)	8.43 (2.43)	**<0.01**
CAS white to red	8.15(3.04)	8.18(2.92)	0.91
CAS green to red	6.46(3.88)	6.95(5.55)	0.31
Ascending Injection	8.06(3.70)	8.41(2.58)	0.58
Injection Size	7.92(3.44)	8.23 (2.67)	0.62
Coin Heap	8.20(4.31)	4.03(8.48)	**<0.01**
AscendingCoin	8.60(3.33)	3.52(8.73)	**<0.01**
WBFPS 6	9.60(1.21)	9.32(1.49)	0.31
WBFPS 3	9.32(2.48)	9.28(2.45)	0.93

The Student's t- test was used for these calculations. The standard deviation is in brackets ( ). The **bold** p values show where there are differences in pain perception between the two groups.

The spread ("no pain", "worst pain") is biggest in both the WBFPS in both education groups, indicating that these two scales are understood well by both education groups. "The spread" is worst in the CAS green to red in both education groups. This Colour Scale is not well understood by participants in both education groups. The higher education group fared slightly better than the lower educated group.

Significant differences ($p<0.01$) in the spread are noted in the VAS and in both Coin Scales. The VAS appears to be understood better by the participants in the higher education group and the Coin Scales appear to be better understood by the participants in the lower educated group. The Ascending Injection Scale has the second best "spread" of all of the scales for both education groups.

The table below depicts the percentage of participants in each education group who correctly marked “the ends” of the scales.

Table 4.4.6 The number and percentage of correct marking of the ends of all of the scales in both education groups.

Pain Scale	Grade≤ 12 (n=50)	Grade > 12 (n=50)	
	Yes	**Yes**	**p value**
VAS	19 (38%)	26 (52%)	0.23
CAS white- red	0 (0%)	4 (8%)	0.12
CAS green- red	1 (2%)	1 (2%)	1.50
Ascending Injection	21 (42%)	27 (54%)	0.32
Injection Size	17 (34%)	33 (66%)	**<0.01**
Coin Heap	28 (56%)	26 (52%)	0.84
Ascending Coin	28 (56%)	24 (48%)	0.55
WBFPS 6	44 (88%)	40 (80%)	0.41
WBFPS 3	45 (90%)	45 (90%)	1.3

Significant differences are in **bold**. The Fisher’s exact test was used to compare the two groups with respect to the proportion of correct marking of the ends of the scales.

Ninety per cent of participants marked the WBFPS 3 accurately for “no pain” and “worst pain”. This is the best understood scale in both education groups followed by the WBFPS 6 which was understood by eighty per cent of participants in both education groups. Another scale which fared well was the Injection Size Scale. This was understood by sixty six per cent of participants in the higher education group. The higher education group marked “the ends” of the scale significantly ($p<0.01$) better than the lower educated group.

The following table, table 4.4.7 shows the correlation of the spread of the different scales in the 44 male participants.

Table 4.4.7 The correlation of the spread of all the scales for males (n=44).

Scale	CAS white-red	CAS green-red	Ascending Injection	Injection Size	Coin Heap	Ascending Coin	WBFPS 6	WBFPS 3
VAS	0.30 0.05	0.34 0.02	0.34 0.02	0.32 0.03	0.22 0.15	0.28 0.06	0.11 0.47	-0.001 0.10
CAS white-red		0.48 <0.01	0.36 0.02	0.41 0.01	0.38 0.01	0.46 0.002	0.28 0.07	0.20 0.18
CAS green-red			0.20 0.19	0.23 0.13	0.28 0.07	0.25 0.11	0.25 0.10	0.23 0.13
Ascending Injection				0.88 <0.01	0.32 0.034	0.44 <0.01	0.50 <0.01	0.46 <0.01
Injection Size					0.43 <0.01	0.48 <0.01	0.48 <0.01	0.36 0.02
Coin Heap						0.88 <0.01	0.43 <0.01	0.36 0.02
Ascending Coin							0.45 <0.01	0.38 0.01
WBFPS 6								0.54 <0.01

Top value in each cell is the r value and the bottom value is the p value. Spearman's correlation was employed as some of the scales are ordinal scales and therefore the conservative route of the non-parametric approach was taken.

In table 4.4.7 above, poor correlation is seen between the CAS green to red and all of the other scales. The VAS correlates weakly with the Coin Heap Scale and both WBFPS having a weak, negative correlation with the WBFPS 3. The Ascending Injection Scale has a very strong degree of association ($r=0.88$; $p<0.01$) with the Injection Size Scale. This means that both of the Injection Scales measure pain in increments of severity and can therefore be used interchangeably for the male gender. The same holds true for the Coin Scales. The Coin Heap Scale has a very strong degree of association ($r=0.88$; $p<0.01$) with the Ascending Coin Scale. This means that both of the Coin Scales measure the same perception of pain in increments of severity and can therefore also be used interchangeably for the male gender. The WBFPS 6 has a moderate to strong degree of association with the WBFPS 3 ($p<0.01$). Here once

more, both scales measure the perception of pain of increasing intensity and can be used in lieu of each other for the male gender.

The next table, table 4.4.8 shows the correlation of the spread of the different scales in the fifty six female participants.

Table 4.4.8 The correlation between the spread of all the scales for females (n=56).

Scale	CAS white-red	CAS green-red	Ascending Injection	Injection Size	Coin Heap	Ascending Coin	WBFPS 6	WBFPS 3
VAS	0.32 0.02	0.42 <0.01	0.58 <0.01	0.53 <0.01	0.36 0.006	0.43 <0.01	0.51 <0.01	0.35 <0.01
CAS white-red		0.42 <0.01	0.26 0.05	0.18 0.18	0.03 0.82	0.04 0.79	-0.03 0.84	0.12 0.37
CAS green-red			0.23 0.09	0.27 0.043	-0.01 0.93	0.003 0.83	0.11 0.41	0.16 0.23
Ascending Injection				0.71 <0.01	0.46 <0.01	0.43 <0.01	0.37 <0.01	0.37 <0.01
Injection Size					0.37 0.01	0.44 <0.01	0.47 <0.01	0.37 <0.01
Coin Heap						0.81 <0.01	0.34 0.01	0.19 0.16
Ascending Coin							0.40 0.002	0.30 0.03
WBFPS 6								0.62 <0.01

Top value in each cell is the r value and the bottom value is the p value. Spearman's correlation was employed as some of the scales are ordinal scales and therefore the conservative route of the non-parametric approach was taken.

When looking at the data for the female participants, poor association is seen between both CAS. Moderate to strong association($r=0.71$; $p<0.01$) is seen between both Injection Scales. Both of the Injection Scales can therefore be used instead of each other to measure

perception of pain of increasing intensity in females. There is a low degree of association between the Ascending Injection Scale and both Coin Scales (r=0.46 and r=0.43; p<0.05). This means that the Ascending Injection Scale and the Coin Scales cannot be used in lieu of each other to measure the perception of pain of increasing severity in this gender group (females).A similar result can be seen for the Injection Size Scale and both Coin Scales, namely, that low association exists between all of these scales and therefore these scales can also not be used in lieu of each other to measure perception of pain of increasing severity.

The Coin Heap Scale has a very strong (r=0.81) degree of association with the Ascending Coin Scale (p<0.01). It can therefore be said that these two Coin Scales measure pain of increasing intensity. As far as the WBFPS are concerned, moderate to strong (r=0.62; p<0.01) association exists between both of the WBFPS. These two scales also measure pain of increasing intensity and can be used instead of each other to measure increasing pain intensity.

Represented next is where the participants, fifty six females and forty four males, marked “no pain” and “worst pain” on each of the scales. Ideally, “no pain” should be marked at nought and “worst pain” should be marked at ten.

The following table, table 4.4.9 shows the differences in perception of the spread of the scales between the two genders.

Table 4.4.9 Differences in the perception of the ends of the scales for the two gender groups (n=100).

Scale	Male (n=44)	Female (n=56)	p-value	Male (n=44)	Female (n=56)	p-value
	No pain. Median			Worst pain. Median		
VAS	1.0	0.0	0.05	10.0	10.0	0.23
CAS white-red	0.85	1.0	0.93	9.3	9.2	0.64
CAS green-red	2.35	1.8	0.79	9.1	9.2	0.42
Ascending Injection	0.0	0.0	0.58	10.0	10.0	0.62
Injection Size	0.25	1.0	0.88	10.0	10.0	0.21
Coin Heap	1.0	0.0	0.52	10.0	10.0	0.78
Ascending Coin	0.5	0.0	0.68	10.0	10.0	0.77
WBFPS6	0.0	0.0	0.84	10.0	10.0	0.91
WBFPS3	0.0	0.0	0.51	10.0	10.0	0.72

The marking of the ends of the scales, in both genders, was compared using the Wilcoxon's rank sum test (also known as the Mann-Whitney U test).

No significant difference is seen in the marking of "no pain" and "worst pain" between the genders. For the VAS lower end ("no pain") the males mark "no pain" at one instead of at nought as the females correctly do. The extremes of the Ascending Injection Scale and both WBFPS were correctly marked by both genders.

The following table 4.4.10 shows the difference in the understanding of the scales between the two gender groups. The larger the spread i.e. the distance between "no pain" and "worst pain", the better the participants' understanding of the scale would be.

Table 4.4.10 Differences in perception of the spread of the scales, between the genders (n=100).

Pain Scale	Male Median	Female Median	p-value
VAS	6.5	9.8	**0.02**
CAS white to red	8.7	8.7	0.78
CAS green to red	6.5	7.6	0.59
Ascending Injection	9.0	10	0.37
Injection Size	9.0	9.0	0.55
Coin Heap	9.0	10	0.55
Ascending Coin	9.0	10	0.61
WBFPS	10	10	0.90
WBFPS 3	10	10	0.54

Bold figures represent a **significant** difference**.** The spread of the scales, in both genders, was compared using the Wilcoxon's rank sum test (also known as the Mann-Whitney U test).

A significant difference in the understanding of the original VAS Scale between the genders is evident as the males (spread of 6.5) do not fare as well as the females (spread of 9.75). The females did significantly better (p=0.02) as they used more of the scale than the males did. The spread for the original Wong-Baker Faces Pain scales is large(10 for both genders), as it is also for both the Coin Scales(a spread of 10 for the females and a spread of 9 for the males) and both the Injection Scales (a spread of 10 for the Ascending Injection and a spread of 9 for the Injection Size Scale for the females and a spread of 9 for both of the Injection Scales for the males).When looking at all of the spreads of all of the scales, the females fared slightly better than the males although the differences between the genders was not significant except for the VAS.

The following table, Table 4.4.11 shows the number of participants who marked the ends of the scales correctly.

Table 4.4.11 The number and percentage of correct marking of the ends of all of the scales in both genders (n=100).

Pain scale	Male (n=44)	Female (n=56)	p-value
	Yes	**Yes**	
VAS	17(39%)	28(50%)	0.23
CAS white- red	2(5%)	2(4%)	1.00
CAS green- red	0(0%)	2(4%)	0.50
Ascending Injection	18(41%)	30(54%)	0.23
Injection Size	17(39%)	24(43**%**)	0.69
Coin Heap	21(48%)	33(59%)	0.32
Ascending Coin	20(46%)	32(57%)	0.31
WBFPS 6	37(84%)	47(84%)	1.00
WBFPS 3	40(91%)	50(89%)	1.00

The Fisher's exact test was used to compare the two groups with respect to the proportion of correct marking of the ends of the scales.

No significant differences exist between the male and female understanding of the "ends of the scales" (p values are all >0.05). Both genders appear to understand the Wong- Baker Faces (six faces) Pain Scales best and the Colour Scales worst. The female participants fare better in all of the scales except the Wong-Baker Faces Pain Scale (three faces) and the Colour Scale "white to red" where the males do slightly better.

The following table, Table 4.4.12 depicts the percentage of participants who favoured the different scales (anecdotal data).

Table 4.4.12 The participants' preference of scales (percentage) n=100.

Pain Scale	%Participants
VAS	2%(n=2)
CAS (white to red and green to red)	3%(n=3)
Injection Scales (Ascending and Size)	30%(n=30)
Coin Scales (Heap and Ascending)	32%(n=32)
WBFPS (six and three faces)	33%(n=33)

From the above table we see that the most popular scales are both Wong-Baker Faces Pain Scales, both Coin Scales and both Injection Scales.

4.5. Discussion.

A total of one hundred participants who were not back pain sufferers, took part in this study. The participants were nurses, teachers, domestic workers, gardeners and builders. They were divided into two education groups, namely grade $\leq$ 12 and grade>12. Each group was comprised of fifty participants. The better educated group (nurses and teachers) was comprised of more females than males and the less educated group (domestic workers, gardeners and builders) was comprised of more males than females. This discussion will cover the findings for each of the Pain Scales tested. It will discuss the overall findings and will go into the detail of the findings for the spreads and "the ends" of each scale for split by education and also by gender.

4.5.1 The spread of the scales.

The reason for measuring the spread of the scales was to establish how much of the scale the participants were using. This is important as the larger the spread of the

scales (the larger the extent of the scale used by the participants) the better their understanding of the scale.

4.5.1.2 Education differences in the spread of the scales.

When these results are split by education we see that the VAS spread was poor for the lower educated group≤12. This could be due to abstract thinking being more difficult for people of lower education (Kim and Buschmann, 2006; Huang, et al., 2012; Sayin, et al., 2014). The spread for the higher education group was larger. They understand the scale better. Agreeing with the fact that participants of lower literacy preferred a pictorial scale and that participants of a higher literacy level were better at abstract thinking, are Jelsma, et al., (1997). They concluded, in their 1997 study, that both numerical and verbal pain rating scales could be used in the better educated Zimbabwean population. On the other hand, alternative methods of pain measurement like a pictorial pain scale were recommended for Zimbabweans of limited education. Also in support of the use of pictorial scales is my 2009 study, where, although the WBFPS did not do very much better than the VAS or the VRS when tested in Tswana speaking, back pain sufferers (Yazbek, et al., 2009) the WBFPS was however better understood by the participants in the older age category and in the higher education category. What could also explain this difference in the understanding of the scales in the two education groups could be that the “pain experience” takes place in the right side of the brain and the left side of the brain is involved in mathematical reasoning (Xu, et al., 1997).The VAS is therefore, perhaps difficult to understand, as it expects the participant to measure something like pain (right brain) with a measurement tool utilizing the left side of the brain. Xu, et al., (1997) concur that the higher educated participants do better with scales where abstract thinking is required, whereas, the lower educated participants have a better understanding of the scales when using the pictorial scales. Furthermore, education levels are predictive of patients’ pain perception, pain intensity, disability, depression, physical functioning and return to work say Haase, et al., (2012).

Of the two **Colour Analogue Scales,** the spread for the CAS white to red is better than that of the green to red CAS in both education groups. This could be due to the fact that the CAS white to red is less complicated and hence easier to understand as

it is comprised of just two colours whereas the CAS green to red has four colours which could make it more confusing and hence more difficult to understand for both education groups. For the higher education group the spread of the CAS white to red is 8.18 and that of the CAS green to red is not as good at 6.95 (table 4.4.5). This means that the participants in the higher education group are using more of the CAS white to red than they are of the CAS green to red. In other words they understand the CAS white to red better than the CAS green to red which is the same finding for their lower educated counterparts. The Colour Scales require one to use abstract thinking which is possibly more difficult for this lower educated group of participants.

The CAS has been used in previous studies and has been found to be a valid and reliable instrument in the measurement of pain particularly in children.In view of the paucity of data in Indian children, Subashini, et al., (2008) undertook their study to compare the effectiveness of two pain assessment scales. The Faces Pain Scale and Colour Analogue Scale (white to red) were compared in Indian children undergoing selected procedures which were painful (venipuncture, intravenous cannulation, intramuscular injection, bone marrow aspiration and lumbar puncture). The Faces Pain Scale and Colour Analogue Scale were used to compare the procedural pain in a child as perceived by the child, the parents and the health care professionals. Both scales were found to be suitable for use in the assessment of pain in Indian children.

The spread for the **Ascending Injection Scale** was equally good for both education groups (table 4.7.5). This scale is understood by both education groups due possibly to the fact that the increasing number of injections is placed above the corresponding number on the horizontal VAS. The **Injection Size Scale** has a better spread for the higher education group. They possibly understood this scale better than their counterparts in the lower education group as more abstract thinking was required for the understanding of this scale. The injections of increasing size were only placed above every second number and this could have added to the confusion as the lower educated group were not sure as to whether they should chose a number or an injection or both.

The spread for the **Coin Scales** shows a better understanding of these scales by the lower educated group. The spread for the higher educated group is poor (4.03 for the

Coin Heap Scale and 3.52 for the Ascending Coin Scale. See table 4.4.5).The Coin Scales were well understood by the lower education group who saw a direct relationship between money and pain (as was meant to be seen). This relationship was seen inversely by the participants in the higher education group i.e. the less the money the more the pain and the more money the less the pain. These participants in the higher education group had a more materialistic view concerning money (the presence or absence thereof).

In support of a difference in the perception of pain in different education levels are Shrestha, et al., (2013) who say that education levels do play a role in patients' perception of pain. They found that patients with higher education levels (secondary and tertiary education) perceived pain as more severe than did those of lower education (primary schooling). They attribute this difference in pain perception to the fact that those patients of higher education levels were perhaps less stoical due to their easier lifestyles and that those with little or no formal education being used to more difficult lifestyles and were therefore more stoical and able to tolerate more pain (physical and emotional). Also supporting this difference in pain perception between differing education levels are Ozdemir, et al, (2013) who tested and compared pain perception in participants with either no formal education or primary education with participants who had either secondary or tertiary education. They too found that the participants in the higher education groups reported more severe pain and pain of longer duration than did those in the lower education group.

On the other hand, contrary to the belief that patients from lower socioeconomic levels and with lower literacy levels have higher tolerance for pain is Omulecki, et al.,(2009).They propose that pain perception has a strong correlation with patient cooperation (during medical procedures, in this instance, surgery to the eye) which in turn is dependent on level of education. The higher education category of patients was more cooperative and had higher levels of pain tolerance than those patients with lower literacy levels.

Both **Wong Baker Faces Pain Scales** have equally good spreads for both education levels. There is however a small educational difference between the spread of the two WBFPS. Namely, that the spread for the two WBFPS is slightly better in the lower educated group (9.60 and 9.32) than in the higher educated group

(9.32 and 9.28)(See table 4.4.5).Here once more we see that pictorial scales are better suited to lower education level participants (Jelsma, et al., 1997; Yazbek, et al., 2009).This is possibly due to the fact that the participants in the higher education group are “reading more” into the faces and they perhaps saw the faces as portraying emotion as well and not only pain (Baron, et al., 2002; Pulvers and Hood, 2013).A reason for the WBFPS (six faces and three faces) doing well in both education groups could be due to their simplicity. Many of the higher educated participants in this study came from a nursing background and were familiar with this scale (six faces) as they use it in their assessment of patients in pain i.e. when asking patients about their pain severity.

In support of the fact that the WBFPS are easy to understand are Wong and Baker, who in 1988 said that the WBFPS is easy to understand and is used widely and very commonly for children. The WBFPS has been used historically in paediatric studies and clinical situations (Wong and Baker, 1988). It is also valid and reliable for use (albeit less commonly) for adults and for subjects with low educational levels (Kim and Buschmann, 2006). Li Li et al., (2007) found that the Faces Pain Scale Revised (FPS-R) was the best understood in their study of adult Chinese patients in pain. Their reasons for this result are that the FPS-R is simple, easy to understand and it reflected more than just pain sensation that is emotion as well.

4.5.1.3 Gender differences in the spread of the scales.

When the results for the spread of the scales are split by gender (see table 4.4.10), all of the scales except the VAS (p=0.02) did not show a significant difference in the spread of the scales between the two genders. The median spreads for most of the scales ranged from 9 to 10 for both genders. However, more noticeable differences were seen in the spread for the CAS green to red and for the VAS. These two scales were better understood by the females. This difference in comprehension is possibly not one of gender but one of education, as most of the males belonged to the lower educated group (who do better with pictorial scales) and most of the females belong to the higher educated group (who do better with scales where abstract thinking is required) (Jelsma, et al., 1997) (Yazbek, et al., 2009).Gender differences are probably therefore not responsible for the disparity seen in “the spread” of the aforementioned scales. Both the males and the females understood the scales

similarly well. Supporting the findings of this study, namely that the perception of pain in the two genders is similar, are Racine, et al., (2012) who say that the majority of studies from ten years of research, show that measured pain intensity, pain perception and unpleasantness of pain showed no sex difference in many pain modalities.

No gender difference is seen in the spread of CAS white to red i.e. this scale is understood equally well by both the males and the females. The same cannot be said for the CAS green to red however. We see that the females understand the CAS green to red better than the males do as they use more of the scales than do the males. The CAS green to red is perhaps a more confusing scale as the participants are presented with four colours (green, yellow, orange and red) instead of just two as in the CAS white to red. The fact that the females did better with the more difficult CAS could be attributed once more to the fact that the majority of the females belonged to the higher educated group and the majority of the males belonged to the lower educated group (see table 4.4.1), thus making this discrepancy in understanding rather one of education and not of gender.

4.5.2 The ends of all of the scales.

Few studies have been found in the literature where the spread and the ends of scales have been measured or tested. A study done in Norway in 2000 by Breivik, et al., compared the pain response patients who underwent surgery. The patients had to fill in where they perceived “no pain” and “pain cannot be worse” immediately post- operatively and hourly for eleven hours after surgery. The scales tested were the Verbal Rating Scale 4(VRS-4), the VAS and the Numerical Rating Scale-11(NRS-11). Their results show that the VAS and the NRS-11 had similar sensitivity and could both be used to measure acute pain in their post- operative patients. In the Chinese setting, Li Li, et al., (2007) also required their patients to score their pain pre-operatively and post-operatively on four pain scales, namely the VAS, the NRS (Numeric Rating Scale), the VDS (Verbal Descriptive Scale) and The Faces Pain Scale Revised (FPS-R). Here, “worst pain” “least pain” and “average daily pain” were measured. All four scales were found to be both valid and reliable. The VAS was however the least popular of the scales as the patients found it most difficult to understand especially by the older adults.

We see throughout my study that not all of the participants marked the extremes of the scales. This was evident in both the education and gender groups. It appears that there is a fear of marking the ends of the scale and that marking inside the limits is perhaps a safer option. There is no literature available to support this avoidance of marking the ends of scales there is however literature available about taking “safer options” when confronted with choices (Alpay, 2013).Contrary to this finding in my study, is the finding of a German study done by Shaygan, et al., (2014). They tested quality and intensity of pain in three hundred and forty four patients suffering from neuropathic pain which included post herpetic neuralgia, complex regional pain syndrome type II, polyneuropathy, trigeminal neuralgia and lower back pain with and without radiculopathy. The patients filled in a quality of pain scale from 0(never) to 5(very strong). Pain qualities were: (a) burning pain (b) paraesthesia, (c) mechanical allodynia (d) spontaneous pain attacks (e) thermal hyperalgesia (f) numbness (g) pressure hyperalgesia and a pain intensity scale marked from 0 to10 (0= no pain and 10= worst possible pain). The participants in this study preferred the end points of the response scales, independent of item content. The researchers conclude that not only do the characteristics of pain determine the symptom report but also the individual’s tendency to select specific responses, like their preference for the ends of the scales.

