A psychometric profile of patients attending the Durban University of Technology Chiropractic day clinic with non-specific low back pain

By

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

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DEDICATION

This is dedicated to my parents, Alessandro and Elena, and to my sister, Rebecca.

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ABSTRACT

BACKGROUND: Low back pain (LBP) is a major health problem and a leading cause of disability worldwide, accounting for numerous medical and chiropractic consultations. Risk factors for developing as well as perpetuating LBP have been recognised, including psychosocial factors and to a lesser extent organic diseases. There is good evidence for the role of biological, psychological, and social factors in the aetiology and prognosis of back pain. The biopsychosocial model developed by Waddell (1987) has become a dominant consideration in determining the aetiology and prognosis of back pain, and has led to the development and testing of many back pain care interventions. This includes a focus on identifying and treating 'yellow flags' which are psychosocial factors that may result in LBP becoming chronic, and incorporating the treatment of these 'yellow flags' as a component of LBP care.

AIM: The aim of this study was to determine a psychometric profile of patients attending the Durban University of Technology (DUT) Chiropractic Day Clinic (CDC) with non-specific LBP using the Keele STarT Back Screening Tool (SBST) and Bournemouth Questionnaire (BQ).

METHODOLOGY: Once ethical clearance was obtained to conduct the research study at the DUT CDC, all patients over the age of eighteen presenting to the DUT CDC with non-specific LBP as new patients, or as former or current patients presenting with non-specific LBP as a new complaint, were directly approached by the researcher. The prospective participants were asked a series of screening questions in order to ensure that they qualified for the study. A total of 132 participants completed an informed consent, a pre-validated questionnaire, the SBST and the BQ. The questionnaires took approximately ten to fifteen minutes to complete; participants were given the choice to complete them either before or after their appointment so as not to interrupt the treatment time. All informed consents and completed questionnaires were collected by the researcher and stored in separate sealed ballot boxes. All questionnaires were kept confidential and only seen by the researcher and supervisor. A code was allocated to each questionnaire before data was captured on a spreadsheet for data analysis. The IBM SPSS version 22 was used for data analysis by a biostatistician.

RESULTS: A total of 132 questionnaires were utilised for statistical analysis. Based on the SBST, 47.7% (n = 63) of the total population (N = 132), had a low risk of developing chronic LBP, 28.8% (n = 38) had a medium risk of developing chronic LBP, and 23.5 % (n = 31) had a high risk of developing chronic LBP. The BQ indicated that 63.6% (n = 84) of the total

population (N = 132) scored 35 or less and thus had a low risk of developing chronic LBP, while 36.4% (n = 48) scored above 35 and thus had a medium to high risk of developing chronic LBP. A very strong association was found between the SBST and BQ risk groups (p = <0.001). A total of 87.1% (n = 27) of the participants who had a high risk of chronicity according to the SBST (N = 31) also had a high risk of chronicity according to the BQ. The female gender, being a current smoker and partaking in little or no physical activity were found to be statistically significant risk factors for chronic LBP.

CONCLUSION: The results in this study suggest that patients presenting to the DUT CDC supports the notion that chronic LBP is a multifactorial condition with significant psychosocial implications and should be approached as such.

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ABBREVIATIONS

ACC	Anterior cingulate cortex
aJIG	Abridged Job in General Scale
BMI	Body mass index
BQ	Bournemouth Questionnaire
CBT	Cognitive behavioural therapy
CDC	Chiropractic Day Clinic
CSF	Cerebrospinal fluid
CT	Computerised tomography
DSM-V	Diagnostic and Statistical Manual of Mental Disorders
DUT	Durban University of Technology
IREC	Institutional Research and Ethics Committee
IV	Intervertebral
LBP	Low back pain
LTP	Long term potentiation
MRI	Magnetic resonance imaging
N	Sample size
NS	Nervous system
SA	South Africa
SASH	South African Stress and Health
SBST	Keele STarT Back Screening Tool
SC	Spinal cord
SMT	Spinal manipulation therapy
WHO	World Health Organisation

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION TO THE STUDY

Low back pain (LBP) is a major health problem and leading cause of disability worldwide, accounting for a large number of visits to primary care providers, chiropractors and physical therapists daily (Dagenais and Haldeman 2011; Vos *et al.* 2013). Various risk factors for developing as well as perpetuating LBP have been recognised, including psychosocial factors, and to a lesser extent organic disease, however in many cases the cause of LBP is vague (Duthey 2013). Waddell (1987) proposed a new theoretical framework for LBP care. He suggested that the traditional biomedical approach was insufficient for the satisfactory management of LBP, and that the patient should rather be approached from a biopsychosocial perspective. Pincus *et al.* (2013) indicated that there is evidence for the role of biological, psychological, and social factors in the etiology and prognosis of LBP. The biopsychosocial model has become a dominant consideration in determining the etiology and prognosis of LBP, and has led to the development and testing of many LBP care interventions (Pincus *et al.* 2013).