There is no literature available as to what makes a scale a good one. Breivik, et al., (2000), say that an important criterion in the choice of pain scale must be the ease of use of the scale and its simplicity in measurement of pain assessment. Agreeing with this rationale are Rothaug, et al., (2013) who say that measurement tools should be simplified to suit the target population and in certain target groups(lower education and cognition) simplified questionnaires are better suited. I regard a scale which has a good “spread” (the larger the better) and where “the ends” are marked at or very close to the extremes of the scale, as being a good scale. This would imply that the participants understand the concept of “no pain” being equivalent to nought (at the lowest end of the scale) and “worst pain” being equal to ten (at the uppermost end of the scale). Once they can equate pain, which is a physical experience, with a numerical measure of intensity, this would facilitate the measuring of pain (which is very subjective) objectively. I agree with both Breivik, et al., (2000) and Rothaug, et al., (2013) who say that a scale must be easy to understand and must be “user

friendly" i.e. simple as well as quick and easy to use in the clinical setting. Therefore, the closer the participants mark "no pain" and "worst pain" to the extremes of the scale, the better the scale. "The ends" of the scales should be marked at nought for "no pain" and at ten for "worst pain". From the results of this study we see that the bottom end ("no pain") of most of the scales is marked further away(less accurately) from nought and that the top end ("worst pain") of the scale, is marked more accurately (closer to ten).

4.5.2.1 Education differences in the ends of the scales.

Neither education group measured "no pain" and "worst pain" at the extremes of any scale. From the overall results of this study, we see that the participants in the higher education group marked "no pain" significantly better on the VAS ($p<0.01$) and on the Ascending Injection Scale ($p<0.02$.) than did their lower educated counterparts. (See table 4.4.4) A reason why the VAS did better in educated participants could be due to the fact that abstract thinking is more difficult for people of lower education levels (Kim and Buschmann, 2006; Huang, et al., 2012; Sayin, et al., 2014) and stoicism could be a reason for the lower educated participants not marking "no pain correctly" on the Ascending Injection Scale (Alvarado, 2008; Haung, et al., 2012; Shrestha, et al., 2013). However, no significant difference between the education levels existed in the marking of "no pain" for both of the CAS and both of the WBFPS. The lower end of the Coin Scales was however significantly ($p<0.01$) better understood by the lower education group.

A possible explanation for the incorrect filling in of the Coin Scales by some of the participants could be due to the fact that they saw an inverse relationship existing between the coins and pain, instead of a direct relationship as is supposed to be. Those participants who did not fill in either Coin Scale correctly could have associated no money or little money as being painful in itself. The more money they had, the happier they were. This way of thinking is possibly due to an emotional or psychosocial component to the participants' perception of pain. Other studies have shown that pain perception and the reporting of pain are affected by socioeconomic status, emotional state and financial security (van Hecke et al., 2013).

Those participants who did not mark "no pain" at the lower end of the scales could be "used to pain" and perhaps regarded any number below three for example as not

being painful as they lived with “pain” (emotional, psychological, socioeconomic) on a daily basis. Many of the participants came from poorer socioeconomic backgrounds (possibly due to the lack of opportunity which a better education provides) and were possibly used to hardship and tolerating pain both “physical” and “emotional” (Shrestha, et al., 2013; Ozdemir, et al.,2013) . Other factors which could contribute to the way in which the ends of the scales were filled in are educational factors, cultural factors and socioeconomic differences. These may sometimes cause patients to consider very carefully if their pain is worth mentioning and therefore getting the attention of the clinician or not. In other words, patients have to consider carefully whether their pain level was high enough to warrant mentioning and the ensuing attention it would procure (Rothaug, et al., 2013).

Rothaug, et al., (2013) tested pain perception for “no pain” and “worst pain” in surgical patients by using a Binary Scale (with either a “yes” answer or “no” answer) and a Numerical Rating Scale (NRS) and the “no pain” end of both scales was better understood by the better educated patients tested. The German researchers suggest that measurement tools be simplified to suit the target population and that in participants where there are lower levels of cognition or were the participants are emotionally labile (e.g. have feelings of anxiety or helplessness), simplified questionnaires are better suited. There was a difference in pain perception for “no pain” between the two scales. The participants of lower cognition struggled with the lower end of both scales and there was also a deviation between the binary zero and the NRS zero. The Binary zero equalled NRS values ranging from zero to two.

Another study done in sub-Saharan Africa with similar findings was one done in Kenya in 2012 by Huang, et al., who tested the Swahili version of the NRS and the FPS-R. The FPS-R was universally preferred by fourteen out of the fifteen patients tested. The participants found the faces easy to understand and they said that it was easy to see the difference in pain severity from looking at the faces. The only discrepancy seen in the results for the FPS-R was for the face for “no pain”. Some participants marked “no pain” at the first face and others marked it at the second face. The researchers say the reason for this could possibly be due to cultural perceptions i.e. some of the patients were being stoical or were too afraid of being considered “weak” to admit that they were feeling pain. The reason why the

participants in the Kenyan study found the NRS more difficult to understand could be due to lower levels of education and difficulties in literacy, say the researchers.

As far as the “upper end” of all of the scales is concerned no significant difference existed in the marking of “worst pain” in all of the scales except for both of the Coin Scales where the upper end of these scales were better understood by the participants in the lower education group (See table 4.4.4). This is possibly due to the fact, already mentioned, that the participants in the higher educated group are seeing an inverse relationship between money and pain and not a direct one as is meant to be portrayed by both of the Coin Scales.

4.5.2.2 Gender differences in the ends of the scales.

When split by gender there was only a significant difference seen for “no pain” for the VAS between the two genders. The males marked “no pain” at 1 and not at 0 as the females did. Once more, this is possibly due to the fact that most of the males were in the lower education group making this poorer understanding of the VAS one due to education and not gender. The extremes of the Ascending Injection Scale and the WBFPS were best marked by both genders and in both education groups, making these three scales the best understood scales for this group of participants.

Citing differences in pain perception due to gender and education levels are Weaver et al., who in 2009 found that being female and having lower education levels were significantly associated with perception of pain severity. Females and participants with lower education levels tolerated more pain than the males and participants of higher education levels in their study.

4.5.3 Other factors affecting the determination of pain perception.

A postulation for the avoidance of marking “the ends” of the scales could possibly be due to a combination of one or more of the following factors, namely, cultural, psychological or certain, bio- psychosocial factors. Supporting this point of view areThomten, et al., (2012) who found that socioeconomic status does have an effect on pain perception. This will affect the way in which the participants perceive pain namely, the lower the socioeconomic status, the higher the pain threshold. A similar finding was determined by Shrestha, et al., (2013) who saw a direct relationship between poor socioeconomic status, lower education levels and increased

stoicism.Agreeing with the fact that there are various determinants of differences in pain perception areGrieve, (2004),Dawson, (2008) and Finley, et al., (2009) who say that perceptual barriers and socio-cultural differences like race, gender, culture, socioeconomic factors and education all play a role in determining pain perception. They too support the fact that the lower educated and poorer socioeconomic participants had higher pain tolerance.

The majority of participants did not mark all of the scales at nought as being “no pain” and ten being “worst pain”. Those participants in the lower education group marked “no pain” further away from nought in all the scales except the VAS and both Coin Scales. Shrestha, et al., (2013) attribute the difference in pain perception and tolerance, between participants of different education groups, to the fact that those participants of higher education levels were perhaps less stoical due to their easier lifestyles and that those with little or no formal education are used to more difficult lifestyles and were therefore more stoical and able to tolerate more pain (physical and emotional). Many of the participants who took part in this study came from the “townships” where many of them do not have formal homes. Some of them still live in shacks with no access to running water, poor sanitation and no electricity. They have to endure many hardships on a daily basis. Just getting to work is arduous, tiring and requires much sacrifice. The lack of sufficient finances definitely plays a role in the perception of pain (Tallon-Baudry, et al., 2011). Patients living in difficult social conditions have differing views of pain and its perception and the reporting of pain is affected by socioeconomic status (Thomten, et al., 2012; van Hecke, et al., 2013).

Stoicism is culturally and economically determined (Alvarado, 2008). He states that African-Americans, Hispanics and Asians tested in his study believe that their forefathers had to endure much suffering and hardship (for example slavery for the African Americans and poverty, racism and difficulties assimilating for the Asian and Hispanic immigrants) and that men and women need to be strong and not complain or show pain. In these cultures it is viewed as weakness to admit to having pain and it is seen as a weakness in character if pain is shown or verbalised. If one suffers silently through pain it is seen as being a virtue and an honour especially in the Asian culture (Alvarado, 2008).

“Acceptance of pain” could also be a reason for the participants not marking “no pain” at the extreme left hand side of the scales. Pulvers and Hood, (2013), say that optimism, hope and acceptance of pain all affect perception of pain positively .i.e. subjects were less likely to fear their pain and were also not likely to “catastrophize” pain. Dispositional optimism they say can contribute to an individual’s resilience. Many of the participants who took part in my study stated that they are so used to hardship and pain, emotional, psychological and otherwise, that they negate anything close to nought as “no pain”. For them, pain they say, can be measured on a scale starting anywhere from two or three upwards (anecdotal data). They are so accustomed to “pain” that for example, anything less than three (on a pain scale), is not really regarded as pain. Their “pain” is not necessarily physical, but could be emotional and or psychological (Baron, et al., 2002; Pulvers and Hood, 2013).

Many of the participants did perhaps not want to admit to having severe pain for “fear” of possible repercussions like ostracism from their communities. They told me, when questioned as to why they did not mark ten as “worst pain”, but rather marked numbers less than ten (eight and nine) as “worst pain” that severe pain, in their culture, could be equated with serious illness like cancer or HIV. They were fearful of admitting to severe pain in case this could be misinterpreted as the presence of serious disease like HIV. HIV has a stigma attached to it in the Tswana culture (Daftary, 2012). The participants seem to perceive anything from eight to ten as “intolerable pain or unacceptable pain” They do not want to be seen as being weak by admitting to having “worst possible pain” and marking this at ten out of ten. Machismo and strong image portrayal could be responsible for male participants not always marking “worst pain” at ten. Clark-Callister, (2003) found that this was the case especially amongst male Mexicans in her study.

Another possible reason for not marking the upper extreme of the scales could be due to the fact that they do not want to be seen as being “dramatic” and do not wish to “catastrophize” pain by admitting to “ten out of ten pain” as being the “worst pain”. Pain “catastrophization” is “an exaggerated, negative, mental set, associated with actual or anticipated pain experiences” according to Evans, (2007). This point of view was also expressed by Gracely, et al., who earlier, in 2004, stated that pain “catastrophizing” is increasingly being recognized as an important factor in the experience of pain and pain perception. The participants in Study Two possibly did

not want to be seen as “exaggerating their perception of pain”. Pain’s psychosocial domain needs to be understood say Waugh, et al., (2014). They say that a patient’s pain experience and perception of pain is also determined by personal devaluation or invalidation relating to self-esteem and pain self-efficacy. They continue by saying that reactions to pain may become internalised i.e. the patient may have internalised stigma which will have a negative relationship on self-esteem and will prevent the patient in pain from reporting the true extent of their pain, as they did not want to be perceived as “exaggerating” or “catastrophizing” their pain. Internalised stigma, can, they say also be associated with cognitive functioning in relation to perception of pain. This can lead to “catastrophizing” about pain and thereby reducing the sense of control over the patient’s pain.

Not marking the extremes of the scales, could also be due to the fact, that the participants may have been keen to please the researcher. They could have possibly perceived the middle of the scales as a “safer bet”. Participants assumed that there is a “correct” or “right” answer to the questions asked of them. A similar “people pleasing” attitude can be seen in the participants taking part in a study done by Garcia, et al., (2007). They took PTM readings of participants suffering from pain and found that their results were also affected by who was doing the testing. The male participants in that study did not want to be appearing weak by admitting to having pain, especially if the researcher was an attractive female. They wanted to prove their “maleness” and were in fact trying to impress the researcher, by giving answers, which they thought would be pleasing to her. (The males in my study however, marked “the ends” of the scales similarly well when compared with the females).Leaper, et al., (2007) found that the gender and status of the assessor can also change the subject’s responses when reporting pain directly to another person. This fact could also be responsible for the way in which the participants in my study filled in the scales presented to them.

Yet another possible explanation for the avoidance of marking the “ends of the scales” could be a psychological one. This avoidance could be attributed to some of the participants’ “fear of making a mistake” and perhaps a “poor self-esteem” or “lack of confidence”. They were therefore afraid to mark extremes in case they were perceived as being “wrong”. The better educated participants perhaps had more self-esteem and were therefore more confident than those in the lower education group

and therefore marked the extremes of the scales more accurately. Agreeing with my hypothesis is Alpay, (2013), who puts forward a theory of “Avoidance” .This is a theory he expounds in his 2013 paper presented to the Department of Chemical Engineering and Chemical Technology at the Imperial College of Science, Technology and Medicine in London. He says that people with low self-image or of low self- esteem tend to be introverted and when faced with choices will more than likely adopt the attitude that “with no attempt there can be no failure”. He goes on to say that people with low self-esteem were also more than likely to take fewer risks and would rather go for safer options.

4.6 Conclusion.

Data generated from pain-rating scales can be easily misunderstood according to Williamson and Hoggart, (2005). They say that in order to use the pain-rating tools well health care workers need to appreciate the potential for error within the tools and the potential which the pain measurement tools have to provide the required information. This is they say, despite the established psychometric properties of pain scales the pain score numbers mean different things to different people. Hjermstad, et al., (2011) in their systematic literature review state that the type of scale used is not the most important choice but that the conditions related to its use are for example: a choice of standardized descriptors, administration methods, time frames, how to use the scales, clinical significance and the use of the most appropriate scales for statistics and research trials.

In order to determine which scales were “user friendly” and could perhaps be taken into Study Four for further testing, I also questioned each participant as to their choices in scale and as to which scale they preferred and why they did so. Subjectively, the most popular scales were both of the WBFPS followed by the Coin Scales and then by the Injection Scales. The objective results show the same trend, namely that the WBFPS, followed by the Coin Scales and thirdly by the Injection Scales ,were the best understood scales for this population of participants for both education and gender split.

The Coin Scales were better understood by the participants in the lower education group and when comparing the results for the two Injection Scales, we see that the Ascending Injection Scale was better understood than the Injection Size Scale. This

was so in the participants in both education groups and in both gender groups. The Ascending Injection Scale was best understood by the female participants and those in the higher education group. The fact that the Injection Scales were the third best understood scales in Study Two, could be attributed to the fact that the participants in this study were not suffering from pain when they were being tested. This could possibly have influenced their choices, as they perhaps did not see the injections as being painful and regarded them as being innocuous i.e. they did not associate the injections with either causing pain nor with relieving pain. I believe that due to the fact that they were not in pain, their perception of pain is different from that of people who are actually in pain. Agreeing that perception of pain is different when one is experiencing pain or not actually in pain are Walker and Carmody, (1998), Giesecke, et al., (2004) and Bisogni, et al., (2014).

The Colour Analogue Scales did not do well in Study One nor did it do well in Study Two. They were not well understood by the majority of participants in both education groups and in both genders. This could be attributed to the fact that the colour changes in the white to red scale were not markedly noticeable as the white tended to blend into the red end of the spectrum making a pink colour. The participants were not sure whether to mark the middle or the ends of this scale as they did not see a clear definition of colour change. The same rationale applies to the Colour Analogue Scale ranging from green to red. Here too, the one colour tended to blend into the other and the participants were not sure whether they should mark the more definite colour or the blended one. For these reasons I have decided not to take the two CAS into study four for further testing.

The VAS, although used widely in clinical practice, was not well understood by the participants in this study, Study Two. This is in keeping with the results from my 2009 study (Yazbek, et al., 2009) where the VAS was poorly understood by the participants in that target group. Due to this fact, I decided to teach the participants in the main study, Study Four how to use the VAS correctly. The VAS is to be taken further into Study Four where it will be used as the “Gold Standard” against which all of the other scales will be tested and compared. The VAS was chosen as the “gold standard” for Study Four as it has numbers from one to ten. Most of the other scales also have ten items per scale. The Coin and Injection Scales all have a horizontal

VAS incorporated into the scales. This fact helped facilitate the correlation of all of the scales.

In Study Two not one scale was marked 100% correctly (see table 4.4.11) I therefore decided to take the top six scales for further testing. I looked at how far off the six scales were and then chose the scales that were least off i.e. the most accurately marked. The scales which were understood by 40% and more of the participants were taken further for testing in Study Four. (See Chapter Three, study One, for all of the Scales).Both of the Wong-Baker Faces Pain Scales, both of the Coin Scales and both of the Injection Scales will be used to test the severity of low back pain in Tswana speaking participants. This will be done in Study Four.

4.7 Limitations of this study.

A limitation for this study could be that there were more female than male participants and that the female participants were mainly from the higher educated group. Perhaps equal numbers of male and female participants and equal numbers of participants from both education levels should have taken part in this study as pain perception does differ in different gender and education groups (Grieve, 2004;Dawson, 2008;Finley, et al., 2009;Shrestha, et al., 2013; Ozdemir, et al, 2013).

The fact that there were more female participants taking part in this study is possibly due to the fact that females are more willing to seek medical attention when necessary (when in pain) and males are more reluctant to do so (Thuan and Le Resche, 2000; Im, 2005).The females were therefore more willing to volunteer in order to participate in this study about pain and its perception. The next chapter, Chapter Five, describes the development of a Tswana Verbal Descriptive Scale in Study Three.

CHAPTER FIVE STUDY THREE

Method

5.1 Introduction.

This chapter describes the third study which developed a new Verbal Descriptive Scale. The study design, sample selection, the inclusion criteria as well as the translation process for the Verbal Descriptive Scale and the results, are all described.

5.2 The Aim of the study.

The aim of this study was to develop a new Verbal Descriptive Pain Scale in forty Tswana speaking participants with back pain and to validate this new Verbal Descriptive Scale.

5.3 Study design.

This was a cross-sectional study.

5.4 Sample Selection.

Forty participants, namely twenty males and twenty females attending the Spine Clinic at the Klerksdorp State Hospital situated in the North West province, South Africa, were invited to participate in this study.

5.4.1 Inclusion criteria.

- males and females
- Tswana speaking individuals (first language)
- older than eighteen years
- education level grade twelve and lower
- back pain sufferers

5.5 Ethical Considerations.

Participants who met the inclusion criteria were asked to sign informed consent prior to participation in the study. Permission was obtained from the management of the Klerksdorp Hospital Spine Clinic. The research was approved by the Human Research Ethics Committee of the University of the Witwatersrand (Ethical

Clearance certificate number M091121) (See Appendix for Ethical Clearance certificate).

5.6 Procedure.

Twenty male and twenty female participants were interviewed separately in two groups, in order for the females not to feel intimidated by the males, as the Tswana culture is traditionally, a strongly patriarchal one http;//www.sahistory.org.za/people-south-africa/tswana

A research assistant who was fluent in Tswana (first language) was present throughout the entire process in order to assist with any translation or communication difficulties. The two groups were interviewed on the morning of the same day. Participants were invited to suggest different descriptions (terms) for; "mild", "moderate", "severe" and" worst pain". The females (n=20) were tested first. They discussed the terms openly amongst themselves and when consensus was reached, the researcher wrote the most popular terms on the blackboard. The female participants then "voted" for the most popular terms by a show of hands. The researcher read the terms out, from the blackboard and the participants "voted" by a show of hands for the terms they preferred. A total of seven different terms was agreed upon. The female participants' were asked to place the terms in ascending order i.e. from "mild", "moderate", "severe" and finally to "worst" possible pain. This was done, once more, by a voting process to determine general consensus.

The female participants agreed on one term for "mild" pain, three terms for "moderate" pain, two terms for "severe" pain and one term for "worst" possible pain. They appeared to have no difficulty in coming up with and agreeing to one term for "mild" pain and one term for "worst" pain, but had more difficulty(took longer) deciding on just one suitable term for "moderate" pain and "severe" pain. Three choices were decided upon for "moderate" pain and two for "severe" pain. Some of the female participants (20%) had difficulties distinguishing the fine nuances between "mild" and "moderate" pain and between "severe" and "worst" pain. To them there were no real differences in pain intensity between "mild" and "moderate" or between "severe" and "worst pain". A total of seven pain descriptors was decided upon by the female participants. I recorded them in ascending order of "mild", "moderate", "severe" and "worst" pain.

The descriptive terms were then erased from the blackboard in order for the next group of participants, namely the males, to be able to develop their own terms and not to be biased by seeing the terms which the females had developed earlier on. The males (n=20) were tested in the same way as the females. The male participants suggested a total of seven, new, descriptors of pain, different from those which the females had developed. These included one for “mild” pain, two for “moderate” pain, three for “severe” pain and one for “worst” pain. Again, as was seen in the female participant group, the male participants had less difficulty in coming up with verbal descriptors for “mild” and “worst” possible pain. They however struggled to agree on the terms used to describe “moderate” and “severe” pain. They eventually agreed upon two terms for “moderate” and three verbal descriptive terms for “severe” pain. Once more, as was seen in the group of female participants, some of the males(15%) did not understand the difference in the concept of “mild” and “moderate” pain nor the difference in the concept of “severe” and “worst” pain.

After the morning’s proceedings, the participants had a lunch break. The males and females were separated into two different rooms, where they had lunch and could rest for one hour. There was no communication between the two groups. Later (at 14:00) in the afternoon of that same day, all the participants (n=40) were then interviewed for the last time, together. The seven verbal descriptors which the females developed were written on the left-hand side of the blackboard and the seven verbal descriptors which the males had developed were written on the right-hand side of the blackboard, both of the groups’ results were written in ascending order i.e. from “mild” pain to “worst” possible pain. All the participants discussed amongst themselves which terms they felt were best to describe the varying degrees of severity of pain. The next step was to “pair” the different verbal descriptive terms. This was done in the following way. The participants chose a term suggested by the females for “mild” pain and paired it with a term suggested by the males for “mild” pain. The same procedure was followed for “moderate”, “severe” and for “worst” possible pain. (Again, as was done in the two morning sessions, general consensus was reached by voting by show of hands).This resulted in seven “pairs” of verbal descriptors.

After this, the four most popular pairs of verbal descriptors were then” voted” for by a show of hands. This resulted in the final four verbal descriptive terms being selected.

There was a majority approval for all four pairs:83% of all the participants (n=33 comprised of 17 males and 16 females) agreed upon the pair of terms for “mild” pain, 60 per cent of the participants (n=24 comprised of 10 males and 14 females) agreed on the pair of term for “moderate” pain,75% of the participants (n=30 comprised of 15 males and 15 females) agreed on the pair of terms to describe “severe” pain and 98% of the participants (n=39 comprised of 19 males and 20 females) agreed on the final pair of terms for “worst” possible pain(see table 5.7.3). The entire process took approximately eight hours to complete. Each morning session was completed in two hours and the afternoon session took about four hours to complete.

5.6.1 Translation of the new Verbal Descriptor Scale.

Once the four pairs of terms had been decided upon, were then translated into English by the translation process recommended by Beaton, et al., (2000) and Oslund, et al., (2006) and a back translation was done from English into Tswana.

Stage one– Two forward translations into the target language (English) were done by an informed and an uninformed translator. The two respective translators were an English speaking, nursing sister who was also proficient in Tswana (translator 1) and an English speaking, high school teacher who taught Tswana (translator 2).

Stage two– Resolve any discrepancies of translator’s reports. A common translation was produced from translator 1 and 2. This was done by the two translators deliberating and then agreeing upon a final, common translation.

Stage three– Back translation. Two Tswana (first language) translators (a medical doctor and a physiotherapist) who were naive to the outcome measurement worked from translator 1and 2’s common version. They then created two back translations i.e. Back Translation 1 and Back Translation 2.

Stage four– Expert committee review. All reports were reviewed by the two forward translators, the two back translators. Consensus was reached on all discrepancies. A pre-final version was then produced.

Stage five– Pre-testing i.e. testing of the pre-final version of this new Verbal Descriptor Scale was done in study three.

5.7 Results.

The original verbal descriptors developed by both genders, describing varying degrees of severity or intensity of pain are:

1. Jaaka go gatelela mo leteketong - like pressing on a bruise. This was to describe “mild” pain and was suggested by the males. It was agreed upon by seventy five per cent of the male participants (n=20).

2. Jaaka go tlhabiwa ka nelete - like being pricked by a pin. This was the term the females (n=20) developed and agreed upon (eighty per cent) to describe “mild” pain.

3. Jaaka ngwatswa ke katse kgotsa kala ya setlhare – like being scratched by a cat or the branch of a tree. This was the term for “moderate” pain which the females (n=20) developed and chose (seventy two per cent).

4. Jaaka go thula sekgono - like bumping your elbow. This was the term that seventy eight per cent of females (n=20) thought would best describe “moderate” pain.

5. Jaaka go kgopa monwanwa - like stubbing your toe. This was the term developed by the males (n=20) and seventy five per cent of them chose it to describe “moderate” pain.

6. Jaaka go longwa ke notshe – like a bee sting. This was developed by the males (n=20) and was chosen by the majority (seventy two per cent) of males to describe “moderate” pain.

7. Jaaka go opiwa ke leino – like a toothache. This was the term developed by the females (n=20) and the majority of females (seventy eight per cent) thought it would best describe “moderate” pain.

8. Jaaka go wela ka morago – like a fall on your bottom. This was the term the females (n=20) developed to describe “severe” pain and was voted for by seventy per cent of the females.

9. Jaaka go wisa sengwe se se bokete mo leotong la gago – like something heavy falling on your foot. This was developed by the males (n=20) and was chosen by the majority (seventy four per cent) of males to describe “severe” pain.

10. Jaaka go segiwa ka thipa - like being cut by a knife. This was a term developed by the females (n=20) and eighty per cent of them the felt that it best described “severe” pain.

11. Jaaka go ikitla mo monwaneng ka hamole - like a hammer blow on your finger. This was developed by the males (n=20) and eighty eight per cent of them thought it described “severe” pain best.

12. Jaaka go tlhabiwa mo mo mokwatleng – like a stab in your back. This was the term the males (n=20) developed to describe “severe” pain. Eight per cent of them agreed that this term best described severe pain.

13. Jaaka go fisiwa ke metsi a a belang - like being burnt by boiling water. This term was developed by the females (n=20) for “worst” pain and ninety per cent of them agreed that it best described worst pain.

14 Jaaka go fisiwa ke molelo - like being burnt by fire. This was developed by the males (n=20) and was chosen by the majority of males (ninety three per cent) to describe “worst” pain.

The final four paired terms, chosen by all of the participants, in ascending order of pain intensity are:

1. To describe the intensity of “mild pain”: Jaaka go gatelela mo leteketong (like pressing on a bruise) which was a term developed by the males and Jaaka go tlhabiwa ka nelete (like being pricked by a pin) which was a female developed term, were paired. 82%of the participants (n=33 comprised of males n=17 and females n=16) favoured this combination to best describe “mild” pain.

2. To describe the intensity of “moderate pain”: Jaaka go thula sekgono (like bumping your elbow) which was originally developed by the males and Jaaka go kgopa monwanwa (like stubbing your toe) which was developed by the females, were paired. A total of 60% (n=24) of all of the participants (comprised of males n=10 and females n=14) chose this paired combination to describe “moderate” pain.

3. To describe the intensity of “severe pain”: Jaaka go segiwa ka thipa (like being cut by a knife) which was developed the females and Jaaka go ikitla mo monwaneng ka hamole (like a hammer blow on your finger) which was developed by the males,

were paired. A total of 76% (n=30) of the participants (comprised of males n=15 and females n=15) chose this combination to describe “severe” pain.

4. To describe the intensity of the “worst possible pain”: Jaaka go fisiwa ke metsi a a belang (like being burnt by boiling water) which was developed by the female participants and Jaaka go fisiwa ke molelo (like being burnt by fire) which was developed by the males, were paired. A total of 98% (n=39) of all participants (comprised of males n=19 and females n=20) felt that these terms best described “worst” possible pain.

Table 5.7.1 Demographic data for Study Three (n=40).

Group	**Age (mean)**	**Education level ≤grade10**	**Education level grade11and12**
Male **n=20**	43 years	n=14(70%)	n= 6(30%)
Female **n=20**	48years	n=11(55%)	n= 9(45%)

From the above table we see that the majority of participants in the lower education group are male (70%).The females are in the majority (45%) in the higher education group. The males participating in Study Three are in their early forties and the females in their late forties.

The following, Table 5.7.2 shows the phrases selected by the participants for mild, moderate, severe and worst pain, when split by gender.

Table 5.7.2 A comparison of the original Verbal Descriptors describing intensity of pain when split by gender (n=40).

	Tswana Phrase	English Phrase	Degree of Pain	% Vote
Male	Jaaka go gatelela mo leteketong	Pressing on a bruise	mild	75%
Female	Jaaka go tlhabiwa ka nelete	Pricked by a pin	mild	80%
Male	Jaaka go kgopa monwana	Stubbing your toe	moderate	75%
Male	Jaaka go longwa ke notshe	Bee sting	moderate	72%
Female	Jaaka ngwatswa ke katse kgotso kala ya setlhare	Scratched cat/branch	moderate	72%
Female	Jaaka go thula sekgono	Bumping your elbow	moderate	80%
Female	Jaaka go opiwa ke leino	Toothache	moderate	78%
Male	Jaaka go wisa sengwe se se mo leotong la gago	Heavy object falling on foot	severe	74%
Male	Jaaka goikitla mo monwaneng ka hamole	Hammer blow on finger	severe	80%
Male	Jaaka tlhabiwa momokwatleng	A stab in your back	severe	80%
Female	Jaaka go wela ka morago	A fall on bottom	severe	70%
Female	Jaaka go segiwa ka thipa	Cut by a knife	severe	80%
Male	Jaaka go fisiwa ke molelo	Burnt by fire	worst	93%
Female	Jaaka go fisiwa ke metsi a a belang	Burnt by boiling water	worst	90%

The above table shows that more than 70% of the participants agreed on the terms for mild, moderate, severe and worst possible pain for the original, long version, of the Tswana VDS. The following table, Table 5.7.3, reflects a similar percentage of the number of participants agreeing on the terms for mild, moderate, severe and worst possible pain for the final, shortened version, of the Tswana VDS.

Table 5.7.3 A comparison of the shortened version of the Verbal Descriptors describing intensity of pain when split by gender (n=40).

Degree of Pain	Gender	Tswana Phrase	English Phrase	% Vote
Mild	**Male**	Jaaka go gatelela mo leteketong	Pressing on a bruise	85%
	Female	Jaaka go tlhabiwa ka nelete	Pricked by a pin	80%
Moderate	**Male**	Jaaka go thula sekgono	Bumping your elbow	50%
	Female	Jaaka go kgopa monwanwa	Stubbing your toe	70%
Severe	**Male**	Jaaka go ikitla mo monwaneng ka hamole	Hammer blow on finger	75%
	Female	Jaaka go segiwa ka thipa	Cut by a knife	75%
Worst	**Male**	Jaaka go fisiwa ke molelo	Burnt by fire	95%
	Female	Jaaka go fisiwa ke metsi a a belang	Burnt by boiling water	100%

5.8 Discussion.

Verbal Descriptive Scales using the terms “no pain”, “mild pain”, “moderate pain” , “severe pain”, “extreme pain” and “ the most intense pain imaginable” have been found to be reliable and valid (Herr et al.,1993). This study, Study Three, developed Tswana terms to quantify pain of varying intensities, namely “mild pain”, “moderate pain”, “severe pain” and “worst pain”. A Verbal Descriptive Scale for back pain sufferers, solely for use in Africa, has not yet been developed. The Verbal Descriptive Scales which have been used historically in the African setting have always been Anglo-American Scales. In a previous study (Yazbek, et al., 2009) a

Verbal Descriptive Scale which was translated from English, was not well understood by the Tswana speaking participants in that study.

The procedure for creating these levels of scales can follow various routes. The routes followed in this study have not been used elsewhere. The descriptions of varying severity of pain, from “mild” to “worst” pain, appear to be different between the genders. The females are historically the home makers and they used daily occurrences like household chores, where they are likely to injure themselves, to describe pain. These include when cooking in the kitchen e.g. to be cut by a knife (severe pain) or to be burnt with boiling water (worst pain) or they could prick their fingers (mild pain) when doing needlework.

The males on the other hand associated different degrees of pain severity with chores they would normally carry out e.g. carpentry, where a hammer blow to the finger is regarded as “severe” pain or being burnt by fire as the “worst” possible pain. Many of the Tswana speaking males are employed in the farming and mining sector. In the North West province there are approximately seven thousand farms employing more than ninety eight thousand labourers. There are eighty seven gold, platinum and diamond mines in this province. The mining sector employs approximately 18.5% of the total labour in the North West province (Visser, et al., 2002).On farms the labourers are sometimes called to put out “veld” fires and when working underground in the mines, they are often exposed to very uncomfortable and high degrees of heat.

The concept of “mild” and “worst” possible pain (the two extremes) seems best understood by the participants in this study. They were quick (taking approximately two to three minutes) to come up with terms which they felt best described these two extremes. They had difficulty however, discerning the nuances between “mild” and “moderate” pain and between “severe” and “worst” possible pain (this process took approximately five to ten minutes). Some of the participants did not understand the concept of “moderate” pain and regarded “mild” and “moderate” as being the same thing. Others equated “severe” pain with “worst” pain again not making a distinction between the two.

Most of the existing Verbal Descriptive Scales use different wording to describe intensity of pain and this results in varying ranges of pain-intensity scores .This in

turn makes comparison of pain intensity levels across instruments difficult Regardless of which pain measurement tool or scale is used, it is important to categorize intensity of pain into mild, moderate and severe and to assign numerical values to each of these descriptions in order to quantify pain effectively (Jones, et al., 2007).

Words used typically in the literature to describe type (quality) of pain are terms like aching, lancinating, stabbing, pricking, scalding etc. The stabbing, pricking, scalding pain for example, can be describing the type of pain, by analogy with the sensation caused by known causes of pain .i.e. being pricked by a pin, being stabbed by a knife or being scalded by hot water (Wagstaff, et al., 1985).

5.9 Conclusion.

The resulting Verbal Description Scale was developed by forty Tswana speaking (all back pain sufferers). It is comprised of four different verbal descriptors, to describe pain of increasing severity, from “mild” to “moderate” to “severe” and finally to “worst” possible pain. This Verbal Descriptor Scale may well be better understood by the target group of participants in the next study, Study Four, as it has not merely been translated form a foreign language, but was developed by Tswana speakers for Tswana speakers.

The following chapter is Chapter Six in which Study Four is described. Study Four tested the VAS, the Ascending Coin Scale, the Coin Heap Scale, the Ascending Injection Scale, the Injection Size scale, the WBFPS six faces and three faces as well as the Tswana VDS developed in Study Three. These scales were all tested in 250 Tswana speaking individuals suffering from back pain.

CHAPTER SIX STUDY FOUR

Method

6.1 Introduction.

This chapter describes the method used in study four including the study design, sample selection and inclusion criteria as well as the results.

6.2 The Aim of the study.

The aim of this study was to test the following eight scales: the VAS, the Ascending Injection Scale, the Injection Size Scale, the Coin Heap Scale, the Ascending Coin Scale, the Wong-Baker Faces Pain Scale (six faces) and the Wong-Baker Faces Pain Scale (three faces), all from the first and second study and the Verbal Descriptive Scale (VDS) developed in Study Three, in two hundred and fifty, Tswana peaking (first language), participants, suffering from back pain.

The following are the specific objectives:

- to determine the symmetry between current (actual) pain and the measurement(marking) of that pain on the different pain scales.
- to compare the marking (measurement) of present (actual) pain on all of the scales for gender, education and age.
- to establish which of the scales was the best understood.

The definition of best understood scale for Study Four = the scale on which the participants fill their present pain perception most accurately i.e. where they fill their present pain (marked out of ten) closest to or on the same (corresponding) number of Coins, Injections, or relevant Verbal Description or relevant Face.

6.3 Study Design.

This was a prospective, cross-sectional study to validate new pain scales, modified scales and to test some existing pain scales.

6.4 Sample Selection.

The participants were all back pain sufferers and were selected from workers at four supermarket groups in Klerksdorp, in the North West province, South Africa, as well as from patients attending Township Clinics in the KOSH (Klerksdorp, Orkney,

Stilfontein and Hartebeesfontein) area in the North West province. In this study the education level was divided into primary school (grade1-10) and high school (grade 11+12) as there was no one in this study who had a tertiary education level.

6.4.1 Inclusion criteria.

- Females and males.
- Age 18 years and above.
- Packers, till workers, merchandisers, bakery workers, delicatessen workers, supermarket supervisors, all suffering from back pain and back pain sufferers attending the four clinics.
- Education level grade 12 and below.
- Tswana speaking (first language).

6.4.2 Sample size.

A total of two hundred and fifty participants, who fulfilled the inclusion criteria, were tested in this study. The sample size was calculated according to Jensen and Turner (1994), where they suggest that ten participants are required for each item on a scale (a total of one hundred subjects is therefore the minimum requirement for each scale tested, as each scale is marked from nought to ten).

6.5 Ethical Considerations.

Participants who met the inclusion criteria were invited to participate in this study and were given an information sheet to read and then signed a consent form. Permission was obtained from the management of the four supermarkets which were selected for this study (Checkers Hypermarket, City Centre, Pick and Pay, Songloed, MCC Spar Supermarket, Flamwood and OK Bazaars, Taxi Rank). Permission was also obtained from the four Clinics in Kuma (Orkney), Kanana (Stilfontein), Alabama (Klerksdorp) and Jouberton (Klerksdorp).Ethical approval was granted by the Human Research Ethics Committee of the University of the Witwatersrand (Ethical Clearance certificate number M091121) (See Appendix for Ethical Clearance certificate).

6.6 Procedure.

6.6.1 Detail of pain scale completion.

Questionnaires were numbered according to the number of participants taking part in the study. The numbers were matched with the participant's details which were recorded and kept confidential in a separate file. The research assistant was present at all times, at all the interviews, in order to translate and explain the entire research process to the participants who could only speak Tswana. Participants were asked in which language they preferred to be interviewed i.e. English, Afrikaans or Tswana.

The participants were also asked which area on their back was painful. I marked this area on a body chart. I then asked the participants if the marked area was correct and this was confirmed by each participant. They were then asked what their present pain perception was out of ten, if nought was "no pain" and ten was the "worst possible pain". Once their present pain perception was recorded, they were asked to fill it in on the VAS. Due to its previous, poor performance in this population group (Yazbek, et al., 2009).I explained the VAS carefully to each participant.

Once the participants had grasped the concept of the VAS, they were asked to continue filling in their present pain perception on all of the other scales. The order of completing the scales was the same for all participants. The next scale to be completed was the newly developed Verbal Descriptive Scale followed by the Ascending Injection Scale, the Injection Scale of varying Size and the Coin Scale in Heaps followed by the Ascending Coin Scale and then the two Wong-Baker Faces Pain Scales were completed. The six faces scale was completed first, followed by the three faces scale. After the entire process was completed, the participants were asked for the reasons for their choices i.e. why they chose the number, verbal description, the injection number or size, the number of coins and the particular face that they found best represented or described their present pain. This was recorded.

6.6.2 Data Analysis.

Descriptive statistics, mean and (SD) are reported for actual pain and marked pain. The categorical data were summarised using frequencies and percentages. The Fisher's exact test was used for categorical data to establish differences between gender, education levels and ages' understanding of the scales i. e the difference between their actual pain perception and the filling in of their pain intensity on all of the scales. The Fisher's exact test was also used to compare the age groups with respect to the education levels i.e. whether age groups differ with respect to

education level. The McNemar's test for symmetry was used to establish the agreement between perceived pain and the pain intensity which the participants marked on each of the scales.

Overall agreement between pain perceptions on the respective pain scales for each participant was determined along with the Kappa-statistic. Overall agreement was determined using the criteria, that agreement is assumed, when two scales score within one unit apart. Landis and Koch, (1977) suggest that a Kappa value above 80% represents excellent agreement; above 60% substantial levels of agreement; from 40% to 60% moderate agreement; and below 40% poor to fair agreement.

Viera and Garrett, (2005) suggest that a Kappa value <0 = Less than chance agreement; 0.01-0.20 = Slight agreement; 0.21-0.40 = Fair agreement; 0.41-0.60 Moderate agreement; 0.61-0.80 = Substantial agreement and 0.81-0.99 = Almost perfect agreement. A p-value of<0.05 was regarded as significant symmetry.

6.7 Results.

The results are presented in tabulated form. The tables are representative of the demographics of the participants, as well as tables depicting data of the agreement between the participants' pain perception and all of the scales, in two education groups(grade 1to10 and grade 11and12), three different age groups(≤35 years,36 to 50 years and> 50 years) and in both genders. The average ages, their gender and the education group of the participants are shown in table 6.7.1.

Table 6.7.1 Demographic data for Study Four (n=250).

Gender	Age ≤35 (n=81) 32 %of whole group	Age36-50 (n=105) 42%of whole group	Age>50 (n=64) 26%of whole group	Grade1-10 (n=115) 46%of whole group	Grade11+12 (n=135) 54%of whole group
Male n=72 (29%)	31 (38%)	27 (26%)	14 (22%)	30(26%)	42(31%)
Female n=178 (71%)	50 (62%)	78(74%)	50(78%)	85(74%)	93(69%)

The majority of the participants was female (71%). The females were mainly between the ages of thirty six and fifty years (74%). Most males (31%) fell into the education level grade 11 and grade 12. The majority of females (74%) were in the lower education group (grade 1-10). Both the higher education and the lower education groups were comprised of more females than males.

The next table represents the number of participants from the three different age groups and the education levels to which they belonged.

Table 6.7.2 The participants in each education level when split by age.

	Education level Grade 1-10	**Education level Grade11 and 12**	**p-value**
Age≤35 years	n=12/ 81 = 15%	n=69/81= 85%	**<0.01**
Age36-50 years	n=45/104 =43%	n=59/104 = 57%	
Age> 50 years	n=57/65=88%	n=8/ 65 =12%	

The Fisher's exact test was used to compare the age groups with respect to the education levels i.e. whether age groups differ with respect to education level.

From the data above we see that the majority of participants were in the age group 36-50 years and that most of the participants in the ≤35 years age group were from the higher educated group. Furthermore the age groups differed significantly with respect to the proportion with higher education ($p<0.01$) in particular, as age increases education level decreases.

The next table is table 6.7.3 which shows the agreement for the total group (n=250) between the participants' perceived pain and the pain intensity which they marked on all of the scales.

Table 6.7.3 The agreement between perceived pain and the pain intensity which the participants marked on each of the scales (n=250).

Scale	Mean(SD) Actual Pain Perception	Mean (SD) Marked Pain Intensity	Agreement	Kappa	p-value
VAS	6.45 (2.62)	6.42 (2.60)	91.20%	0.90	0.61
VDS	2.52 (1.00)	2.53 (1.10)	55.60%	0.40	0.34
Ascending Injection	6.45 (2.62)	5.69 (2.93)	65.60%	0.61	**0.01**
Injection Size Scale	6.45 (2.62)	5.88 (2.72)	57.20%	0.52	**<0.01**
Coin Heap Scale	6.45 (2.62)	6.12 (2.70)	71.20%	0.67	0.38
Ascending Coin Scale	6.45 (2.62)	6.17 (2.76)	73.20%	0.70	0.36
WBFPS 6	6.88 (2.52)	6.04 (2.86)	48.80%	0.36	**<0.01**
WBFPS 3	3.13 (1.80)	3.27 (1.39)	63.60%	0.39	**<0.01**

Significant values are in **bold**. Descriptive statistics, mean (SD) are reported for actual pain and marked pain in the first two columns. We see from the two-way table that agreement follows when perceived pain versus marked pain are considered on the actual scale as the percentage of participants that score the same. Kappa is the

statistic used to measure the extent of this agreement. The p-value is for the McNemar's test for symmetry i.e. when in disagreement is there a bias (does one tend to score higher than the other)?

From the above table we see excellent agreement between the marking of pain intensity and the actual pain perception for the VAS for the total group of participants. For both Coin Scales there are non-significant, moderate to substantial degrees of agreement. For both Injection Scales ($p<0.01$) moderate to substantial agreement also exists between the marking of pain intensity and the actual pain perception. For both the WBFPS 6 and for the WBFPS 3 ($p<0.01$) poor agreement exists between the marking of pain intensity on these two scales and the participants' actual pain perception.

Explanation for the following table, Table 6.7.4.

An explanation of what is meant by *-1, 0* and *1* being assumed agreement in the following table, is that for example, if the participants say that their pain is eight out of ten but mark either 7*(-1)* or 9*(+1)* on the scales, then these values should also be regarded as acceptable agreement.

Table 6.7.4 The agreement between perceived pain and pain intensity marked on both Injection Scales and both Coin Scales when *-1, 0* and *1* are assumed agreement.

Pain Perception versus Scale	*-1,0,+1* assumed agreement
Ascending Injection Scale	79.6%
Injection Size Scale	79.6%
Coin Heap Scale	84.0%
Ascending Coin Scale	84.4%

In the above table, we see that for the Ascending Injection Scale and for the Injection Size Scale (when *-1, 0* and *1* are assumed agreement) the total agreement increases to 79.6%, making these two scales understood by the majority (80%) of participants tested (See table 6.7.3 for original values).For the two Coin Scales we see that the Ascending Coin Scale did slightly better than the Coin Heap Scale.

Namely if *-1, 0* and *1* is assumed agreement, the total agreement for the Coin Heap Scale increases to 84% and the total agreement for the Ascending Coin Scale increases to 84.4%(See table 6.7.3 for original values).The two Coin Scales are therefore understood by 84% of the participants tested.

The following table 6.7.5 represents the perceived pain of all the participants. The participants were asked “How bad is your back pain?” and graded the intensity of their pain from one to ten.

Table 6.7.5 The distribution of pain perception in the total population (n=250).

Pain Perception	Frequency	Percentage (%)	Cumulative (%)
1	6	2.40	2.40
2	12	4.80	7.20
3	23	9.20	16.40
4	23	9.20	25.60
5	35	14.00	39.60
6	26	10.40	50.00
7	21	8.40	58.40
8	37	14.80	73.20
9	22	8.80	82.00
10	45	18.00	100
Total	250	100	

Eighteen per cent of the participants (n=45) claimed that their pain was ten out of ten followed by thirty seven individuals or 14.80 % whose pain was eight out of ten. Only a small percentage of participants 2.40% (n=6) had minimal pain (one out of ten).

The following table, table 6.7.6 shows the agreement between the participants’ perceived pain and the pain intensity which they marked on all of the scales, for both genders (males = 72) (females n=178).

Table 6.7.6 The agreement of pain perception and marked pain by gender.