Psychosocial risk factors indicating a possibility of chronicity of pain, otherwise known as 'yellow flags', have consistently been found to be the strongest predictors of chronicity in persons with acute non-specific LBP. Evidence supports the effectiveness of early biopsychosocial interventions in the treatment of acute non-specific LBP (Wand and O'Connell 2008). Despite this knowledge, LBP continues to be an increasingly alarming health problem globally (Vos *et al.* 2013). It is suggested, however, that rather than a failure in the biopsychosocial model of pain itself, this rising problem of LBP may be a consequence of the restrictive way in which the model has been understood and applied by health care providers (Pincus *et al.* 2013).

Some studies conducted by Durban University of Technology (DUT) students touched on psychosocial factors relating to LBP (Vlok 2005; Jaman 2007; Dyer 2012). To the researcher's knowledge there appears to be a paucity of literature focusing exclusively on the psychosocial aspects of non-specific LBP within Durban, and specifically those that influence chronicity, with the exception of a study conducted by Seethal (2010). This study was conducted outside of the DUT Chiropractic Day Clinic (CDC) however, and only targeted adolescents (Seethal 2010).

1.2 AIM AND OBJECTIVES

1.2.1 Aim

The aim of this study was to determine a psychometric profile of patients attending the DUT CDC with non-specific LBP using the Keele STarT Back Screening Tool (SBST) and Bournemouth Questionnaire (BQ).

1.2.2 Objectives

1. To determine the demographic profile of patients presenting to the DUT CDC during the months of October and November 2014, and January 2015, with non-specific LBP, including age, gender, BMI and area of pain.
2. To determine a basic psychometric profile of patients presenting to the DUT CDC with non-specific LBP.
3. To determine associations between the demographic profile and psychometric profile of patients presenting to the DUT CDC with non-specific LBP.

1.3 LIMITATIONS

All participants are required to report honestly in their responses to the questionnaire. It is not possible to determine, however, if the participant did in fact elect to respond honestly (unless blatant), and therefore such responses would still be included in the outcomes of this study.

1.4 RATIONALE

Research data regarding psychosocial risk factors and LBP varies dramatically depending on regions assessed and study populations. Seethal (2010) reported a 57.42% (n = 352) prevalence of LBP amongst 613 (N) Grade 12 learners in the Greater Durban area, as well as a number of psychosocial risk factors relating to LBP. These risk factors included alcohol abuse, family history, exam stress, anxiety and depression. A study conducted by Irgens *et al.* (2013) on a population aged from eighteen years onwards, indicated that 11% (n = 214) of patients in Norway and 24% (n = 186) of patients in England were ‘distressed’ by their condition of LBP.

South Africa (SA) is a country with a unique social history which influenced the lives of South African individuals in many ways, especially psychologically and socially (Dutra *et al.* 2014).

Over and above physical manifestations of LBP, it is important to understand the psychosocial manifestation of LBP patients in a South African context. Additionally, Seethal (2010:6) concluded "that [the increasing prevalence of LBP with age] illustrates the need for further investigations with more profound studies on the risk factors so that more light can be shed on how to manage this ever-growing problem [of LBP]". Age plays a role in both biological and psychological factors relating to LBP. Since to the researcher's knowledge no local studies have examined the effect of psychosocial factors on LBP in adults aged from eighteen years onwards in SA, research investigating this would provide information on the role that age plays on psychosocial factors in LBP.