Scale	Males Mean(SD) Actual Pain perception	Males Mean(SD) Marked Pain intensity	Kappa	Agreement	Females Mean(SD) Actual Pain perception	Females Mean(SD) Marked Pain intensity	Kappa	Agreement
VAS	5.60 (2.80)	5.58 (2.80)	0.89	90.28%	6.80 (2.50)	6.80 (2.43)	0.90	91.57%
VDS	2.21 (1.00)	2.30 (1.14)	0.51	63.89%	2.64 (0.94)	2.63 (1.00)	0.34	52.25%
Ascending Injection	5.60 (2.80)	4.86 (2.90)	0.60	63.89%	6.80 (2.50)	6.02 (2.90)	0.62	66.29%
Injection Size	5.60 (2.80)	5.03 (2.69)	0.53	58.33%	6.80 (2.48)	6.22 (2.66)	0.51	56.74%
Coin Heap	5.60 (2.80)	5.32 (2.82)	0.66	69.44%	6.80 (2.48)	6.45 (2.58)	0.68	71.91%
Ascending Coin	5.60 (2.79)	5.29 (2.87)	0.72	75.00%	6.80 (2.48)	6.52 (2.64)	0.69	72.47%
WBFPS 6	6.06 (2.68)	5.31 (2.91)	0.38	50.00%	7.21 (2.38)	6.35 (2.79)	0.34	48.31%
WBFPS3	2.64 (1.96)	2.92 (1.39)	0.43	63.89%	3.33 (1.70)	3.41 (1.37)	0.36	63.48%

Descriptive statistics, mean (SD) are reported for actual pain and marked pain. Agreement follows when perceived pain versus marked pain is considered on the actual scale as the percentage of participants that score the same. Kappa is the statistic used to measure the extent of this agreement.

From the table above, the results reflect that 90% of the males and 92% of the females marked their pain perception accurately on the VAS. For the VAS, overall excellent agreement is seen as all Kappa values are over 80%. The majority of participants marked their pain perception accurately and therefore understood this scale. The VDS was understood by 52% of the females and 64% of the males. Kappa values are indicative of fair to moderate agreement. For the Ascending Injection Scale agreement ranges from 64% (for the males) to 66% (for the females) who marked their pain perception accurately on this scale. The Kappa values range

from 0.60 to 0.62. This is indicative of moderate to substantial levels of agreement. The Injection Size Scale was understood by 57% of the females and by 58% of the males. Here the Kappa values are indicative of moderate degrees of agreement. For the Coin Heap Scale the agreement is 72% for the females and 69% for the males. The Kappa values show moderate to substantial levels of agreement. The results for the Ascending Coin Scale are similar. Agreement is 72% for the males and 75% for the females. This means that more than seventy three per cent of the participants understood this scale. The Kappa values show substantial levels of agreement (ranging from 0.69 to 0.72).For the Wong-Baker Faces Pain Scale 6 we see that the agreement is 50% for the males and 48% for the females. Poor agreement is noted here as all Kappa values range from 0.34 to 0.38. Similarly for the Wong-Baker 3 Faces Pain Scale poor agreement is seen in this table, as all Kappa values range from 0.36 to 0.43 Here 63.89% of the males and 63.48% of the females understood this scale.

The following table, table 6.7.7 shows the difference between the marking of pain perception on all of the scales and the participants' actual pain perception for both genders. The Fisher's exact test was done to test for differences between the groups. All the values in which there was either no difference *(0)* or only one *(-1 or +1)* point difference were considered to be the same and all those values outside of these numbers were considered to be different. All the tabulated numbers in table 6.7.7 below are the number of participants fitting into each category.

Table 6.7.7 Gender comparisons between all of the scales when *-1, 0, +1* are assumed agreement.

Scale	Male	Male	Female	Female	p-value
	Same	Different	Same	Different	
VAS	68	4	174	4	0.23
VDS	41	31	95	83	0.67
Ascending Injection	57	15	142	36	1.00
Injection Size	54	18	145	33	0.30
Coin Heap	59	13	151	27	0.57
Ascending Coin	61	11	150	28	1.00
WBFPS 6	51	21	116	62	0.46
WBFPS3	36	36	90	88	1.00

From the above table we see that no significant difference exists between the genders, for the marking of pain perception (on each of the scales) and their actual pain perception.

The next table is Table 6.7.8 shows the agreement in both education levels (grade1-10 and grade 11+12), between the participants' perceived pain and the pain intensity which they marked on all of the scales.

Table 6.7.8 Agreement of pain perception and marked pain by education level.

Scale	Grade 1-10 Mean(SD) Actual Pain perception	Grade 1-10 Mean(SD) Marked Pain intensity	Kappa	Agreement	Grade 11+12 Mean(SD) Actual Pain perception	Grade 11+12 Mean(SD) Marked Pain intensity	Kappa	Agreement
VAS	7.13 (2.55)	7.13 (2.50)	0.89	90.43%	5.90 (2.56)	5.81 (2.53)	0.91	91.85%
VDS	2.80 (1.00)	2.74 (1.10)	0.30	48.70%	2.30 (0.94)	2.40 (1.00)	0.47	61.48%
Ascending Injection	7.13 (2.60)	6.11 (3.10)	0.60	64.35%	5.87 (2.60)	5.33 (2.80)	0.63	66.67%
Injection Size	7.13 (2.55)	6.30 (2.80)	0.49	55.65%	5.90 (2.56)	5.52 (2.63)	0.53	58.52%
Coin Heap	7.13 (2.55)	6.70 (2.71)	0.64	68.70%	5.90 (2.56)	5.67 (2.62)	0.70	73.33%
Ascending Coin	7.13 (2.55)	6.68 (2.81)	0.67	71.30%	5.87 (2.56)	5.73 (2.65)	0.72	74.81%
WBFPS6	7.57 (2.45)	6.57 (2.91)	0.35	49.57%	6.30 (2.44)	5.60 (2.74)	0.35	48.50%
WBFPS3	3.52 (1.72)	3.63 (1.41)	0.37	64.35%	2.80 (1.81)	2.97 (1.30)	0.37	62.96%

Descriptive statistics, mean and (SD) are reported for actual pain and marked pain. Agreement follows when perceived pain versus marked pain is considered on the actual scale as the percentage of participants that score the same. Kappa is the statistic used to measure the extent of this agreement.

In table 6.7.8 above the agreement between the participants' perceived pain and the pain intensity for the VAS we see that 91.85% of the participants in the education level, grade 11 and 12 and 90.43% participants in the lower grades correctly marked their actual pain perception on the VAS. Kappa values are 0.89 to 0.91which is indicative of an excellent (almost perfect) degree of agreement. The agreement seen for the VDS was also greater in the higher educated group (61.48%), as opposed to 47.8% agreement for the lower education group. Here the degree of agreement is poor (Kappa 0.30 to 0.47).Similarly, the results for the Ascending Injection Scale and

for the Injection Size Scale show that the agreement was higher in the higher educated group(grade11+12). Here moderate to substantial levels of agreement are noted in this table. The Coin Heap Scale and the Ascending Coin Scale also have better agreement for the participants in grade 11and 12. The Kappa values (ranging from >60% to just less than 80%). This shows substantial levels of agreement. Both WBFPS had better agreement in the grade 1 to grade 10 education level. Poor agreement is noted here as all Kappa values range from 0.35 to 0.37. These two scales were not well understood.

The next table is table 6.7.9 which shows the education comparisons between all of the scales when *-1, 0, +1* are assumed agreement. For the table below, the Fisher's exact test was done to test for differences between the groups. All the values in which there was either no difference *(0)* or only one *(-1 or +1)* point difference were considered to be the same and all the values outside of these numbers were considered to be different. All the tabulated numbers in table 6.7.8 below are the number of participants fitting into each category.

Table 6.7.9 Education level comparisons between the scales when *-1, 0, +1* are assumed agreement.

Scale	Grade 1-10	Grade 1-10	Grade11+12	Grade 11+12	p-value
	Same	Different	Same	Different	
VAS	111	4	131	4	1.00
VDS	56	69	80	55	0.10
Ascending Injection	86	29	113	22	0.09
Injection Size	88	27	111	24	0.28
Coin Heap	94	25	116	19	0.39
Ascending Coin	94	25	116	19	0.39
WBFPS 6	76	39	91	44	0.90
WBFPS3	57	58	69	66	0.90

From the above table we see that no significant difference exists between the education groups, in the marking of pain perception (on each of the scales) and their actual pain perception.

The following table, table 6.7.10 shows the agreement between the participants' perceived pain and the pain intensity which they marked on all of the scales, for age groups ≤35, 36-50 and >50 years.

Table 6.7.10 Agreement of pain perception and marked pain by age

Scale	≤35 years Mean (SD) Actual Pain perception	≤35years Mean (SD) Marked Pain intensity	Kappa	Agreement	36-50years Mean (SD) Actual Pain perception	36-50years Mean (SD) Marked Pain intensity	Kappa	Agreement	>50years Mean (SD) Actual Pain perception	>50years Mean (SD) Marked Pain Intensity	Kappa	Agreement
VAS	5.56 (2.52)	5.40 (2.40)	0.88	88.89%	6.73 (2.64)	6.72 (2.67)	0.93	94.29%	7.25 (2.40)	7.25 (2.40)	0.87	89.06%
VDS	2.16 (0.91)	2.30 (1.10)	0.46	60.49%	2.61 (1.00)	2.70 (1.04)	0.38	54.29%	2.81 (0.91)	2.70 (1.00)	0.33	51.56%
Ascend Injection	5.50 (2.52)	5.10 (2.60)	0.68	71.60%	6.73 (2.64)	5.91 (3.10)	0.61	65.71%	7.25 (2.36)	6.13 (3.03)	0.52	57.81%
Injection Size	5.50 (2.52)	5.32 (2.50)	0.50	55.56%	6.73 (2.64)	6.05 (2.90)	0.56	61.90%	7.25 (2.36)	6.31 (2.70)	0.44	51.56%
Coin Heap	5.46 (2.52)	5.41 (2.51)	0.72	75.31%	6.73 (2.64)	6.39 (2.81)	0.68	72.38%	7.25 (2.36)	6.59 (2.59)	0.58	64.06%
Ascend Coin	5.46 (2.52)	5.42 (2.60)	0.68	71.60%	6.73 (2.64)	6.49 (2.80)	0.76	79.05%	7.25 (2.36)	6.59 (2.73)	0.60	65.63%
WBFPS 6	5.95 (2.47)	5.19 (2.75)	0.34	46.91%	7.12 (2.51)	6.48 (2.90)	0.37	50.48%	7.66 (2.27)	6.44 (2.70)	0.34	
WBFPS 3	2.41 (1.74)	2.84 (1.17)	0.37	65.43%	3.40 (1.81)	3.33 (1.46)	0.27	56.19%	3.59 (1.60)	3.17 (1.41)	0.52	

From Table 6.7.10 above we see that the VAS has the best agreement levels in the participants from the age group 36 to 50 years. Ninety four per cent of them were correct in marking their pain perception on the VAS. For the VDS the youngest age group, thirty five years and younger, had better agreement than the other two age groups. Here we see Kappa values varying from approximately 0.33 to 0.46 for the different age groups which is indicative of a poor degree of agreement.

The results for the Ascending Injection Scale show that this scale had best agreement in the youngest age group. Kappa values range from >50% to >70%. This is indicative of moderate to substantial levels of agreement. On the other hand, the Injection Size Scale had best agreement in the participants in the middle age group (36-50 years).Poor to moderate degrees of agreement are noted for the Injection Size Scale in all age groups.

The agreement for the Coin Heap Scale was best in the youngest age group (≤35 years).For this scale the Kappa values show moderate to substantial levels of agreement. For the Ascending Coin Scale the agreement in the middle age group (36-50years) was best. The Kappa values also show moderate to substantial levels of agreement (ranging from >60% to just less than 80%).

The WBFPS 6 shows best agreement for the middle age group (36-50years).Agreement for this scales is however poor as all Kappa values range from 0.34 to 0.37.The WBFPS 3 had the best agreement in the oldest age group (>50years). Poor to moderate agreement is seen for this scale as all Kappa values range from 0.27 to 0.52.

The next table is table 6.7.11 which shows the age comparisons between all of the scales when *-1, 0, +1* are assumed agreement. For the table below, the Fisher's exact test was done to test for differences between the groups. All the values in which there was either no difference *(0)* or only one *(-1 or +1)* point difference were considered to be the same and all the values outside of these numbers were considered to be different. All the tabulated numbers in table 6.7.11 below are the number of participants fitting into each category.

Table 6.7.11 Comparison of age groups with respect to agreement *(-1, 0, +1)* for the respective scales.

Scale	≤35 years n=81	≤35 years n=81	36-50years n=105	36-50years n=105	>50years n=64	>50 years n=64	p-value
	Same	Different	Same	Different	Same	Different	
VAS	76	5	104	1	62	2	0.14
VDS	50	31	56	49	30	34	0.20
Ascending Injection	68	13	84	21	47	17	0.29
Injection Size	67	14	86	19	46	18	0.23
Coin Heap	74	7	86	19	50	14	0.06
Ascending Coin	70	11	90	15	51	13	0.53
WBFPS 6	56	25	68	37	43	21	0.82
WBFPS3	43	38	49	56	34	30	0.62

From the above table we see that no significant difference exists between the age groups, between the marking of pain perception (on each of the scales) and their actual pain perception. The Fisher's exact test was done in order to compare age groups with respect to the proportion of agreement *(-1, 0, +1)* for the respective scales.

6.8 Discussion.

The closer the participant's pain perception (a measure from nought to ten) to the corresponding number or verbal descriptive term or picture on the scales, the better their understanding of the scale.

6.8.1 Understanding the Scales in the total group. The best understood scale to the worst understood scale.

The scales which were best understood by the participants, in Study Four, were, in order of best to worst:

1. The Ascending Coin Scale. 2.The Coin Heap Scale. 3.The Ascending Injection Scale. 4.The Injection Size Scale. 5.The Wong- Baker Faces (three faces). 6.The VDS (Verbal Descriptive Scale). 7.The Wong- Baker Faces (six faces)

The best scale in Study Four was **the Ascending Coin Scale** which was understood by the majority (seventy three per cent) of participants and we see that if *-1, 0* and *1* are assumed agreement, the result improves considerably to eighty four per cent. By having three choices (*-1, 0* and*1)* instead of only one (*0*) the understanding of the scale improves. The majority of participants are filling in their pain perception accurately on this scale. The next best understood scale was the new, modified **Coin Heap Scale** which was understood by seventy one per cent of the participants and as with the Ascending Coin Scale, this result improves to eighty four per cent if *-1, 0* and*1* are assumed agreement. The Coin Heap Scale is a modified scale, similar to the Pakistani Coin Scale used by Salim, (1993) (See Table 6.7.3 and Table 6.7.4).

The Ascending Coin Scale depicts an increase in pain associated with coins spread out and arranged in ascending order and as can be seen from the results, it appears to be slightly better understood by the participants than the Coin Heap Scale where the coins are arranged in heaps. This finding is possibly due to the fact that the increments in the number of the coins were easier to identify in the Ascending Coin Scale and that the Coin Heap Scale had the coins piled on top of each other, looking rather like a pile of stones of increasing in height. I believe that when the coins are spread out over a larger area of the scale, they depict to the participants, a larger area and hence “larger increase in pain”.

In both of the Coin Scales in this study, a direct relationship is seen between pain severity and the amount of money required to treat the pain i.e. more pain was expressed as more money and less pain was represented by less money. Some participants did not fill this scale in correctly. A possible explanation for the incorrect filling in of the Coin Scales by some of the participants could be due to the fact that they saw an inverse relationship between the coins and pain, instead of a direct relationship. They reasoned that a lack of money caused pain as they could not afford to buy what they needed. The more money they had, the happier they were. This way of thinking is possibly due to an emotional or psychosocial component to the participants’ pain.

In support of this emotional or psychological link between pain and money are other studies which have shown that pain perception and the reporting of pain are affected by socioeconomic status, emotional state and financial security. Neighbourhood

deprivation, low levels of education and (perceived) income inequalities all affect pain perception and the onset of pain interfering with daily activities (Thomten, et al., 2012; van Hecke et al., 2013).Another proponent of the theory that money or more specifically, the lack thereof has a direct relationship with “emotional pain” is Kluger, who in 2013 says that money can be seen as a means of achieving our goals and fulfilling our dreams. The more money we have the less “pain” we would experience and the happier we would be. The way in which we respond to money is determined by the value placed on money by our cultural perceptions and by the society we live in (Zelizer, 1989; Tallon-Baudry, et al., 2011; Kluger, 2013).

The next best understood scale is the **Ascending Injection Scale** which was understood by sixty six per cent of the participants in the total group. However, if we consider *-1*, *0* and*1* are assumed agreement, the understanding of this scale improves as it increases to eighty per cent. Once more we see that by having three choices (*-1, 0* and*1)* instead of only one (*0*) the understanding of the scale improves (See Table 6.7.3 and Table 6.7.4).

Other studies have been done where a range of three numbers is regarded as being acceptable as reflecting a true representation of perception of pain (Shrestha, et al., 2013). This rationale I believe could possibly provide better results for gauging the severity of pain as more choices or options become available. By being less rigid and by permitting more than one number to represent a certain intensity of pain, quantification of pain would improve as more than one option or choice could be regarded as being correct i.e. more than one choice of number *(-1*,*0*, *+1*) being representative of a certain intensity of pain. This would possibly simplify the measurement tools and would thereby enhance a better understanding of them.

When filling in their “pain perception” on the Ascending Injection Scale, the majority of the participants seemed to correctly associate more pain with more injections. The reasoning of the majority, who understood the scale, is twofold (taken from anecdotal data):

a. The more pain they have, the more injections they require from the doctor or nurse to take away their pain or

b. The more injections they receive, the more pain the injections cause.

The few instances where agreement was not as good, could have been attributed to the fact that the participants had a genuine fear of needles and that they would regard only one or two injections as being severely painful or “painful enough”. They could not imagine having as many as eight injections to take away their severe pain and would choose to have the minimum number of injections for fear of the fact that the injection process itself, would cause more pain and emotional trauma. The fact that the injection process itself is a painful one is supported by Subashini, et al., (2008), Chae, et al., (2011), Rah, et al., (2012) and Ozdemir, et al., (2013).

The **Injection Size Scale** is the fourth best understood scale and differs from the Ascending Injection Scale in that it has injections increasing in size and not in number. The Injection Size Scale was understood by fifty seven per cent of participants and if *-1*, *0* and*1* are assumed agreement, this increases to eighty per cent. Again we see that by having three choices (*-1, 0* and*1)* instead of only one (*0*) the understanding of the scale improves (See Table 6.7.3 and Table 6.7.4). The majority of participants correctly attributed the increasing size of the injections on this scale, to increasing levels of pain (the injections themselves, causing pain). Some of the participants reasoned that the sicker they were, or the more pain they had, the larger the medicinal content of the injection needed to be. They associated more pain with more medication required to ease their pain. The participants who did not fill this scale in correctly, could also be those who did not understand the scale or those who had a fear of injections and no matter how much pain they had, they were not prepared to be injected by a larger injection. They associated a larger injection with a thicker needle which would cause them more pain (this was told to me by some of the participants). They also stated that that the larger the injection, the greater its content and the longer the injection process would take, causing them prolonged pain (Subashini, et al., 2008; Ozdemir, et al, 2013).Some of the participants had a large emotional component to their pain (fear of needles) (anecdotal data) and others a more stoical approach and were therefore perhaps prepared to tolerate more pain (injections) in order to get rid of their pain(anecdotal data) (Chae, et al., 2011; Rah, et al., 2012; Brown, 2012).

The next best understood scale was the **Wong-Baker (three faces)** which was understood by sixty four per cent of the participants (See Table 6.7.3). The Wong-Baker Faces Pain Scales (three and six faces) are pictorial scales and although they

were best understood by participants in the lower education level in Study Four these two scales fared the worst out of all the scales. The WBFPS 3 was better understood than the original six faces scale. This is perhaps due to the modified scale's simplicity as it may be easier to understand as there are less choices and the participants are less likely to get confused.

The scale which fared the worst in Study Four was the **Wong-Baker Faces Pain Scale (six faces)** as it was only understood by forty nine per cent of the participants (See Table 6.7.3).Many studies favour the use of the WBFPS in the paediatric and in the adult setting (Wong and Baker, 1988; Terai, et al., 1998; Kim and Buschmann, 2006). The Wong-Baker Faces Pain Scale, as discussed in the literature, is easy to understand and is used widely and very commonly for children (Wong and Baker, 1988). It is also valid and reliable for use, albeit less commonly, for adults and for subjects with low educational levels (Kim and Buschmann, 2006).

A possible explanation why the WBFPS6 was the worst understood scale in this study could be that the majority of participants may have seen the faces as an expression of their present state of mind, mood or emotional state and did not associate the facial expressions as depicting pain as such. Pain perception is affected by biological and psychosocial factors (Gamsa, 1994; Ott, et al., 2012). In accordance with this are the findings of Bates, et al., who almost ten years earlier in 1993 determined that there is a definite connection between mood, cognition and psychosocial variables which will affect perception of pain. Also agreeing that a relationship does exist between emotion and pain perception are Davies et al., (1993).

What was confusing for some of the participants were the last two faces both with down turned mouths and the last face with tears running down the cheeks. There was confusion as to which of the last two faces to choose for "severe" and "worst pain", as the participants said that although they may have severe pain, they would most definitely not cry due to the pain, as crying (in the Tswana culture) was done by children and not by adults. Other participants marked the smiling face as worst pain and when asked why they did this, they said that they thought that the smile was a grimace and that a grimacing face was one expressing pain. Adding to the confusion, they said that the first two faces on this scale look almost the same. The

difference between the two faces is the broadness of the smile, which if you do not scrutinize the faces very carefully, you may miss. Therefore for “no pain” the first two or three faces may be misunderstood to represent “no pain” (Huang, et al., 2012).The participants, although in pain, did perhaps not want to admit to being in pain lest they be chastised for not being stoical. In certain cultures males are not encouraged and are sometimes even punished for expressing their pain (Nayak, et al., 2000; Chin, et al., 2005).

Another scale which fared badly in this study was the **Verbal Descriptive Scale (VDS)** (See Table 6.7.3).Only the WBFPS 6 did worse than the VDS. Verbal Descriptive Scales using the terms “no pain”, “mild pain”, “moderate pain” , “severe pain”, “extreme pain” and “ the most intense pain imaginable” have been found to be reliable and valid (Herr, et al.,1993) and have been used extensively throughout numerous studies. They have been adapted for use and have been translated into the language of the country in which they were to be used. In Africa however, few studies have been carried out where VDS has been translated into various African languages. My 2009 study tested a VDS which was translated into Tswana. This scale was not well understood by the 110 participants (all back pain sufferers) in that study.

In this study, when the participants were asked to mark the severity of their pain on the VDS fifty six per cent of them correctly marked their present pain perception but forty four per cent of the participants did not understand the Tswana version of the VDS at all. This could possibly be due to the fact that certain participants confused the “severity” of their pain with the “nature” of their pain i.e. they would say that their pain was “burning” in nature and would not attribute burning to the worst possible type of pain. Most of the existing Verbal Descriptive Scales use words to describe quality of pain and not intensity of pain. Words used typically in the literature to describe type (quality) of pain are terms like aching, lancinating, stabbing, pricking, scalding etc. The stabbing, pricking, scalding pain for example, can be describing the type of pain, by analogy with the sensation caused by known causes of pain .i.e. being pricked by a pin, being stabbed by a knife or being scalded by hot water (Wagstaff, et al., 1985).

6.8.2 Gender differences in the scales.

There were no significant gender differences in the understanding of all of the scales. Both the males and the females marked their pain perception similarly accurately on all of the scales. This is possibly due to the fact that the participants all came from similar socioeconomic and educational backgrounds and therefore their perceptions of pain were also similar (Omulecki, et al., 2009; Valencia, et al., 2011; Ozdemir, et al., 2013; Shrestha, et al., 2013; van Hecke, et al., 2013). The same finding was made by Walker, et al., (1998) who found that females and males have similar perceptions of pain when tested for cold and ischaemic pain. This finding could possibly be due to the fact that the participants in both studies (1998 and this study, Study Four) had similar levels of education, namely primary and secondary levels.

On the other hand, Strong, et al., (2009) found that gender differences in the language used by men and women when reporting pain may affect how their pain is understood and evaluated by health professionals. Gender differences have also been reported in the level and type of emotional and social content of symptom descriptions, willingness to report pain, the conversation describing the symptoms and the words used to describe similar pain episodes and conditions (Albarran, et al., 2007). Women are reported to be more willing to disclose pain, provide more somatic symptoms, have higher emotional content and have a stronger social and holistic focus in their symptom reports. The reasons for these communication differences are often attributed to psychosocial aspects, gender role expectations, social roles in the communication of pain and forebrain cerebral activation patterns in pain perception (Paulson, et al., 1998; Suyenbou, et al., 2003; Strong, et al., 2009).

6.8.3 Education differences in the scales.

In Study Four there were no significant differences between the two education groups either, as far as their understanding of the pain scales was concerned (They marked their pain perception accurately on all of the scales).This could possibly be attributed to the fact that the participants all came from a previously disadvantaged background where their system of education (the Apartheid Bantu Education System) was inferior when compared with that of this present day. In Study Four none of the participants had tertiary education and most of the literature that shows

that education levels are predictive of pain perception, have participants with tertiary levels of education (Shrestha, et al., 2013; Ozdemir, et al, 2013).

Education levels are predictive of patients' pain perception, pain intensity, disability, depression, physical functioning and return to work say Haase, et al.,(2012).Agreeing with this are Shrestha, et al., (2013) who found that those with higher education levels (secondary and tertiary education) perceived pain as more severe than did those of lower education (primary). In support of this difference in pain perception between differing education levels are Ozdemir, et al, (2013) who found that the participants in the higher education groups reported more severe pain and pain of longer duration than did those in the lower education groups. Better literacy leads to better understanding of measurement tools. Low functional health literacy may limit a patient's ability to comprehend, retain, recall and act on written health care measures (scales or questionnaires) of both literary and numerical content (Salim, 1993; Teutsch, 2003).

6.8.4 Age differences in all of the scales.

Age differences in the understanding of the scales were also not significant. This once more could be attributed to the fact that the participants all came from similar socioeconomic and educational backgrounds, therefore making their perceptions of pain similar (Omulecki, et al., 2009; Valencia, et al., 2011; Ozdemir, et al., 2013; Shrestha, et al., 2013; van Hecke, et al., 2013).Age related differences should be considered when assessing pain perceptions and age is definitely an important factor in the relationship between pain and cognitive function (Scherder, et al., 2001;Ceko, et al., 2013; Koenig, et al., 2013; Oosterman, et al., 2013; Nishimura, et al., 2014). There are also other studies like mine which have found that there was no significant difference between pain perception and age of the patient (Kunz, et al., 2009; Dahm, et al., 2013; Mathew, 2013 Saramma, et al., 2013).

6.8.5 "The Gold Standard" The VAS.

The VAS was chosen as the "gold standard" with which all of the other scales could be compared. The VAS was chosen as the "gold standard' for this study as it has numbers ranging from one to ten. Most of the other scales also have ten items per scale. Due to the poor performance of the VAS in my 2009 study, I decided to teach

the participants in Study Four how to use the VAS in order to facilitate its understanding. Overall, excellent agreement is seen as all Kappa values are over eighty per cent. This result however, is not a “true reflection” of whether the participants truly understood the VAS or not, as they were taught by me how to use the scale and how to mark their present pain perception on the scale. Therefore, the results of the VAS are excellent because the participants were coached on how to use it. All the other scales were completed by the participants without guidance or help from me

6.9 Conclusion.

No significant differences existed between the marking of the participants’ pain intensity on all of the scales and their actual pain perception when the results were split by gender, education and age. This could possibly be attributed to the fact that all of the participants came from similar socioeconomic and educational backgrounds. None of the participants had tertiary education. They all came from previously disadvantaged backgrounds and were educated in the inferior Apartheid Bantu Education System. These educational and socioeconomic factors could therefore contribute to the similar perceptions of pain seen in this group of participants (Brekke, et al., 2002; Latza, et al., 2004; Soares, et al., 2004; Carr, et al.,2005; Omulecki, et al., 2009; Dawson and List, 2009; Radat and Koleck, 2011;Shrestha, et al., 2013; Ozdemir, et al., 2013; Thomten, et al., 2013).

The scales which are to be taken into the next study, Study Five for further testing are the Ascending Coin Scale and the Ascending Injection Scale. I decided to further test, only one Coin Scale (as both Coin Scales were equally well understood (by approximately 84% of participants) and one Injection Scale as both Injection Scales were equally well understood (by approximately 80% of participants). I chose the Ascending Coin Scale as it was the slightly better one of the two Coin Scales and the Ascending Injection Scale as it was also the slightly better one of the two Injection Scales. Both of these scales are ascending scales and I wanted to test them further, together with a Triangle Scale, in order to see if the participants truly understood the scales or whether they were just going according to the shape of the scale i.e. increasing in size from left to right.

A favourable factor in support of taking the Ascending Injection Scale further into Study Five when comparing it with the Coin Heap Scale for example is that there exists no possibility of a confusing, inverse relationship between pain perception and the Ascending Injection Scale taking place, as can occur when using the Coin Heap Scale. Whichever way one looks at the Ascending Injection Scale, a direct relationship exists between the number of injections and the pain they cause or between the numbers of injections required to take away the pain. Therefore, only the two Ascending Scales (Coin and Injection) were tested further in the last study, Study Five.

6.10 Limitations of the study.

This study had many more female (71%) than male participants (29%).This discordance in the gender numbers could be attributed to the fact that females, when in pain, are known to seek medical attention, more readily than males (Thuan and Le Resche, 2000; Im, 2005). This could once more be due to the fact that, as with the previous studies Study One and Study Two, the females were perhaps more willing to volunteer in order to participate in this study about pain and its perception. Despite this discordance in gender numbers, no significant differences existed between the genders' understanding of the scales.

The following chapter, Chapter Seven describes the final study, Study Five. Both Ascending Scales were tested together with a new scale namely the Triangle Scale in 50 Tswana speaking participants with back pain.

CHAPTER SEVEN STUDY FIVE

Method

7.1 Introduction.

This chapter describes the participants and the method used in Study Five. Study design, sample selection, inclusion and exclusion criteria are all described. The entire research process for Study Five is described as well. Study Five tested three scales namely the Ascending Coin Scale, the Ascending Injection and a right angle Triangle Scale. The right angle Triangle was chosen for its shape in order to establish whether the subjects truly understood the Ascending Coin Scale and the Ascending Injection Scale or whether they were just filling them in according to their shape i.e. an increment in size, going from left to right.

7.2 The Aim of the study.

The aim of this study was to test three scales namely The Ascending Coin Scale and the Ascending Injection Scale and a new scale, the Triangle Scale in fifty Tswana speaking participants with back pain.

The following are the specific objectives:

(1) to compare the understanding of the three new scales between both genders, education levels and differing ages.

(2) to establish which of the scales was best understood.

7.3 Study Design.

This was a cross-sectional study.

7.4 Sample selection.

A total of fifty participants took part in this study. They were all farm labourers, Tswana speaking and suffering from back pain. The study was carried out on a cattle farm , “Shackleton Farm” in Viljoenskroon in the Free State, South Africa, about forty kilometers south of Klerksdorp and on an Arabian Horse stud farm, “Bosworth Farm”

in Palmietfontein, ten kilometers north of Klerksdorp, South Africa. In this study the education level is divided into grade 1-10 and grade 11+ 12.

7.4.1 Inclusion criteria.

- Females and males.
- Age 18 years and above.
- Education level grade 0 to grade 12.
- Farm labourers.
- Back pain sufferers.
- Tswana speaking (first language).

7.4.2 Sample size.

Fifty participants were chosen as the two Ascending Scales are both ten point scales and these two scales were tested previously in two hundred and fifty participants in Study Four (Jensen, et al., 1994;Jensen, et al., 2003).

7.5 Ethical Considerations.

Permission was obtained from all the participants and from the management of the farms. Participants were all invited to participate in the study. Participants who met with the inclusion criteria were asked to sign informed consent prior to participation in the study. The research commenced once ethical clearance had been granted by the Human Research Ethics Committee, of the University of the Witwatersrand (Ethical Clearance certificate number M091121) (See Appendix for Ethical Clearance certificate).The participants were informed as to the entire process i.e. completing the three scales, with their perception of “worst pain” and their perception of “no pain” as well as their “present pain”.

7.6 Procedure.

7.6.1 Detail of Pain Scale completion.

The participants were all interviewed separately. The research assistant helped with translation in instances where the participants did not understand the English or the Afrikaans I spoke. They were asked about their back pain i.e. about the severity out of ten and about the location of the pain. This was all recorded on the information sheet of each participant. They then proceeded to fill in the three scales. The first

scale to be completed was the Triangle Scale, then the Ascending Coin Scale and lastly the Ascending Injection Scale. The participants were asked to fill in “no pain”, “worst pain” and lastly, their “present pain” intensity on all three scales.

The definition of the “ends of the scale” is: at the left, lower end of the scale, nought depicts “no pain” and at the right, higher end of the scale ten depicts “worst possible pain”.

The definition of best understood scale for Study Five = the scale where the participants accurately mark their “pain perception” on the scale i.e. their “pain perception” as a number out of ten corresponding accurately with the said number of either coins or injections and where the ends are marked at or very close to the extremes of the scale.

7.6.2 Data Analysis.

The results, presented as frequencies and percentages for age, education and gender categories, are in tabulated form. I analysed the data from the Triangle Scale by drawing a vertical line from the x marked by the participants on the scale to the horizontal line at the Triangle’s base. This line was 20cm in length and for the purpose of analysis the line was halved to 10 cm as the other two scales in this study both had 10cm horizontal lines. In other words, if the participant placed an x on the 20cm horizontal line at 8cm then this would be equivalent to 4cm on a 10 cm horizontal line.

The results for the Injection and Coin Scales were analysed and compared with each other, in the two education groups, in both genders and in the three age groups. Spearman’s correlations for “no pain”, “worst pain” and “present pain” were also done for all three scales. The Fisher’s exact test was also used to establish differences in the understanding of the scales when split by gender, education and age. The Student’s t test was used to calculate differences in ages between the two genders. Pain perception versus the Ascending Injection Scale, the Ascending Coin Scale and the Triangle Scale is plotted on Scatter graphs. The p value was set at $p<0.05$.

7.7 Results.

Data for the correlation between the participants' pain perception and the Ascending Injection and Ascending Coin Scales, in both education groups (grade1to10 and grade 11and12) in both genders and in three age groups are presented in tables, as are the data for the correlation between all three scales.

The next table represents the number of participants in each gender and age group and the education levels to which they belonged.

Table 7.7.1 Demographic data for Study Five.

	Males n=30	**Females n=20**	**p-value**	**≤ 35 n=28**	**35-50 n=8**	**>50 n=14**	**p-value**
Grade 1-10	21(70%)	18(90%)	0.09	17(61%)	8(100%)	14(100%)	**<0.01**
Grade 11+12	9(30%)	2(10%)		11(39%)	0(0)%	0(0)%	

The Fisher's exact test was done to compare genders and different age groups with respect to levels of education.

From the above table we see that most of the participants were in the lower education group (80%). There is a **significant** difference($p<0.01$) in education levels for the three age groups namely none of the older age groups 35-50 and >50 years had secondary school education.

The table below shows the mean ages of the males and females in Study Five.

Table 7.7.2 The age differences for the genders in Study Five (n=50).

	Mean Age	p-value
Male n=30	38.4 years (14.37)	
Female n=20	37.9 years (12.75)	**0.90**

The Student's t-test was used to calculate differences in ages between the two genders.

From the above table, it can be seen that the majority of the participants were male (60%), the average age was 38 years. There is no significant difference in the ages of the males and females.

The following table shows the correlation between the Ascending Injection Scale, the Ascending Coin Scale and the Triangle Scale.

Table7.7.3 The correlation between the Ascending Injection Scale, the Ascending Coin Scale and the Triangle Scale.

Scale	No Pain	Worst Pain	Present Pain
Ascending Injection and Ascending Coin	0.56	0.78	0.98
	<0.01	<0.01	<0.01
Ascending Injection and Triangle Scale	0.05	0.09	-0.11
	0.71	0.36	0.47
Ascending Coin and Triangle Scale	0.15	0.15	-0.04
	0.28	0.21	0.81

Top value in each cell is the r value and the bottom value is the p value. Spearman's correlation was done since the scale scores are ordinal.

From table 7.7.3 above, moderate to very strong degrees of association are seen for the Ascending Injection Scale and the Ascending Coin Scale for "no pain", "worst pain" and "present pain" ($p<0.01$). This means that both scales can be used in lieu of each other to measure pain in increments of severity.

There is poor correlation between the Triangle Scale and both Ascending Scales. This means that the Triangle Scale cannot be used instead of the two Ascending Scales. This is an important result as it shows that the participants are looking at the both of the Ascending Scales as they were intended to (i.e. measuring pain in increments of pain severity) and they were not going according to the triangular shape of each scale.

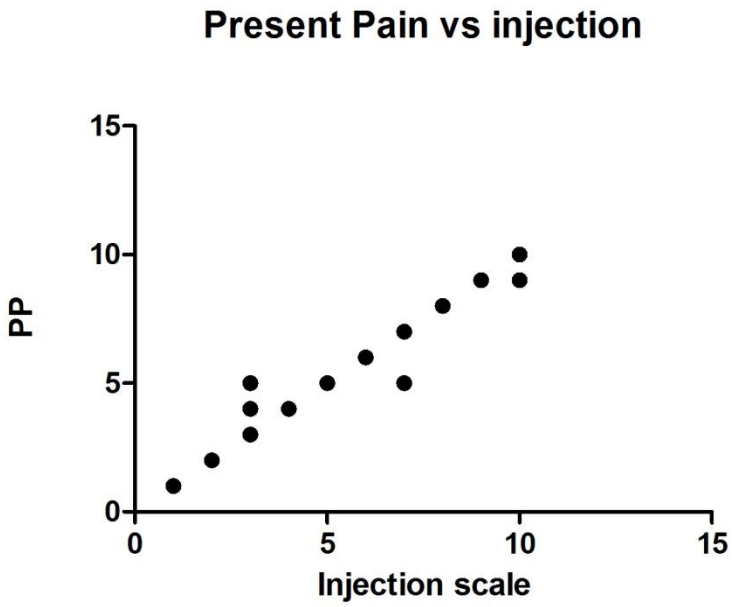


Figure 7.7.1 Scatter graph of Pain perception versus the Ascending Injection Scale.

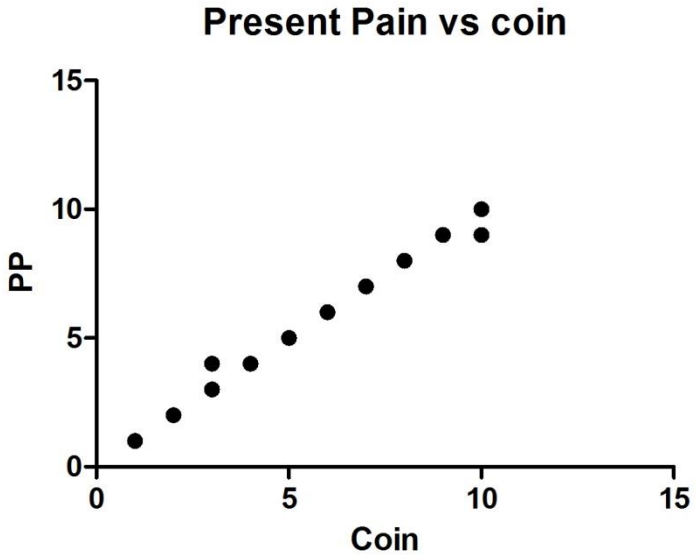


Figure 7.7.2 Scatter graph of Pain perception versus the Ascending Coin Scale.

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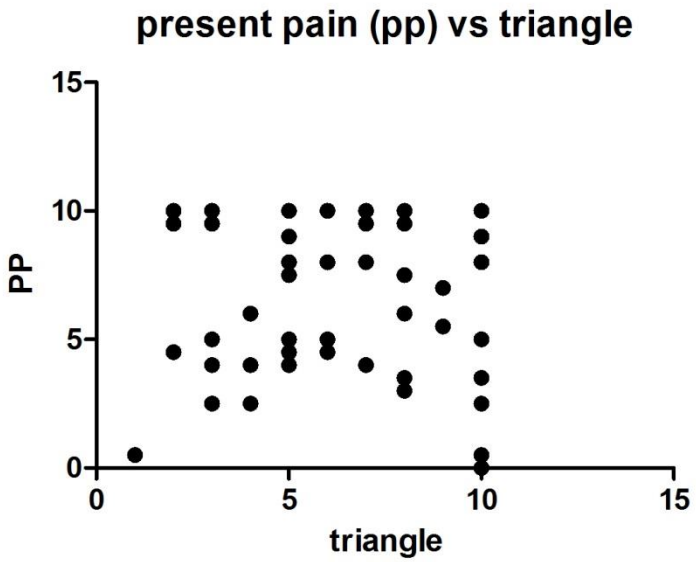


Figure 7.7.3 Scatter graph of Pain perception versus the Triangle Scale.

Due to the poor results for the Triangle Scale, I have therefore decided not to include any more data for the Triangle Scale. Only data for the Ascending Injection Scale and the Ascending Coin Scale will be presented and discussed further.

Explanation for the following tables Table 7.7.4 Table7.7.5 Table 7.7.6

The Fisher's exact test was done to test for differences among the groups. All the values in which there was either no difference *(0)* or only one *(-1 or +1)* point difference were considered to be the same and all those values outside of these frequencies were considered to be different. All the frequencies and percentages are tabulated. In Table 7.7.4, Table 7.7.5 and Table.7.7.6 below are the number of participants fitting into each category.

The table below shows where the participants marked their “pain perception”, “no pain” and “worst pain” for both Ascending Scales in both genders when *-1, 0, +1* are assumed agreement.

Table 7.7.4 Gender comparisons between both of the Ascending Scales, for pain perception and the ends of scales when *-1, 0, +1* are assumed agreement.

Scale	Male (n=30)	Female (n=20)	p-value	Male (n=30)	Female (n=20)	p-value	Male (n=30)	Female (n=20)	p-value
	Marked pain and Pain Perception	**Marked pain and Pain Perception**		**No Pain**	**No Pain**		**Worst Pain**	**Worst Pain**	
Ascending Injection	30/30=100%	18/20=90%	0.61	29/30=97%	16/20=80%	0.21	25/30=83%	15/20=75%	0.91
Ascending Coin	30/30=100%	20/20=100%		27/30=90%	11/20=55%		24/30=80%	15/20= 75%	

The Fisher’s exact test was used.

No significant difference exists in the understanding of the Ascending Injection Scale and the Ascending Coin Scale between the genders. Both genders understand both scales equally well when marking their “pain perception”, “no pain” and “worst pain” on both of the scales.

The next table shows where the participants marked their “pain perception”, “no pain” and “worst pain” for the Ascending Scales in both education levels when *-1, 0, +1* are assumed agreement in.

Table7.7.5 Education comparisons between both of the Ascending Scales, when *-1, 0, +1* are assumed agreement, for pain perception and the ends of scales.

Scale	**Grade1-10 (n=39)**	**Grade 11+12 (n=11)**	**p-value**	**Grade1-10 (n=39)**	**Grade11+12 (n=11)**	**p-value**	**Grade1-10 (n=39)**	**Grade11+12 (n=11)**	**p-value**
	Marked pain and Pain Perception	**Marked pain and Pain Perception**		**No Pain**	**No Pain**		**Worst Pain**	**Worst Pain**	
Ascending Injection	36/39=92%	10/11=91%	0.84	9/39=74%	10/11=91%	1.00	26/39=67%	9/11=82%	0.56
Ascending Coin	36/39=92%	10/11=91%		23/39=59%	8/11=73%		27/39=69%	8/11=73%	

The Fisher’s exact test was used.

No significant difference exists in the understanding of the Ascending Injection Scale and the Ascending Coin Scale between the two education levels. Both education levels understand both scales equally well when marking their “pain perception”, “no pain” and “worst pain” on both of the scales.

Table 7.7.6 Age comparisons between both of the Ascending Scales, for “pain perception”, “no pain” and “worst pain” when *-1, 0, +1* are assumed agreement.

Scale	≤35 years (n=28)	36-50years (n=8)	>50years (n=14)	p-value	≤35years (n=28)	36-50years (n=8)	>50years (n=14)	p-value	≤35 years (n=28)	36-50years (n=8)	>50years (n=14)	p-value
	Marked pain and Pain Perception	Marked pain and Pain Perception	Marked pain and Pain Perception		No Pain	No Pain	No Pain		Worst Pain	Worst Pain	Worst Pain	
Ascending Injection	28/28 =100%	8/8 =100%	14/14 =100%	1.00	27/28 =96%	5/8 =63%	12/14 =86%	0.26	24/28 =86%	5/8 =63%	12/14 =86%	0.99
Ascending Coin	28/28 =100%	8/8 =100%	14/14 =100%		22/28 =79%	3/8 =38%	11/14 =79%		20/28 =71%	4/8 =50%	10/14 =71%	

The Fisher’s exact test was used.

There is no significant difference in understanding between the Ascending Injection Scale and the Ascending Coin Scale for “pain perception”, “no pain” and “worst pain”, for the three age groups.

7.8 Discussion.

In Study Five “pain perception”, “no pain” and “worst pain” were filled in on all of the scales. From the data collected from the interviews with the fifty farm labourers, it was apparent that most of the participants did not understand what to do with the Triangle Scale. There was no significant correlation between the Triangle Scale and the two Ascending Scales. All associations were either weak or had no association whatsoever (see table 7.1.3). The Ascending Injection Scale and the Ascending Coin Scale on the other had moderate to very strong degrees of association ($p<0.01$). The importance of this finding is that both Ascending Scales can be used in lieu of each other.

For the purpose Study Five the definition of the best understood scale is one where the participants accurately mark their “pain perception” on the scale i.e. their “pain perception” as a number out of ten corresponding accurately with the said number of either coins or injections and where the ends are marked at or very close to the extremes of the scale. This would imply that the participants understand the concept of “no pain” being equivalent to nought (at the lowest end of the scale) and “worst pain” being equal to ten (at the uppermost end of the scale). Once they can equate pain, which is a physical experience, with a numerical measure of intensity, this would facilitate the measuring of pain (which is very subjective) objectively (Jones, et al., 2007).

There is no literature available as to what makes a scale a good one. Breivik, et al., (2000), say that an important criterion in the choice of pain scale must be the ease of use of the scale and its simplicity in measurement of pain assessment. I agree with Breivik, et al., (2000), that a scale must be easy to understand and must be “user friendly” i.e. simple as well as quick and easy to use in the clinical setting.