Psychosocial risk factors have been shown to have a significant effect on exacerbating and perpetuating LBP (Pincus *et al.* 2002; Viggers and Caltabiano 2012). In order to understand what approach is needed when assessing and selecting the best treatment protocol for patients with LBP, it is helpful to have a profile which indicates what risk factors the majority of LBP patients presenting to the DUT CDC possess and should be focused on. Studies have indicated that the most effective way in which LBP can be managed is by taking into account both psychological and physical factors and taking a collaborative and integrative treatment approach, which may entail working with more than one health care provider (Kroenke *et al.* 2011). Psychometric testing using simple tools, such as the SBST and BQ, not only helps to identify the psychosocial risk factors requiring attention but can further be used to evaluate a patient's outcome and response to treatment (Coaley 2010). If a psychometric profile of patients presenting to the DUT CDC indicates a high prevalence of patients who are at high risk of chronicity based on psychosocial factors, students and clinicians may consider introducing tools such as the SBST and/or BQ as a guide for patient management so as to enhance the effectiveness of chiropractic treatments.

1.5 OUTLINE OF CHAPTERS

Chapter One has introduced the basis of the research study, explained the gap in the literature, outlined the aims and objectives and the rationale, as well as described the benefits and limitations of the study. Chapter Two will present the literature review, which will discuss the background of LBP and factors affecting the chronicity of LBP. Chapter Three will describe the methods and materials used for the research study. Chapter Four reports the results of the study, which will be discussed and analysed in Chapter Five. Chapter Six will provide a conclusion for the study as well as recommendations for future research studies.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

Low back pain (LBP) is a major health problem and a leading cause of disability worldwide, accounting for a large number of health care consultations daily (Vos *et al.* 2013). Decreased physical activity, absence from work and changes in work activity are much higher for individuals with LBP than for individuals with mid back pain or neck pain (Leboeuf-Yde *et al.* 2011). Psychosocial factors, such as negative beliefs about back pain, anxiety and depression, have been recognised to play a role in both developing and perpetuating LBP (Duthey 2013). Waddell (1987) proposed a new theoretical framework for back pain care; he suggested that the traditional biomedical approach to LBP was insufficient for satisfactory management, and that the patient should rather be approached from a biopsychosocial perspective. Pincus *et al.* (2013) indicated that there is good evidence for the role of biological, psychological, and social factors in the aetiology and prognosis of back pain. The biopsychosocial model has become a dominant consideration in determining the aetiology and prognosis of back pain, and has led to the development and testing of many back pain care interventions (Pincus *et al.* 2013).

2.2 LUMBAR ANATOMY

LBP has been attributed to a number of anatomical structures within the back. Structures such as intervertebral (IV) discs, muscles and ligaments, among others, are all possible pain generators, often with more than one structure contributing to the pain at any one time (Rea, Kapur and Mutagi 2012). Any of these structures may be the source of LBP provided that the structure is innervated, is capable of causing clinically recognisable pain and is prone to pain-causing disease or injury (Depalma *et al.* 2011). Hence, familiarity with the anatomy of the lower back is beneficial in understanding the pathology of LBP.

The lower back, anatomically referred to as the lumbar spine, comprises the posterior aspect of the trunk extending inferior to the thoracic region of the spine and superior to the sacrum, and typically has a slight inward curve known as lordosis (Davis 2013). The lumbar spine includes the vertebral column, the vertebral canal, numerous muscles, various segmental nerves and vessels, as well as the overlying skin and subcutaneous tissue (Moore, Dally and Agur 2010).

2.2.1 The Vertebral Column

The vertebral column extends from the base of the skull to the tip of the coccyx and is collectively comprised of 33 vertebrae, five of which are found in the lumbar spine, intervertebral discs and associated ligaments (Moore, Dally and Agur 2010).

2.2.1.1 *Lumbar Vertebrae*

There are five vertebrae in the lumbar spine, each typically consisting of a vertebral body, a vertebral arch and seven processes (Moore, Dally and Agur 2010). Vertebral bodies are designed to bear weight. Successive vertebrae gradually become larger as the vertebral column descends to the sacrum as they must bear increasing amounts of the body's weight; hence the lumbar vertebrae are the largest segments of the vertebral column (Moore, Dally and Agur 2010; Gray 2013). Together with the posterior surface of the vertebral body, the vertebral arch forms the walls of the vertebral foramen, which houses and protects the spinal cord and its nerve roots. The seven processes characteristic of a lumbar vertebra include a spinous process, two transverse processes and four articular processes. The backward-projecting spinous process and the transverse processes, which project at each side of the vertebra, serve for muscle attachment (Gray 2013). The articular processes (two superior, two inferior) form facet joints which are designed for weight-bearing and strength as well as to facilitate and determine the extent of movement in the lumbar spine (Moore, Dally and Agur 2010; Gray 2013). The two lowest segments in the lumbar spine have the most movement and, being the largest segments of the vertebral column, carry the most weight, making the area prone to injury (Davis 2013).