7.8.1 Pain Perception.

No significant difference exists between the Ascending Injection Scale and the Ascending Coin Scale in the marking of “pain perception” when split by education, gender and age. The participants all came from similar socioeconomic and education backgrounds and this could possibly be the reason for the similarity in the results for both pain scales i.e. their perception of pain is similar (Omulecki, et al., 2009;

Valencia, et al., 2011; Ozdemir, et al., 2013; Shrestha, et al., 2013; van Hecke, et al., 2013).

When looking at the results for pain perception we see that both Ascending Scales are equally well understood by both education groups and by all three age groups (see table 7.7.4, table 7.7.5 and table 7.7.6). Although no significant difference exists between the understanding of the Ascending Injection Scale and the Ascending Coin Scale in the genders when marking pain perception, the males (100%) understood the Ascending Injection Scale slightly better than the females (90%).This could possibly be due to the fact that the females were fearful of injections and regarded marking a number of injections less than their actual pain perception as being painful enough. Pain caused by injections has been well documented (Subashini, et al., 2008; Chae, et al., 2011; Rah, et al., 2012).

7.8.2 The ends of the scales.

Avoiding marking the ends of the scales was seen earlier in Study Two of this thesis. Although in Study Five, no significant difference exists between the Ascending Injection Scale and the Ascending Coin Scale in the marking of “no pain” and “worst pain” when split by education, gender and age, we see that some participants were more accurate than others in marking the ends of both scales.

The males were better at marking the ends of the Ascending Injection and the Ascending Coin Scales than the females were. This could possibly be due to the fact that more males(30%) were in the higher educated group when compared with the females(10%).The males were most probably less fearful and perhaps knew better what was expected of them when filling in the scales (Reid, 1992). This result could be due to their somewhat better education level.

When the results for the ends of the scales are split by education we see that the participants in the higher education group were more accurate in marking the ends of the scales for both the Ascending Injection Scale and the Ascending Coin Scale. This is possibly due to better abstract thinking abilities in higher educated individuals (Jelsma et al., 1997: Yazbek, et al., 2009). Although no significant difference existed between the understanding of both scales when split by education, we see that the Ascending Injection Scale was slightly better understood than the Ascending Coin

Scale for both education levels (table 7.7.5).As far as the age split is concerned all age groups marked the ends of the scales more accurately for the Ascending Injection Scale (table7.7.6). Once more, no significant difference existed between both scales in the marking of the ends of the scales.

Few studies have been found in the literature where the spread and the ends of scales have been measured or tested. Two studies, one done in Norway (Breivik, et al., 2000) and one done in China (Li Li, et al., 2007) measured the ends of scales. The participants had to mark “no pain” and “pain cannot be worse” in the Norwegian study and in the Chinese study “worst pain” “least pain” and “average daily pain” were measured. Both studies found that the participants correctly marked the ends of the scales.

The participants in Study Five all came from similar socioeconomic and education backgrounds and this could possibly be the reason for the similarity in the results for both pain scales i.e. their perception of pain is similar. (Omulecki, et al., 2009; Valencia, et al., 2011; Ozdemir, et al., 2013; Shrestha, et al., 2013; van Hecke, et al., 2013).

7.9 Conclusion.

The Triangle Scale was developed in order to see if the participants truly understood the scales or if they were only filling them in by going according to their shape. This new scale was not understood by the fifty participants. It appears that by over-simplifying the scale by “taking out the content” of the scale resulted in it not making any sense and therefore not being understood by the participants. On the other hand, they appeared to understand the other two scales much better.

In Study Five no significant difference exists between the Ascending Injection Scale and the Ascending Coin Scale, for the marking of “no pain”, “worst pain” (the ends of the scales) and “pain perception” when the results are split for gender, education and age. Both scales are equally well understood by the participants in Study Five.

CHAPTER EIGHT DISCUSSION

8.1 Introduction.

This chapter discusses the results of the five studies in this thesis, the scales which were best understood by the participants in each study and the resulting, overall most appropriate scale. (The definition of understood is, the correct marking of the participants' pain perception on the pain scales and the correct marking of the ends of the scales).

A total of four hundred and forty participants took part in the five studies. The culture and perception of pain of the Tswana speaking participants were taken into consideration when developing and testing the scales and the differences in genders, education levels and age groups were all tested. New scales were developed and modified and existing scales were also tested. An extensive review of the literature helped in the choice of the scales to be used. Other studies, testing the validity and reliability of certain pain scales which were done in the developed and developing world, were taken into consideration when choosing relevant and suitable scales for testing. The aim of the entire thesis was therefore to develop a scale, to measure the intensity of back pain in Tswana speaking individuals in South Africa, which would be suitable for those with differing education levels and also for those who have difficulty understanding pain scales from developed countries.

8.2 The best understood scale.

The Ascending Injection Scale, which emerged from this comprehensive thesis as the most appropriate scale for Tswana speaking individuals of different genders, ages and with differing education levels, has the following strengths:

- It is simple to use.
- It is easy to understand.
- It is a pictorial scale, which made it easy to understand for participants with limited or no formal education and for those who cannot read or understand numerical scales.
- The increments go from left to right. This is in the same direction as we read and makes understanding of the scale easier to grasp.
- Reversing the scale made no differences to the understanding of the scale.
- The VAS component of the scale is helpful for those who can read and have good numeracy and literacy skills. The participants can see the actual increments in the numbers and not only in the number of injections.

- The use of pictures of injections is appropriate as most people associate injections with pain i.e. whether injections are the cause of pain or whether they are required to treat pain.
- The spread of injections over the entire scale is helpful as the participants appear to better understand large changes rather than small nuances of change.
- The participants tended to regard “no pain” more as “tolerable pain or acceptable” and “worst pain” more as “intolerable or unacceptable pain”. Therefore, if one regards “no pain” as any value from 0 to 3 and “worst pain” is regarded as any value from 8 to 10, the understanding of the scale is much easier. In other words, the participants have a wider area of the scale from which they can choose. The value of this is that if they mark one of three or four numbers as being correct as far as “no pain” and “worst pain” is concerned, their chances of getting the scale correct are greater.
- This scale was understood by both genders, both education levels (greater than and equal to grade twelve and less than grade twelve) and all age groups.
- It is a quantitative measure of pain as it measures pain intensity. It will be a quick and easy way of measuring pain intensity in clinical practice. This scale will also be useful for measuring pain in physiotherapy practice when using and gauging the effect of pain relieving modalities. A quantitative measure of pain is useful to gauge changes in pain intensity and therefore to determine if certain analgesic treatment employed is effective or not (Moffet, et al., 2006).
- The development of this scale was lengthy and extensive. It went through a comprehensive development process. In 2009, Yazbek, et al., found that the Wong-Baker Faces Pain Scale was the best understood in Tswana speaking participants of lower education levels (with back pain). The VAS was not well understood. Due to the fact that a pictorial scale was the best understood scale in my 2009 study, I thought of using pictures of injections for my new pain scale. Injections depict pain and the Ascending Injection Scale is a pictorial scale which seems to work better for this population group. No one has used injections in a scale before although there is literature about injections being painful (Subashini, et al., 2008; Chae, et al., 2011; Rah, et al., 2012).
- I decided to make sure that the participants truly understood the scale and that they were not merely going according to shape. Hence, I introduced the Triangle Scale in the last study, Study Five. The finding was that the participants did not understand the triangular shape at all and I could therefore deduce that they understood the scale as it was originally intended i.e. in increments of injections. The Triangle Scale was also reversed to ensure that the participants were not merely “going from left to right” as when reading or writing.
- The Ascending Injection Scale unlike both of the CAS and both the WBFPS cannot be confused with measuring emotion instead of pain and it cannot be seen as having an inverse relationship with pain as can be done with the Coin Scales. The Ascending Injection Scale will also be quicker and easier to use than the VAS in the clinical setting.

8.3 The process of developing the best understood scale.

The process of developing the best understood scale took place in five studies, carried out over four years. The five studies are briefly summarized below:Study One and Study Two were done to get a feel of the scales, to make the necessary adjustments to the scales and to gauge which scales could be taken through to the next stage, Study Four, the main study n=250. The first stage, of the entire thesis, **Study One**, included a total of one hundred nurses, teachers, gardeners, domestic workers and builders for testing of the scales. The participants were not back pain sufferers. The aim of this study was to validate and to assess the understanding of currently used pain scales, modified pain scales and newly developed pain scales. The scales were as follows: Three existing scales, the VAS (numerical), a Colour Analogue Scale (CAS white to red), the Wong–Baker Faces (six faces) Pain Scale and five new scales: a Colour Analogue Scale (CAS green to red), two types of Injection Scales and two types of Coin Scales as well as a modified scale the Wong–Baker Faces (three faces) Pain Scale (See Chapter Three, Study One for scales). “No pain” and” worst pain” were marked on the scales by the participants and “the ends” of all of the scales as well as “the spread” of the scales were measured. The scales were all reversed as well. The results of Study One show that reversing the scales did not make a difference to the understanding of the scales. It was therefore decided not to use the reversal of the scales in any of the further studies.

Study Two aimed to establish the validity and assessed the understanding of the existing pain scales, modified pain scales and newly developed pain scales in one hundred Tswana speaking individuals without back pain (the same participants from Study One).

When looking at the overall results for Study Two, the best scales for participants of both education groups and in both gender groups were both of the Wong- Baker Faces Pain Scales (the WBFPS 3 did slightly better than the WBFPS 6). The Wong-Baker Faces Pain Scales did well in Study Two, possibly due to the fact that they are both pictorial scales and are easier to understand (Jelsma, et al., 1997; Yazbek, et al., 2009) and that many of the participants (the nurses in particular) were familiar with the way in which the scale worked. Another factor which needs to be considered is that the participants in Study Two were not suffering from pain and perception of pain differs between individuals in pain and those who are pain-free. Presence of pain could

sensitise the participants due to “fear of pain”, “expectancy of pain” or “memory of pain” which in turn would affect the participants’ perception of pain when filling in the scales (Walker and Carmody, 1998; Hansen, et al., 2005; Giesecke, et al., 2004; Bisogni, et al., 2014).

The fact that the participants in Study Two were not suffering from pain could possibly be the reason why they did not do as well in the Injection Scales. Perhaps they saw the injections as being innocuous instead of causing pain. Two studies which found injections to be regarded as being painful were done by Chae, et al., (2011) and Rah, et al., (2012).Because the participants in Study Two were actually not in pain, they most probably reasoned that they would therefore not require injections as an analgesic to take away pain. They also possibly did not associate injections with causing pain either.

The same could be said for the Coin Scales in Study Two. The Coin Scales like the Injection Scales are a combination of a numerical VAS and pictures. The Coin Scales possibly did better than the Injection Scales in Study Two because the participants were pain-free and were better able to “relate emotionally” to the value of money (they were not focusing so much on pain as they were not in pain).Zhou, et al., (2012) found that interpersonal rejection and physical pain caused the desire for money to increase. With this group of pain-free participants, most of them correctly equated more money with more pain but the participants in the higher education group(> grade12) saw an inverse relationship between pain and money instead of a direct relationship as is intended to be for this scale. They were perhaps more materialistic in their outlook and looked at the financial benefits afforded by money and not as much at the pain relief that money could afford them.

The VAS which is widely used in clinical practice was not as well understood ($\leq$50% of the participants understood this scale in Study Two). These findings are in keeping with my 2009 study (Yazbek, et al ,.2009) where the VAS did not do well either, in that population of Tswana speaking participants with back pain. The overall finding of Study Two appears to be that that participants preferred the simple pictorial scale (WBFPS) over the pictorial and VAS combination scales(Coin and Injection Scales) and certainly over the VAS on its own.

There are no criteria available in the literature as to what makes a pain scale a good one. If one considers the recommendations of Landis and Koch(1977) who suggest

that, statistically, overall agreement is determined using the criteria, that agreement is assumed, when two scales score within one unit apart and that a Kappa value above 80% represents excellent agreement; above 60% substantial levels of agreement; from 40% to 60% moderate agreement; and below 40% poor to fair agreement, then the same criteria in determining how good a scale is i.e. an excellent scale would be one understood by≥80%, a good scale would be one which is understood by ≥60% of participants and a poor scale could be regarded as one which is understood by ≤ 40% of participants was used in this thesis. Correlations were done in order to establish whether all of the scales measured pain of increasing severity.

The scales understood by less than forty per cent of participants were not selected for further testing in this thesis, as they were regarded as poor scales. Both of the Colour Analogue Scales (CAS) from Study Two, due to their poor performance were not tested further in Studies Four and Five. The Colour Analogue Scale (white to red) was only understood by 5% of the participants and the Colour Analogue Scale (green to red) was understood by 0% of the participants.

Study Three developed a Verbal Descriptive Pain Scale (VDS). This was developed by forty participants (twenty males and twenty females) suffering from back pain and who attended a Spine Clinic at the Klerksdorp Hospital in the North West Province South Africa. The Verbal Descriptive Scale is comprised of four different verbal descriptors, to describe pain of increasing severity, from “mild” to “moderate” to “severe” and finally to “worst” possible pain. Qualitative Verbal Descriptive Scales using the terms “no pain”, “mild pain”, “moderate pain” , “severe pain”, “extreme pain” and “the most intense pain imaginable” have been found to be reliable and valid (Herr, et al.,1993). Most of the existing Verbal Descriptive Scales use words to describe quality of pain and not intensity of pain. Words used typically in the literature to describe type (quality) of pain are terms like aching, lancinating, stabbing, pricking, scalding etc. The stabbing, pricking, scalding pain for example, can be describing the type of pain, by analogy with the sensation caused by known causes of pain i.e. being pricked by a pin, being stabbed by a knife or being scalded by hot water (Wagstaff, et al., 1985).

This (Tswana) Verbal Descriptor Scale would possibly be better understood by the target group of participants in Study Four, as it had not merely been translated form another foreign language but was developed by Tswana speakers for Tswana

speakers. Historically, a VDS has been used successfully in studies done in the developed world (Clark, et al., 1983).The patients tested in their study found the VRS easier to use than the VAS and were more comfortable using words to express their pain, than numbers. They concluded that although both scales are valid measures of pain intensity, the choice of scale used should depend on the clinical setting, the clinician's goal and the patient's level of education. The VDS was tested further in Study Four.

Study Four was a confirmatory study and tested pain perception on the scales in symptomatic participants.Study Four tested two hundred and fifty participants; all back pain sufferers, who worked in the retail business and also back pain patients attending local clinics in the Klerksdorp-Orkney-Stilfontein-Hartebeesfontein (KOSH) area South Africa. This study, as with the previous studies, tested males and females and participants of different age groups and different education levels

The scales tested in Study Four were the two Injection Scales, the two Coin Scales, the two Wong-Baker scales and the newly developed, Verbal Descriptive Scale. The definition of best understood scale for this study is: the scale on which the participants fill their "present pain perception" most accurately i.e. where they fill their present pain (marked out of ten) closest to or on the same (corresponding) number of Coins, Injections, or relevant Verbal Description or relevant Face. No significant differences existed between the marking of the participants' pain intensity on all of the scales and their actual pain perception. This could possibly be attributed to the fact that all of the participants came from similar socioeconomic and educational backgrounds. None of the participants had tertiary education. They all came from previously disadvantaged backgrounds and were educated in the inferior Apartheid Bantu Education system. These factors could therefore contribute to a similar perception of pain. (Brekke, et al., 2002; Latza, et al., 2004; Soares, et al., 2004; Carr, et al.,2005; Omulecki, et al., 2009; Dawson and List, 2009; Radat and Koleck, 2011;Shrestha, et al., 2013; Ozdemir, et al., 2013; Thomten, et al., 2013).

The scales which were best understood by the participants in Study Four were, in order of best to worst:

1 The Ascending Coin Scale.2 The Coin Heap Scale.3 The Ascending Injection Scale.4 The Injection Size Scale.5 The Wong- Baker Faces (three faces).6 The VDS (Verbal

Descriptive Scale).7 The Wong- Baker Faces (six faces).Of the new scales, although both Coin Scales and both Injection Scales were the best scales for this population group it was decided, to further test (in Study Five), only one Coin Scale and one Injection Scale, namely the Ascending Scales as they are both new scales, are similar in appearance (increasing incrementally from left to right) and both scales did similarly well in Study Four.

A possible explanation why the Coin Scales and Injection Scales did better than the WBFPS in Study Four could be attributed to the fact that the Coin Scales and the Injection Scales were all ascending scales where one could see the increment in the number of Coins and the increase in number or size of Injections. In the WBFPS, this (ascending order) increment is not seen. The WBFPS portrays six (or three) individual faces placed in a consecutive order (one face at a time) and not as an increasing number of faces. Instead of a change of number of faces, one sees a change of expression on each face. The latter could have led to confusing the expressions with emotions and not as actual depiction of increasing severity of pain as is meant to be. Lastly, another factor which comes into play here is the fact that the participants in Study Four all had back pain. This affected their perception of pain and also affected the way in which they filled in all of the scales they were presented with (Walker and Carmody, 1998; Giesecke, et al., 2004; Bisogni, et al., 2014).

Study Five tested three scales, namely, a right angle Triangle, chosen for its shape, the Ascending Coin Scale and the Ascending Injection Scale in fifty farm labourers with back pain. The latter scales are two of the better scales from Study Four. I chose the Ascending Coin Scale as it was the slightly better one of the two Coin Scales and the Ascending Injection Scale as it was also the slightly better one of the two Injection Scales. The Triangle Scale was tested to see whether the participants truly understood the two Ascending Scales (which have a triangular shape i.e. increasing in size from left to right) or whether they were looking at the shape of both scales and understood the shape and not the actual scale. The Triangle Scale did not correlate well with either the Ascending Injection Scale or the Ascending Coin Scale. It was not understood by all of the participants in Study Five. Some participants even turned this scale upside down in order to try and make better sense out of it. In Study Five no significant difference exists between the Ascending Injection Scale and the Ascending Coin Scale, for the marking of “no pain”, “worst pain” (the ends of the scales) and “pain perception” when the results

are split for gender, education and age. Both scales can therefore be used in lieu of each other.

8.4 A comparison of the most appropriate scale, the Ascending Injection Scale with the other scales.

Overall, the Ascending Injection Scale appears to be the best understood out of all the scales tested for this population group. It was better understood than the VAS. The participants in this study most probably found it easier to understand than the VAS as it was comprised of both pictures (of injections) and numbers. Participants from higher education groups do better with scales were abstract thinking is required and participants from lower education groups prefer pictorial scales (Xu, et al., 1997; Jelsma, et al., 1997; Yazbek, et.al., 2009). The relevance of this in the clinical situation would be that the Ascending Injection Scale unlike the VAS would most likely be suitable for use for both the lower and higher educated patients as it is a combination scale comprised of a VAS (which the higher educated patients would most likely understand) and pictures of injections (which the lower educated patients would more likely be able to understand).The Ascending Injection Scale was also filled in quicker and more easily than the VAS. This factor has implications for its use in the clinical situation especially when the health care practitioner is pressed for time, the Ascending Injection Scale should be quick and easy to use.

The Ascending Injection Scale was better understood than both of the CAS and both WBFPS as the participants did not confuse emotion with pain in the Ascending Injection Scale as they tended to do with both of the aforementioned scales (Ou, et al., 2004).The CAS (white to red) was better understood than the CAS (green to red) due perhaps to its simplicity (fewer colours to choose from).

As far as both of the WBFPS are concerned, the majority of participants, who did not equate the amount of pain to a particular face, appeared instead to equate the faces with emotion or mood. The influence of effect on cognition is such that our emotions and moods can affect our reactions to stimuli such as pain and will also affect our perception of pain (Bates, et al., 1993; Baron, et al., 2002; Ott, et al., 2012). Fortunately, with the Ascending Injection Scale, unlike with the WBFPS, the likelihood of confusing emotions with the injections is unlikely, as the injections definitely depict and serve to denote “pain” and not “emotional well-being”. In other words, the injections, unlike human faces,

cannot portray different feelings, emotions or moods making this scale less likely to be confused with the psyche or mood of the patient and therefore more likely to be associated with intensity of pain (Unruh, 1997).

Although the Ascending Coin Scale did well throughout this thesis there existed a qualitative confusion with regards to both Coin Scales as far as the better educated (Studies One and Two, education level >grade 12) participants were concerned. They saw an inverse relationship existing between pain and money i.e. the more money the less pain. Cultural perceptions, social structure and personal experience are known to determine the value and the meaning of money in different societies and cultures (Zelizer, 1989; Burgoyne, et al., 2006; Tallon-Baudry, et al., 2011). The participants in the higher education group possibly see a lack of money as being painful as they would have to endure hardships and hence more pain. “The less money the more the pain” (Brekke, et al.,2002;Latza, et al., 2004; Carr, et al., 2005;van Hecke, et al.,2013) .

The Coin Heap Scale is a scale similar to the Pakistani Coin Scale used by Salim, in 1993. The participants in my study seemed to prefer the Ascending Coin Scale to the Coin Heap Scale. This is possibly due to the fact that the increments in number of coins were easier to identify in the Ascending Coin Scale and that the Coin Heap Scale had the coins piled on top of each other, looking rather like a pile of stones of increasing in height. Possibly when the coins and the injections for that matter, are spread out over a larger area of the scale, they depict to the participants, a larger area and hence “larger increase in pain”. With the Ascending Injection Scale this inverse relationship which exists between money and pain did not exist as the participants understood the significance of injections either causing pain, or taking away pain (Subashini, et al., 2008; Chae, et al., 2011; Thomas, et al., 2011; Rah, et al., 2012). Whichever way one looks at the Ascending Injection Scale, a direct relationship exists between the number of injections and the pain they cause or between the numbers of injections required to take away the pain (Parr, et al., 2012; Brown, 2012).

The Ascending Injection Scale was also better understood than the VDS. Perhaps the VDS was not well understood due to the small nuances between “mild”, “moderate”, “severe” and “worst pain”. These small “almost imperceptible differences” were difficult for the participants to discern and they struggled to differentiate between them all. To them pain was either present or not. Here they seemed to understand the “ends of the

scale" better than the "in between section" of the scale i.e. they understood "mild" pain and "worst possible" pain better but did not understand the difference between "moderate" and "severe" pain. On the other hand, both the "ends" of the Ascending Injection Scale and the section in between the "ends" (spread) were better understood. The Ascending Injection Scale clearly increases from one injection all the way to ten injections. There are no small, nuances of change in the number of injections e.g. one and half injections or one and three quarters injections, which could be confusing. The easily identifiable changes in the number of injections in the Ascending Injection Scale perhaps make this scale easier to understand than the VDS.

The Ascending Injection Scale was also easier to understand than the Injection Size Scale perhaps due to the fact that one can see larger changes in intensity of pain as the injections increase in number from left to right. The Ascending Injection Scale is spread out in such a way that the increments in the number of injections are easy to see. It is less confusing than the Injection Size Scale as an injection is added to each increasing number on the horizontal VAS, unlike the Injection Size Scale, where an injection of increasing size was not placed above each corresponding number on the horizontal VAS. The injections were placed only above the even numbers. The participants were not quite certain as to whether they should mark a number, or an injection, or both, when marking the Injection Size Scale. Another possible reason why the Injection Size Scale was confusing could be due to the fact that the difference in the sizes of the injections, were small i.e. The increments in the injection sizes were small and it was therefore difficult to see a real difference in the changes in size. The participants were not picking up the finer nuances in the change of size of the injections. This could possibly be due to the fact that the participants who did not understand the scale were mainly from the lower literacy group (Jelsma, et al., 1997: Yazbek, et al., 2009.