2.2.1.2 *Intervertebral (IV) Discs*

The IV discs are the most prominent joints of the spinal column (Raj 2008). The complex structure of the IV discs assists them to play a crucial role as shock absorbers, while concurrently allowing for movement and flexibility of the lumbar spine. These fibrocartilaginous joints consist of a fibrous outer ring, known as the annulus fibrosis, which surrounds a viscous central mass, known as the nucleus pulposis (Raj 2008; Moore, Dally and Agur 2010). The lamellae of the annulus fibrosis run in such a way that while limiting rotation between adjacent vertebrae they provide a strong bond between them. The nucleus pulposis is an avascular structure with a semifluid nature. During movements such as flexion, extension and rotation, the nucleus pulposis acts as a semifluid fulcrum making it largely responsible for the flexibility and resilience of the spinal column as a whole (Moore, Dally and Agur 2010).

2.2.1.3 *Ligaments*

Martin (2010:613) defines a ligament as “a tough band of white fibrous connective tissue that links two bones together at a joint”. The ligaments of the lumbar spine connect the vertebral bodies, laminae and transverse processes (Gray 2013). They function to limit excess movement hence preventing injury of the lumbar spine and IV discs, maintain lordosis and prevent posterior herniation of the IV discs (Moore, Dally and Agur 2010; Snell 2010).

2.2.2 The Vertebral Canal

The vertebral canal comprises the spinal cord, spinal nerve roots and spinal meninges, as well as the neurovascular structures by which they are supplied (Moore, Dally and Agur 2010).

2.2.2.1 *The Spinal Cord*

Along with the brain, the spinal cord (SC) is the second major component of the central nervous system (NS) (Kishner *et al.* 2014). Protected by the vertebrae, their associated ligaments and muscles, the spinal meninges and the cerebrospinal fluid (CSF), the SC is the major reflex center and communication channel between the body and the brain (Moore, Dally and Agur 2010). The spinal cord begins as the inferior part of the brain stem and typically ends at the level of the second lumbar vertebra as the conus medullaris. The lumbar and sacral nerve roots are the longest nerve roots of the spinal cord, extending beyond the conus medullaris and forming a bundle of spinal nerves and spinal nerve roots known as the cauda equine (Kishner *et al.* 2014).

2.2.2.2 *The Meninges*

The spinal meninges is comprised of three membranes that surround, support and protect the SC and spinal nerve roots. These membranous connective tissue layers are known as the spinal dura mater, the spinal arachnoid mater and the spinal pia mater (Moore, Dally and Agur 2010). The superficial spinal dura mater is composed of tough fibrous tissue interlaced with elastic fibres and serves to protect the spinal nerve roots from being stretched during movement of the lumbar spine (Moore, Dally and Agur 2010; Kishner *et al.* 2014). The intermediate spinal arachnoid mater and deep spinal pia mater are delicate loose connective tissue membranes separated by the CSF-filled subarachnoid space. They facilitate mixing of the CSF, which plays a vital role in the functioning of the central NS, and protect the roots of the spinal nerves and the spinal blood vessels (Moore, Dally and Agur 2010; Kishner *et al.* 2014).

2.2.3 Muscles

There are two major muscle groups in the back. The superficial and intermediate muscles of the lumbar spine initiate and regulate limb and respiratory movements respectively, and are termed extrinsic muscles. On the other hand the deep muscles, termed the intrinsic back muscles, maintain posture and produce movements of the vertebral column. The intrinsic and extrinsic muscles of the lumbar spine can further be divided into four functional groups, namely extensors, flexors, lateral flexors and rotators (Kishner *et al.* 2014).

2.2.4 Fascia

Fascia is a connective tissue layer of variable thickness, which encases, separates, or attaches muscles, organs and other soft structures throughout the body (Martin 2010). Within the lumbar spine the three layered fascia play a biomechanical role distributing force and supporting the spine. The posterior layer of fascia plays the largest biomechanical role (Marras 2008).

2.2.5 Lumbar Innervation and Vasculature

2.2.5.1 *Innervation*

The spinal cord contains posterior afferent and anterior efferent nerve roots, which unite to form a mixed spinal nerve. The afferent sensory root is responsible for conveying sensory information to the brain, while the efferent motor root carries nerve impulses away from the CNS and to muscles or glands to incite the appropriate reaction to a stimulus (Kishner *et al.* 2014). Along with other nerves outside of the central NS, such as nerves that branch off the SC into the extremities, the nerves in the lumbar region make up the peripheral NS. Branches arising from the mixed spinal nerve innervate the vertebral column itself (Moore, Dally and Agur 2010).

2.2.5.2 *Vasculature*

Typical lumbar vertebrae are supplied by paired lumbar arteries, which arise from the aorta (Moore, Dally and Agur 2010). The lumbar arteries pass anterolateral to the vertebral body giving off posterior and spinal branches (Kishner *et al.* 2014). The posterior branches supply the vertebral arch structures and the lower back muscles, while the spinal branches enter the vertebral canal through the IV foramina to supply the bones, periosteum, ligaments and meninges (Moore, Dally and Agur 2010).

Familiarity with the anatomical structures of the lower back, which are all possible pain generators, is beneficial in understanding the pathology of LBP. In order to understand the pathology of LBP more fully, however, it is necessary to understand possible pain mechanisms.

2.3 PAIN

The Oxford Concise Medical Dictionary (Martin 2010) defines pain as “an unpleasant sensation ranging from mild discomfort to agonized distress, associated with real or potential tissue damage”. Balagué *et al.* (2012) referred to pain, and specifically LBP, as “a symptom, with different stages of impairment, disability and chronicity”. While injured tissues are typically the source of pain, there are various physiologic and psychological factors which influence the perception and duration of pain (Marras 2008). Over the centuries, various theories have been proposed to explain the complex mechanism of pain perception (Moayedi and Davis 2013).

2.3.1 Early Theories

Early pain theories included the specificity theory, the intensity theory and the pattern theory. While they were all adequate in describing various observations regarding pain, they focused predominantly on superficial pain and made little or no mention of deeper visceral or muscular pain. In addition, they made no mention of the mechanism of chronic pain or of the psychological factors affecting pain perception (Keller and Krames 2009; Moayedi and Davis 2013).

2.3.2. Gate Control Theory

The gate control theory proposed by Melzack and Wall (1967) builds on earlier pain theories, endeavouring to explain the psychological components of pain and the mechanism of chronic pain by taking into account the complex structure of the NS. It suggests that the way pain is perceived depends on the interaction between the peripheral NS and central NS. As with the specificity theory, the gate control theory suggests that injury activates specialised pain receptors, which transmit pain impulses to the SC and ultimately to allocated pain centers in the brain (Moayedi and Davis 2013). Before these pain impulses are permitted to reach the brain, however, they lead to specialised neurons in the SC which make up the ‘gate’, and will only reach the brain if the gate is open. Whether the gate is open or closed depends on a number of factors (Keller and Krames 2009). A-beta and A-delta fibres and C fibres (described in Table 2.1) are nerve fibres responsible for carrying various impulses from the site of the stimulus to

the dorsal horn of the spinal cord, where they will either continue to the brain via transmission cells or their activity will be hindered by inhibitory neurons (Melzack and Wall 1967; Moayedi and Davis 2013).

Table 2.1 Description of Nerve Fibers

Fibre Type	Function	Conduction Velocity (m/s)	Myelinated
A-Beta fibre	Sensory, touch pressure and vibration.	40 – 70	Yes, thickly
A-Delta fibre	Pain (sharp), temperature and touch.	6 – 30	Yes, thinly
C fibre	Pain (diffuse, deep), temperature.	0.5 – 2	No

*Table adapted from Snell, 2010

Activity from the thin A-Delta and C fibres tends to hamper the activity of the inhibitory neurons, causing the gate to open and the transmission cells to fire and allowing the pain message to reach the brain. Contrary to this, thick A-Beta fibres enhance the activity of the inhibitory neurons, limiting transmission cell activity. If A-Delta and C fibre impulses are stronger than A-Beta fibres, the gate opens, and vice versa. This is the reason why massage may relieve pain in patients with LBP; more large A-Beta fibre activity is brought about by the constant touch and pressure, enhancing the activity of the inhibitory neurons and hence limiting the pain impulses being transmitted to the brain (Keller and Krames 2009). The opening and closing of the gate may also be influenced by activity in the brain itself. Cognitive processes, such as anxiety, depression and focusing on pain, may sensitise the gate to C fibres by blocking the neurotransmitter from the A-Delta and C fibres, causing it to open, while optimism, distraction and concentration sensitise the gate to A-Beta fibres, promoting closure of the gate. The cases of soldiers who experienced little or no pain despite major injuries can be explained using the gate control theory. Concentration on the task at hand (survival) and other important factors send signals which sensitise the gate to A-Beta fibres, causing it to close and inhibiting the transmission of pain impulses to the brain (Melzack and Wall 1967; Keller and Krames 2009; Snell 2010; Moayedi and Davis 2013).