The Ascending Injection Scale was far better understood than the Triangle Scale. The Ascending Injection Scale, although also triangular in shape, was better understood than the Triangle Scale. The participants did not try and turn the Ascending Injection Scale upside down or sideways attempting to determine which side was up and which side was down (as they did with the Triangle Scale). They instead, looked at it and immediately proceeded to fill it in, as they understood the concept of increments in injections from left to right (depicting increasing severity of pain). The significance of this finding is that the Ascending Injection Sale is understood by the participants who were

not going according to the shape of the scale, but instead appeared to understand its content (the meaning of the injections).

8.5 The "Gold Standard".

The VAS was chosen as the "gold standard" for Study Four, as it comprised of numbers from one to ten. Most of the other scales also have ten items per scale. Jensen, et al., (1994) said that ten and twenty, one point scales, provide sufficient levels of discrimination when dealing with pain. Due to this fact, I decided to make all the scales in this thesis are either ten or twenty, one point scales.

The Coin and Injection Scales all have a horizontal VAS incorporated into the scales. The Wong-Baker Faces Pain Scale (6 faces) is also marked with numbers ranging from nought to ten and the modified Wong-Baker Faces Pain Scale(three faces) is marked with the numbers nought, five and ten. Using the VAS as the "gold standard" makes correlation easier as the participants' pain perception is also denoted as a number from nought to ten.

The VAS is used extensively in clinical practice to ascertain the intensity of pain. The VAS was used in three of the five studies (Study One, Study Two and Study Four). It was however used differently in each of the aforementioned studies. In Study One and Study Two it was tested in the same manner as were all the other scales but in Study Four it was used as the "gold standard" against which the other scales could be compared.

The question "How bad is you pain on a scale nought to ten?" is asked on a daily basis in clinical practice. It was my finding in 2009 and now again in Study One and Study Two, that the VAS although widely used, was not as well understood by the Tswana speaking people of South Africa. They did not understand the concept of equating their pain with numbers. The VAS was better understood by participants in the higher education levels (Jelsma, et al., 1997; Yazbek, et al., 2009).

The process of filling in the VAS in Study One and Two was lengthy and time consuming as the participants were not quite sure of how the VAS worked. The fact that the filling in of the VAS was time consuming could prove to be disadvantageous in a clinical setting when assessing a patient's pain. Due to the fact that it is a lengthy process to fill in the VAS, it is not practical to use the VAS, especially when the health

worker or clinician is busy and time is of the essence. Although there is a lot of literature supporting the use of the VAS in clinical practice (Carlsson, 1983; Herda, et al., 1994; Ogon, et al., 1996; Terai, et al., 1998; Clark, et al., 2003) there are also other studies which disagree that the VAS is the best scale to use in clinical practice (Gagliese and Katz, 2003: Pengel, et al., 2004; Lund, et al., 2005; Oosterman, et al., 2013).

The aforementioned studies which support the use of the VAS claim that the VAS is a simple and sensitive means of measuring pain and that it is also better at detecting small changes of pain over time especially in participants with higher literacy levels. This fact, namely that the VAS is better at discriminating between small changes of pain could possibly be the reason why the VAS does not work for this group of Tswana participants. The Tswana speaking participants seem to prefer larger changes or increments in intensity and do not seem to understand the finer nuances of change. This could also possibly be one explanation as to why they ignore the ends of this scale and why they put the numbers nought, one, two and three together all representing “no pain” “tolerable” or “acceptable” pain and why they regard the numbers eight, nine and ten as being representative of “worst pain” or “intolerable” or “unacceptable” pain.

8.6 Anecdotal data.

This was captured in the following way: After filling in their pain perception on the Ascending Injection Scale, I asked the participants in studies One, Two, Four and Five about their reasoning behind their choices and the majority of the participants seemed to associate more pain with more injections. Some of the participants reasoned that the sicker they were or the more pain they had, the larger the medicinal content of the injection needed to be. They associated more pain with more medication required to ease their pain. Some of the participants who had been to traditional healers in the past, stated that the traditional healers also provide more herbs and natural homeopathic medicines for more painful and more serious ailments and less “medication” for less serious conditions or pain.

The few participants who did not fill the Injection Scales in correctly, could possibly be those who did not understand the scales, or had a fear of injections and no matter how much pain they had, they were not prepared to be injected by a larger injection or by more than one injection. The few participants, who got the Injection Scales wrong, when asked why they did not understand the scales, said that they confused the injections

with spades or pneumatic drills. They had to be told that the pictures were of actual injections. When questioned as to their choices after filling in the scales, some of the participants stated that they associated a larger injection with a thicker needle which would cause them more pain and also regarded more injections as causing more pain. They also stated that that the larger the injection, the greater it's medicinal content and the longer the injection process would take, causing them more pain (Ozdemir, et al., 2013).Some of the participants had a fear of needles and others were more stoical in their approach to their pain and were perhaps prepared to tolerate more pain (injections) in order to get rid of their pain. This scale is good because no matter how one looks at it, interprets or understands it, whether one perceives more injections as being more painful or whether one looks at it as the more pain one has, the more injections are required to take the pain away, injections are associated with pain, whether they cause it or take it away.

Those participants, who did not fill the two Coin Scales in correctly, associated no money or little money as being painful (an inverse relationship). In these two coin scales, a direct relationship is hoped to be seen between pain severity and the amount of money (required to treat the pain or take the pain away) i.e. More pain was expressed as more money and less pain was represented by less money.

8.7 Avoidance of marking the ends of the scales.

A thread which runs through the entire thesis is the fact that many of the participants seemed to avoid marking the ends of the scales. The participants in this study who are not using the entire scale (from nought to ten) seem to be more comfortable filling in the inner area of the scale, ignoring or avoiding the extremes of the scale. They seemed to regard "no pain" as tolerable pain and "worst pain" as intolerable pain .They appear to mark "no pain" as any number from one to three and "worst pain" as any number from eight to ten. The participants are not using the entire scale (from nought to ten) instead they seem to be more comfortable filling in the inner area of the scale, ignoring or avoiding the extremes of the scale. In other words they were more comfortable with taking "safer options" (Alpay, 2013).

This avoidance of marking the ends of the scales could possibly be due to the fact that all the participants, except those in Study One and Two, were suffering from back pain. Perhaps it was difficult for them to mark "no pain" on the scales when they "were"

actually “in pain”. “Stoicism” could be a possible explanation for this, as far as “no pain” is concerned. Perhaps the participants only regard the numbers one, two or three as “tolerable pain” or as “the beginning of negligible pain” .They equate this negligible pain with “no pain”. In other words, pain only started for them at three or four and not at nought or one. Stoicism is culturally determined and is known to affect pain perception (Bates, et al., 1993; Chin, et al., 2005; Guarnero, 2005: Alvarado, 2008; Komiyama, et al., 2009; Palit, et al., 2013).This stoicism could also be due to socioeconomic factors which are known to affect perception of pain (Valencia, et al., 2011;van Hecke, et al., 2013). Some participants said that they were so used to living with pain (whether it be physical, emotional, psychological and/ or financial) that they would therefore regard “no pain” as only starting at around about three on the pain scales. Any number from nought to three could be regarded as “no pain” as they were so used to pain (Haung, et al., 2012; van Hecke, et al., 2013). Those participants, who were chronic pain sufferers ,stated that they were so used to living with some sort of underlying pain of varying intensity, that they negate or regard pain intensities of less than and equal to three as “no pain”, real pain beginning only at three onwards. “Avoiding” or “ignoring” pain as a coping strategy, could therefore also be other reasons why the ends of the scales are ignored.

When questioning the participants as to why they do not favour marking the extremes of the scales they informed me that in Tswana culture, when a woman gets married a shawl is placed over her shoulders at the marriage ceremony. The woman is then told by the minister/ marriage official presiding over the ceremony, that it is under this shawl that she should hide her “pain and tears”. This means that as a wife and a mother, she should remain stoical and bear her lot in life bravely and quietly. She is told that she has to keep her suffering to herself. It is perhaps due to this cultural perception that the women in this study did not admit to having “worst pain” even if “worst pain” was present. As far as not marking “no pain” is concerned, they regard nought to three as not being painful. This finding is again perhaps due to stoicism. Anything from nought to three is regarded as “negligible pain” or “tolerable pain” which they seem to equate as “no pain”.

When I asked some of the males in this thesis as to why they avoided marking the ends of the scales, they informed me that the Tswana male, is taught from a very early age, that” boys do not cry”. Tears are not a sign of manliness. The males are taught to be

stoical and not to admit to having pain. The males did not always mark the upper end of the scale(“worst pain”) correctly, as they do not wish to “catastrophize” their pain and they do not want to be seen as admitting to having “worst pain” (Gamsa, 1994; Gracely, et al., 2004; Evans, 2007; Keefe, 2011).They are, after all, supposed to be stoical and should be able to handle “worst pain” and if they do not, this is seen as weakness and regarded as not being “manly” (Bates, et al., 1993; Sheffield, et al., 2001; Chin, et al., 2005; Guarnero, 2005; Alvarado, 2008; Komiyama, et al., 2009; Palit, et al., 2013).

Some of the participants who were HIV positive stated that they were fearful of marking the upper end of the scale as this would be admitting to severe pain and they were scared to admit to having “worst pain” as this could possibly give away their status to the health care worker interviewing them. They did not want to divulge their status as they felt that there is a stigma attached to having HIV and they would rather die than disclose their status or let their family be embarrassed by their condition. They want to be seen as normal and healthy and not suffering from “worst pain” as this may give clues as to their underlying illness status (Daftary, 2012).

Another reason why some of the participants were not marking the upper extreme of the scale, “worst pain” is perhaps due to the fact that they regarded eight and nine as the “worst possible pain” due to a factor of “fear”. They were prepared to tolerate small amounts of pain and regarded them as negligible but were not prepared to go to maximum pain 10 out of 10 due possibly to “fear” of pain, “expectancy” of pain and/ or “memory” of pain (Hansen, et al., 2005; Swinkels-Meewisse, et al., 2006; Chou and McCarberg, 2011; Meulders, et al., 2012).Some of the participants were eager to please the researcher and were scared of giving the wrong answer. They therefore felt that it was “safer” to mark the inner section of the scales in case the extremes were seen as been “too extreme” and unacceptable. They did not want to be seen as over or under exaggerating.

In summary, possible reasons for the ends of the scales not being marked, could be attributed to:

1. Stoicism. The participants did not want to be seen as being weak. (Bates, et al., 1993; Sheffield, et al., 2001; Chin, et al., 2005; Guarnero, 2005; Alvarado, 2008; Komiyama, et al., 2009; Palit, et al., 2013).

2. They do not want to be accused of “catastrophizing” their pain (over exaggerating) (Gamsa, 1994; Gracely, et al., 2004; Evans, 2007; Keefe, 2011).

3. A “people pleasing” attitude (wanting to please the researcher) (Gijsbers,et al., 2005;Garcia, et al., 2007; Leaper, et al., 2007).

4. “Fear of making a mistake” and of perhaps being regarded as being stupid therefore preferring to “playing it safe” (Alpay, 2013).

5. “Fear of pain” which would cause them to avoid the upper extreme of the scales (Hansen, et al., 2005; Swinkels-Meewisse, et al., 2006; Chou and McCarberg, 2011; Meulders, et al., 2012).

6. “Expectancy of pain”, causing them to be overly anxious and sensitizing them to pain (Hansen, et al., 2005; Swinkels-Meewisse, et al., 2006; Chou and McCarberg, 2011; Meulders, et al., 2012).

7. “Memory of pain”. Previous pain experiences thereby making them wary of marking their true perception of their actual pain (Hansen, et al., 2005; Swinkels-Meewisse, et al., 2006; Chou and McCarberg, 2011; Meulders, et al., 2012).

For this population group, the concept of “no pain” should therefore be expanded to include numbers from nought to three and “worst pain” be expanded to cover numbers from eight to ten. This could be more acceptable and perhaps easier to understand. Therefore, by including more than one number for either end of the scale i.e. include a larger area on the scale to depict the “ends” of the scales, this would possibly facilitate the understanding and the ease of use of the scales. What we expect of a good scale is a large “spread”. The larger the “spread” = the better the understanding of the scale i.e. the bigger the extent of the scale that the participants were using, the better. There is no literature available to support this avoidance of marking the “ends of scales”.

8.8 Strengths of this thesis.

Strengths of this thesis lie in the fact that it was comprehensive and extensive. Five studies were completed and a large number of participants took part in the total study (four hundred and forty all in all).They included Tswana participants with and without back. Gender differences, education differences and differences in age were all taken into account. Cultural pain perception and cultural differences were also taken into

consideration. One of the pain scales, namely the VDS scale developed in Study Three was in fact developed by the participants themselves for use in their Tswana speaking communities. This has not been done in Africa before. No literature could be found supporting the development of such a pain scale in Africa. Participants came from different walks of life and brought with them their individual and different life experiences as well as their differing pain perceptions and responses to pain. The thesis was extensive and took over four years to complete.

8.10 Conclusion.

Qualitatively there was confusion with the Ascending Coin Scale especially in the higher education group (> grade 12). Therefore to avoid possible confusion when using the Ascending Coin Scale, the Ascending Injection Scale would be better to use to measure pain in the Tswana speaking population of South Africa.

When looking at the data for the entire thesis, it can be seen that for the Ascending Coin Scale, the disagreement is concentrated in the upper and lower ends of this scale for the higher educated group (> grade 12).This group of participants tended to over analyse what the Coin Scales actually represented. Hence an inverse relationship between pain and the meaning of money ensued. On the other hand, for the Ascending Injection Scale, the higher education group was more accurate in marking both ends of this scale. The lower educated group was also more accurate at marking “no pain” on the Ascending Injection Scale than on the Ascending Coin Scale. As far as “worst pain” is concerned, for the lower educated group ($\leq$ grade 12) the results for both scales were similar (see table 4.4.4 and table 4.4.5). The overall result is indicative of a better understanding of the Ascending Injection Scale therefore making the Ascending Injection Scale the better of the two for this group of participants.

8.11 Recommendations.

The Ascending Injection Scale should be translated into the other eight black languages spoken in South Arica and its validity and reliability should be tested in these population groups. I would also recommend that this new pain scale which was only tested in back pain sufferers should also be tested for use in other types of pain. Perhaps when analyzing the results of the Ascending Injection Scale, that the numerical values of nought to three should be regarded as being acceptable for depicting “no pain” and that

nine and ten be regarded as being acceptable in depicting “worst pain”. “Mild pain” could then be marked at four, five and six injections and “severe pain” at seven or eight injections.

If the Ascending Injection Scale is translated into the other eight, black national languages spoken in South Africa for testing and eventual use in our country we will probably no longer have to use “foreign” scales. This is likely to promote a better understanding of pain perception and better measurement of pain in our local black population. In turn this will lead to better choices of pain treatment or choice of analgesic modalities and may better enable us to monitor a patient’s progress or lack thereof when receiving treatment for pain.I would also recommend that due to the fact that this thesis is only the beginning of a process, proper validity and reliability studies should be done using the Ascending Injection Scale.

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APPENDIX

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Ms Michelle A Yazbek

CLEARANCE CERTIFICATE	**M091121**
PROJECT	The Development of a Back Pain Scale for Tswana Speaking Individuals
INVESTIGATORS	Ms Michelle A Yazbek.
DEPARTMENT	Department of Physiotherapy
DATE CONSIDERED	2009/11/27
DECISION OF THE COMMITTEE*	Approved unconditionally

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

DATE 2009/11/30 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Prof A Stewart

DECLARATION OF INVESTIGATOR(S)

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

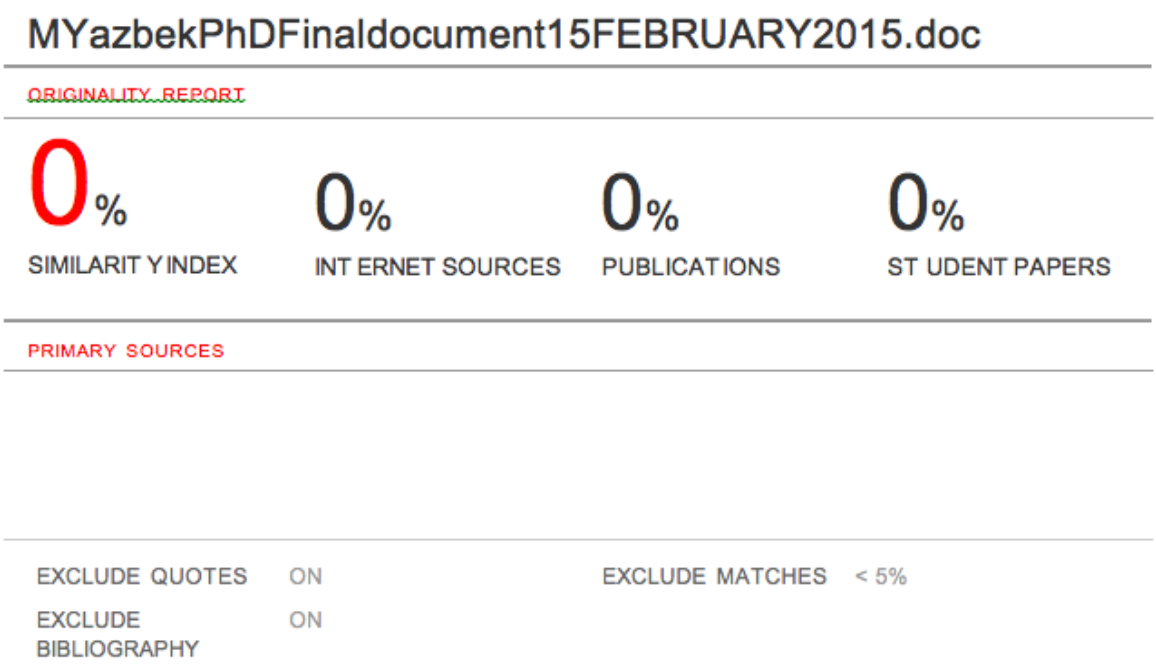
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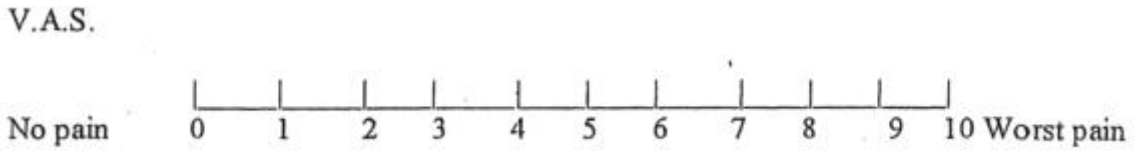
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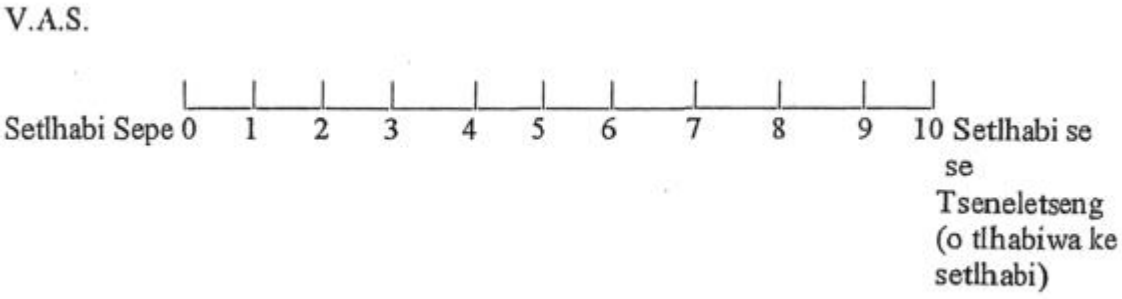
By Michelle Yazbek

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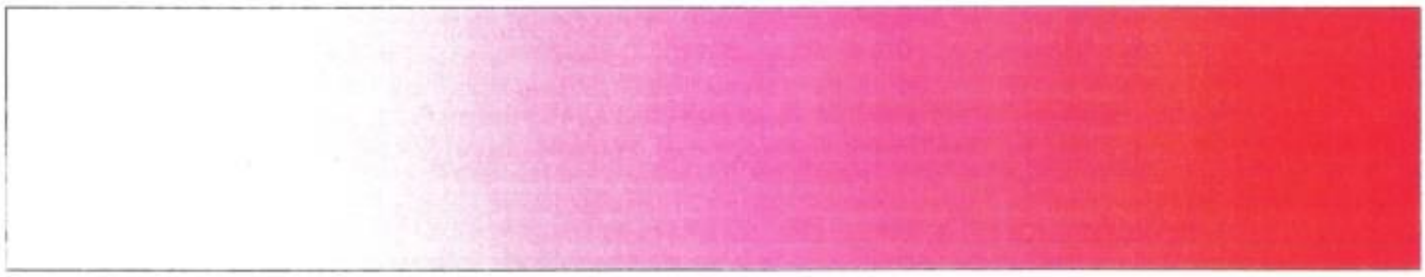


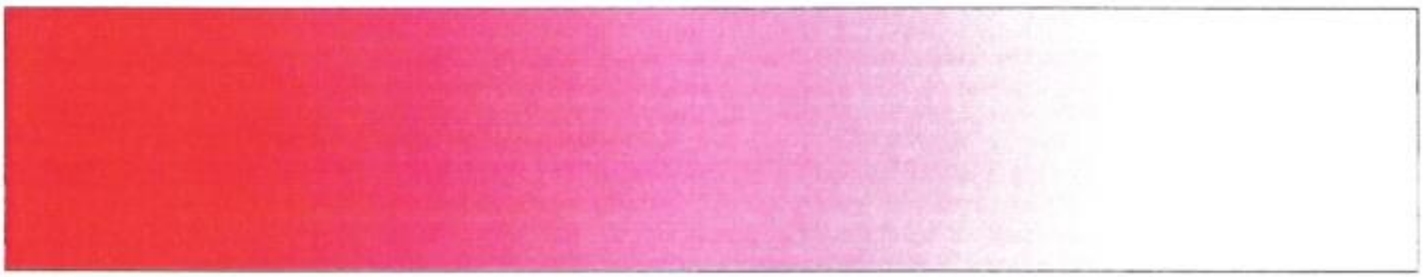
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The Colour Analogue Scales (original and reversed versions).

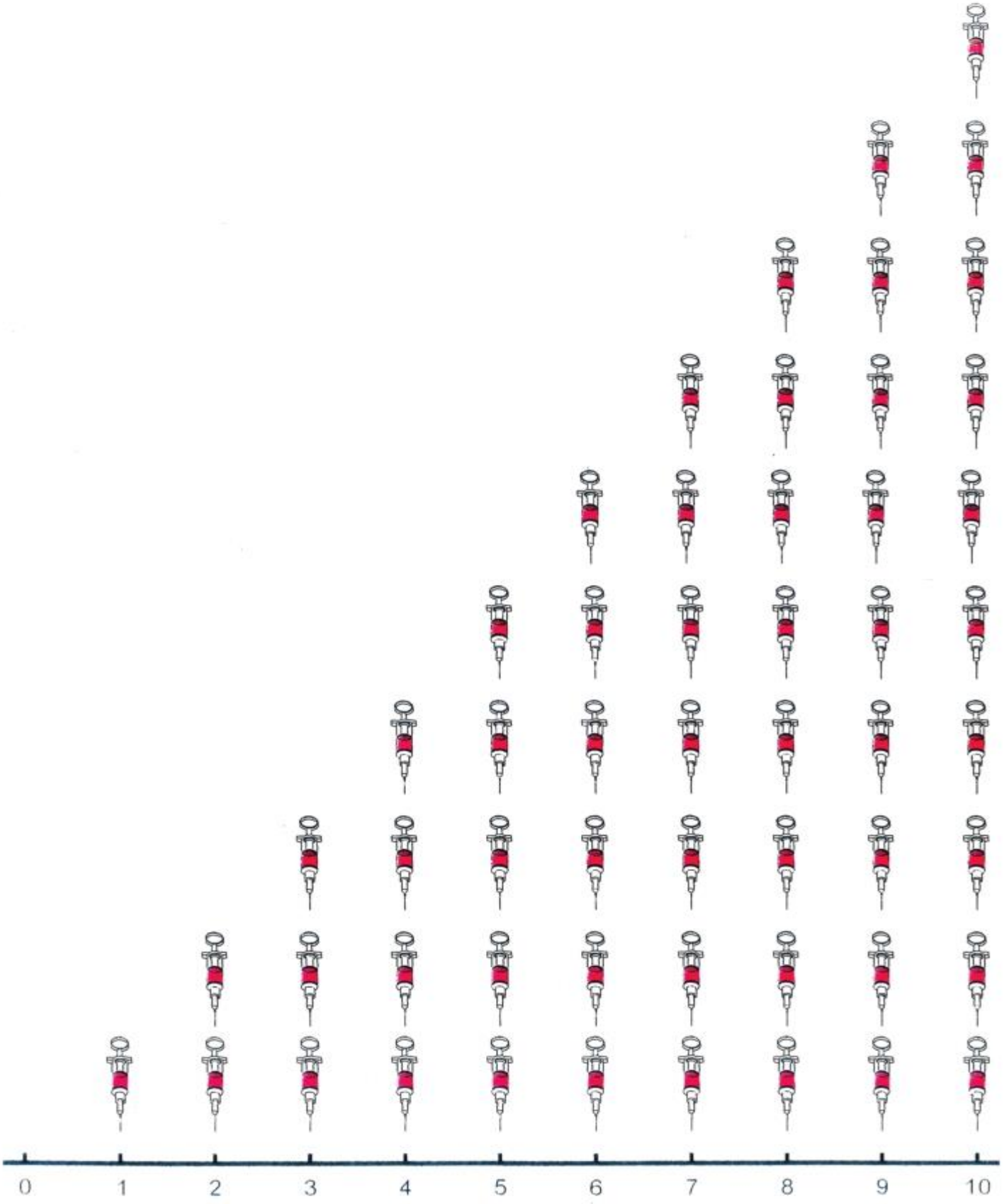


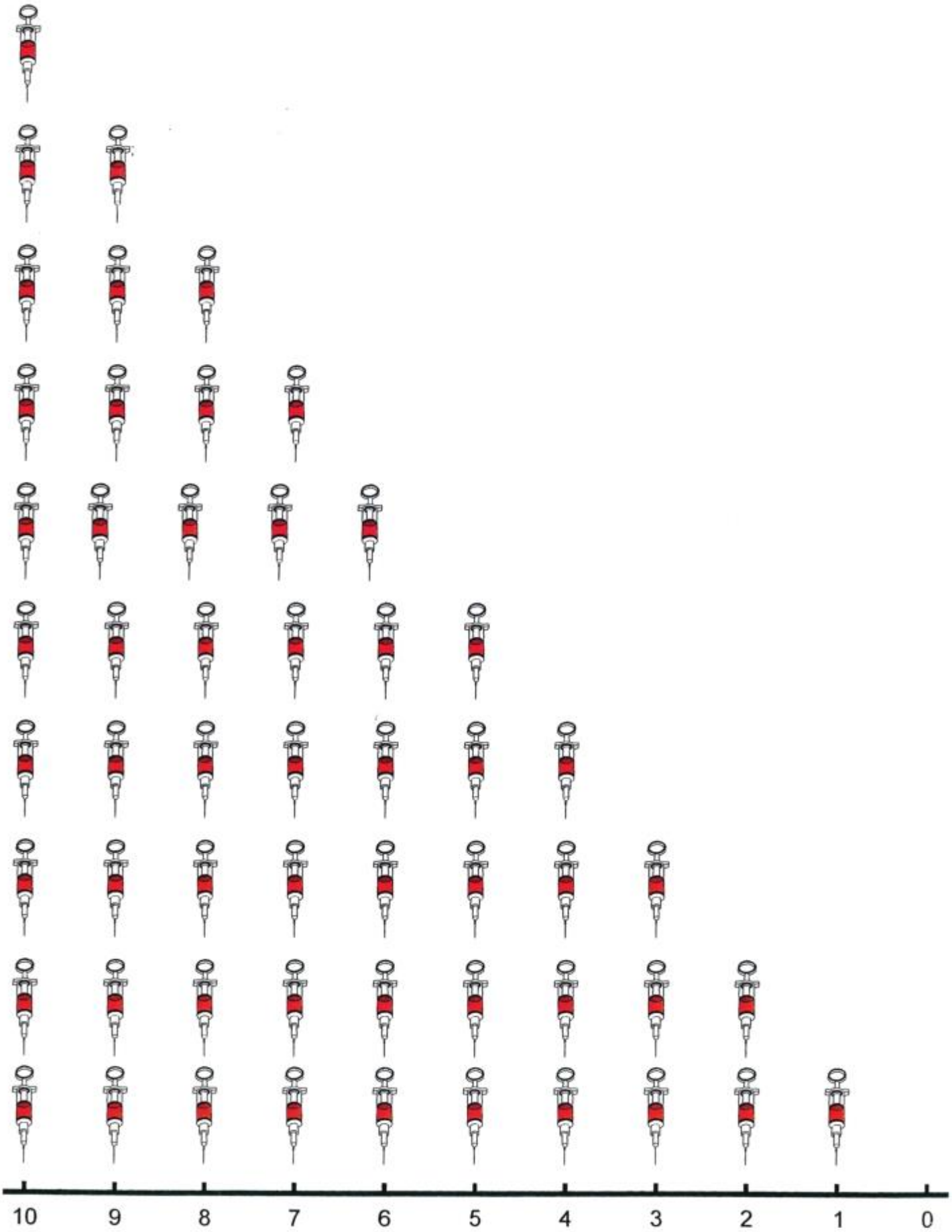




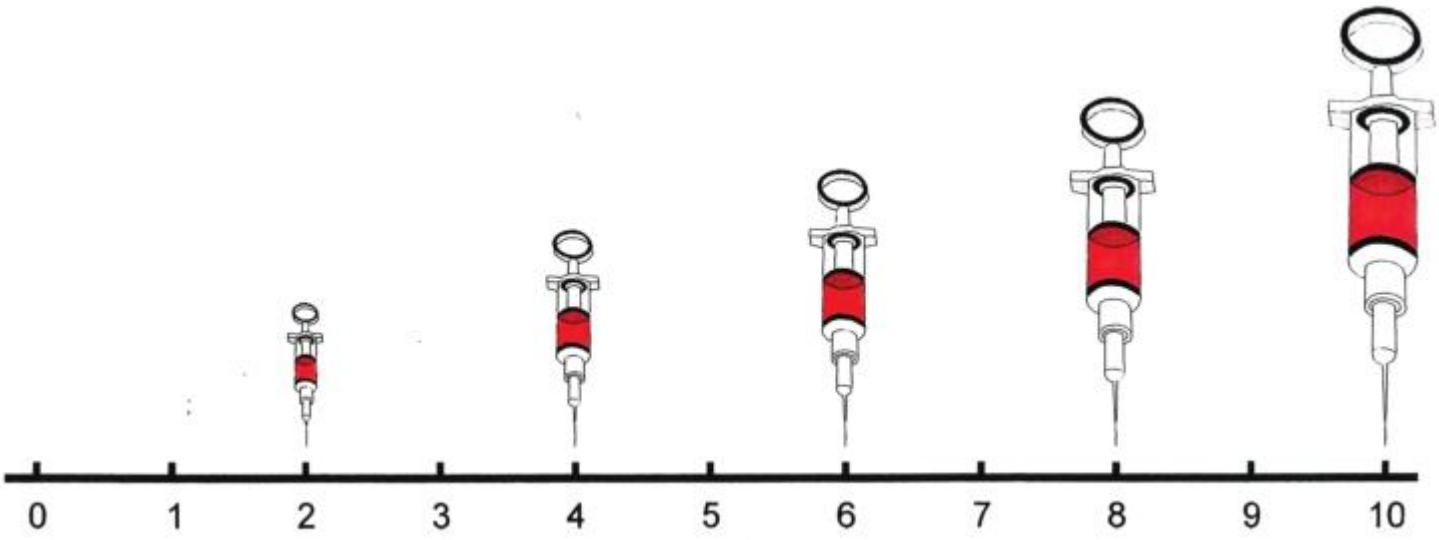


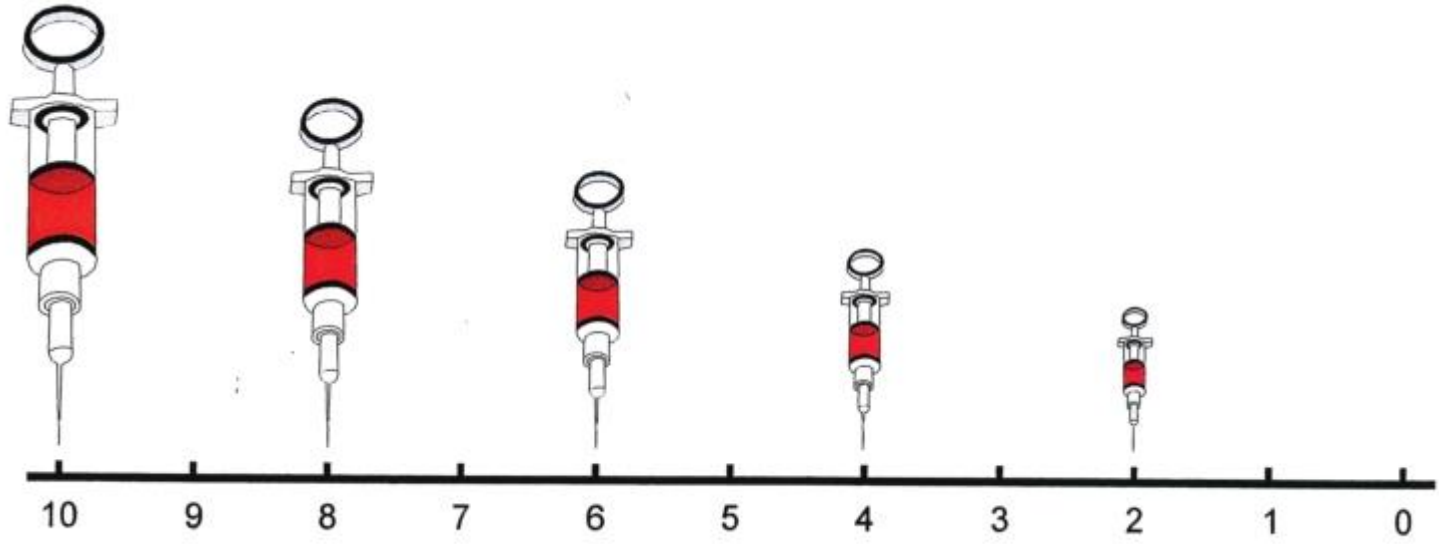
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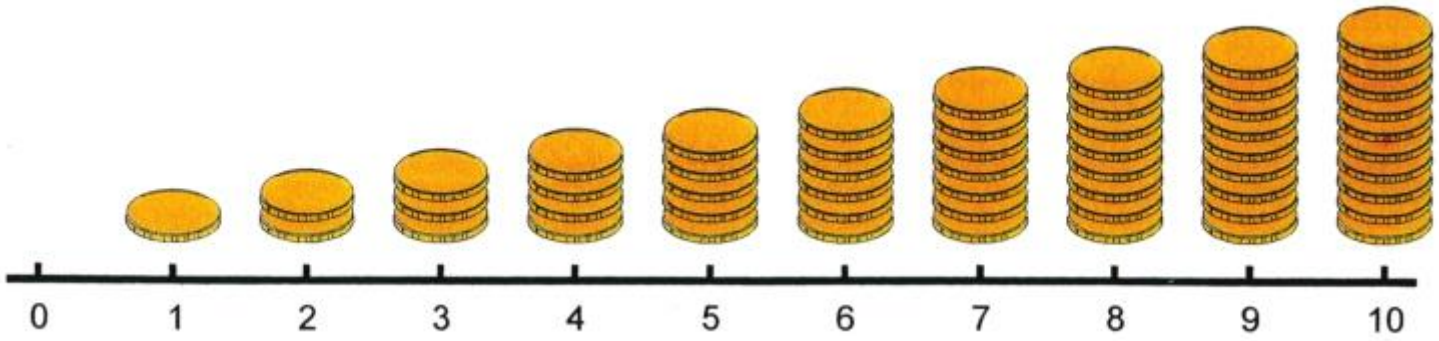

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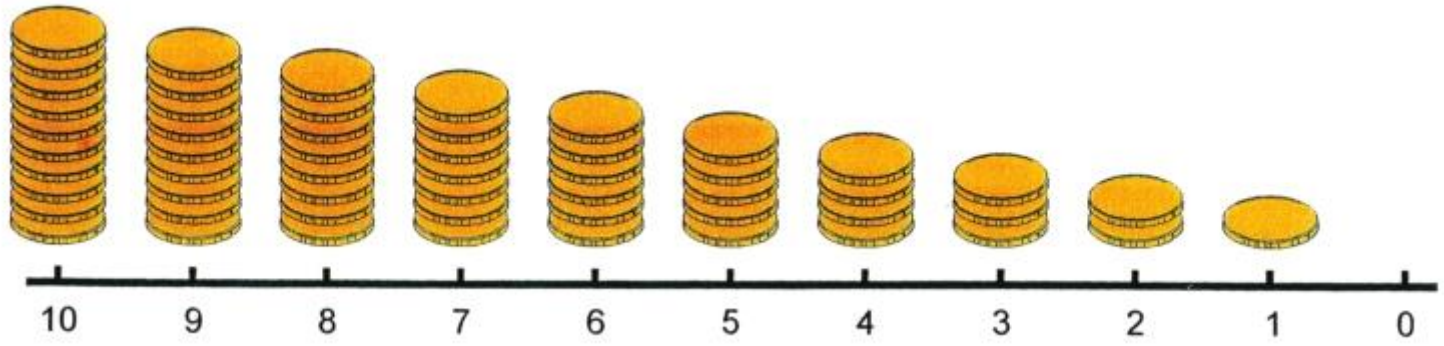
The Injection Size Scale (original and reversed versions).



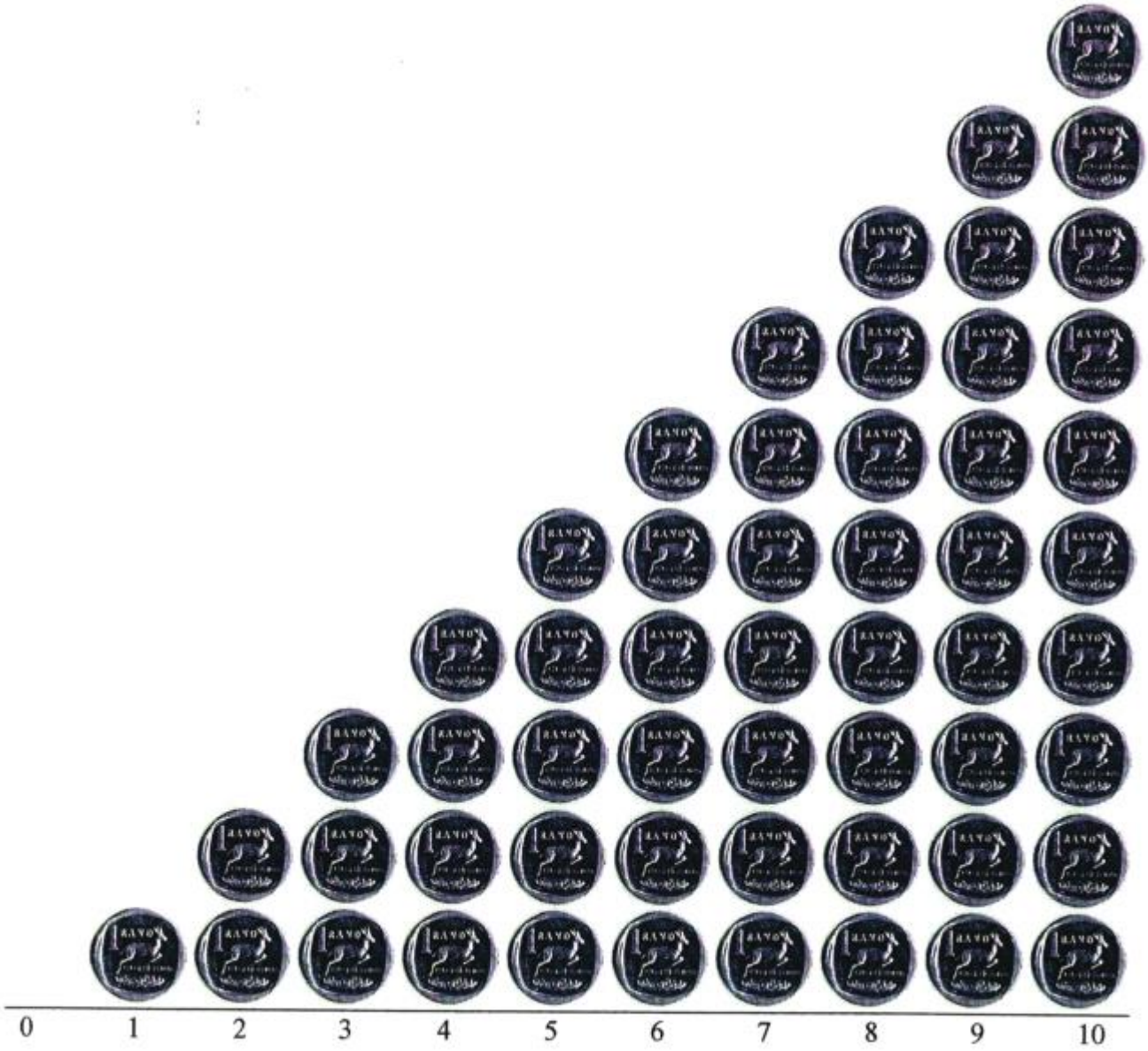


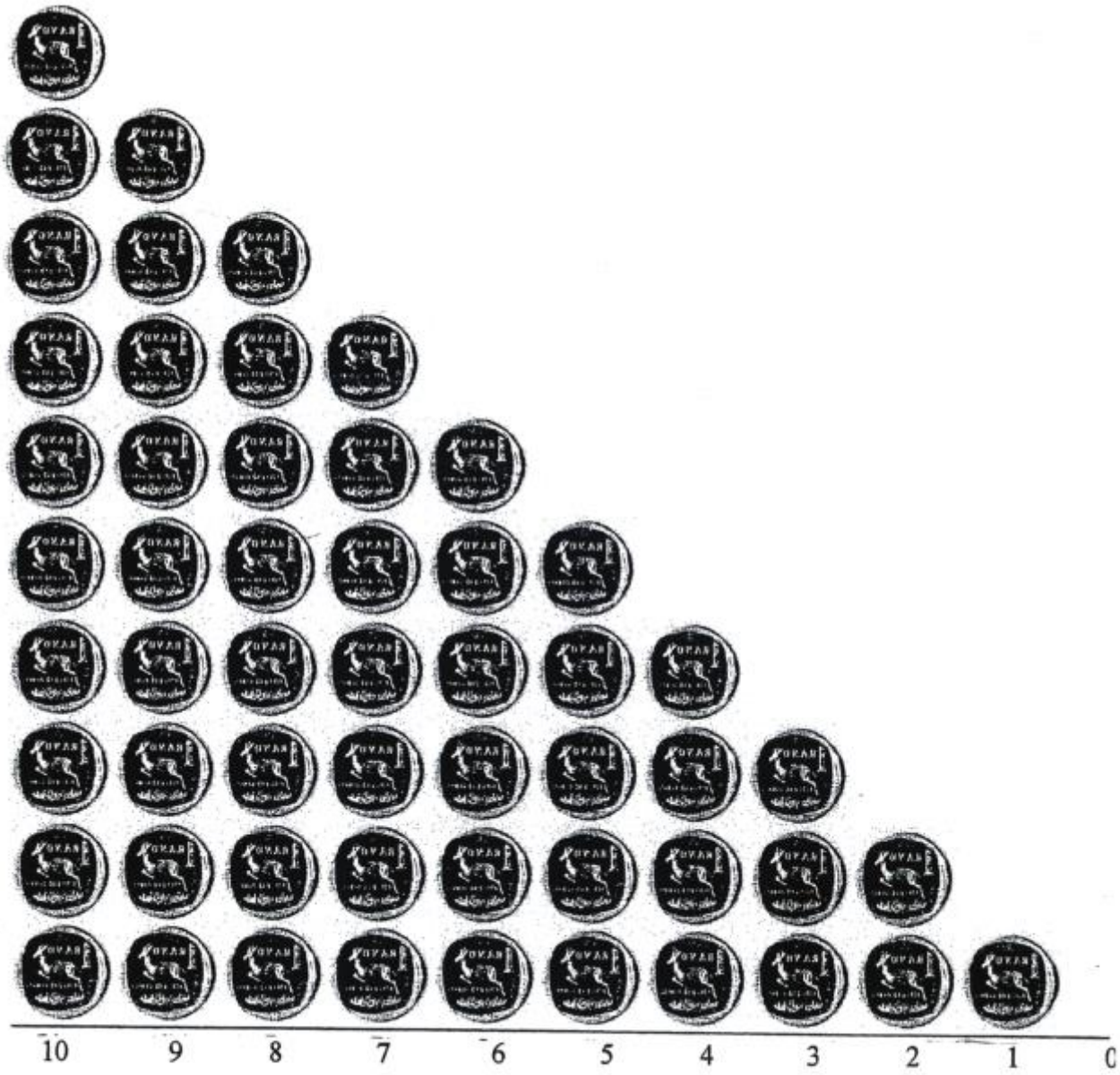
The Coin Heap Scale (original and reversed versions).





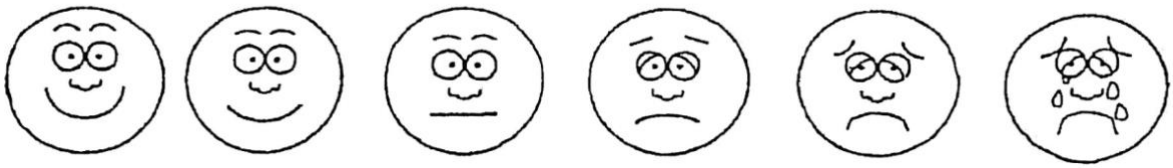
The Ascending Coin Scale (original and reversed versions).




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The Wong-Baker (six) Faces Pain Scale.





Se tlhabisa sepe	Se tlhabisa go le gonnye	Se tlhabisa go le gonnye go feta	Se tlhabisa go feta	Se tlhabisa go fetisa	Se tlhabisa mo go feteletseng

The Wong-Baker (three) Faces Pain Scale.



No hurt



Hurts little more



Hurts worst



Se tlhabisa Sepe



Se tlhabisa go le gonnye Go feta



Se tlhabisa mo go fete--letseng

The Triangle Scale (original and reversed versions).