The gate control theory is comprehensive and widely accepted, and accounts for mechanisms and experiences that previous theories could not (Moayedi and Davis 2013). Chronic LBP, the factors affecting it, such as stress and depression, and certain treatments for LBP can be described using the gate control theory.

2.3.3 Chronic Pain

Chronic pain is broadly defined as pain persisting beyond the resolution of the initial pain-causing stimulus (Alcântara *et al.* 2013). As explained by the gate control theory the perception of pain can, from a physiological perspective, either be controlled by specialised neurons in the SC which make up the 'gate' or by activity in the brain itself (Melzack and Wall 1967). Processes which occur at either of these structures are partly responsible for the development of chronic pain. Neural structures have the ability to adapt, as they are plastic rather than static. This neuroplasticity is affected by pathological states such as pain, anxiety and depression, as well as by behavioural, sensory, cognitive and emotional experience (Tracey and Bushnell 2009; Fornasari 2012; Nekovarova *et al.* 2014). Central sensitisation and long-term potentiation (LTP), which occur in the dorsal horn of the SC (or gate) and in the brain itself respectively, are adaptive neural processes which facilitate the development of chronic pain. Once the pain-producing stimuli are resolved, there is a return to a normal high threshold for activation of pain, unless there is NS damage. Painful stimuli, tissue injury and nerve damage are all impulses which are transmitted to the dorsal horn of the spinal cord. When these stimuli are intense, the pain mechanism causes the neural structures to adapt. Neurons become more efficient at transmitting impulses in the nociceptive pathways; this is known as central sensitisation. Once central sensitisation occurs, an individual's pain threshold decreases; hence almost any stimuli to the area will produce pain (Ji *et al.* 2003; Cohen, Quintner and Buchanan 2013). Similarly LTP, which occurs in the anterior cingulate cortex (ACC) of the brain, refers to the strengthening of connections between neurons through repeated use. Neurons essentially 'become better' at transmitting a specific pain signal and much like central sensitisation, will cause even non-painful stimuli at the previous site of tissue injury or nerve damage, will produce pain (Koga *et al.* 2015). The structural and functional changes to the neural system by chronic pain may become permanent and ultimately affect brain processes which are not directly connected with pain itself, including psychiatric disorders (Nekovarova *et al.* 2014). While the mechanisms of pain and chronic pain operate in the same manner throughout the human anatomy, defining types of pain, such as LBP involve specific structures, timelines and causative factors.

2.4 DEFINING LBP

Non-specific low back pain (LBP) refers to soreness, tension and/or stiffness in the lower back region (Bronfort *et al.* 2010) in which no specific anatomical structure or pathology can be identified as being responsible for symptoms (Dagenais and Haldeman 2011), and which cannot be attributed to a recognisable, known specific pathology (Duthey 2013). Rather than a condition, non-specific LBP is a symptom for which consistent pathology cannot currently be identified (Balagué *et al*. 2012). The natural history of LBP, which is the development of a condition in the absence of treatment, has been observed to be extremely variable (Kent and Keating 2008). Low back pain can be classified as acute, sub-acute or chronic (Duthey 2013). In acute LBP the current symptoms have lasted less than six weeks; in sub-acute LBP from six to twelve weeks; and in chronic LBP for more than twelve weeks (Dagenais and Haldeman 2011). Chronic LBP also refers to "recurring back pain that intermittently affects an individual over a long period of time" (Duthey 2013: 5). Contrary to traditional views of LBP consisting of single episodes of acute and chronic LBP, it is more commonly viewed as a "chronic problem with intermittent exacerbations" (Deyo and Weinstein 2001: 367) or a "recurrent course with fluctuating symptoms" (Nicholas *et al.* 2011: 740). Low back pain may last a few days or persist for many years, although most commonly people who experience activity-limiting LBP of more than a day's duration tend to experience recurrent episodes. Frequent or long-lasting LBP episodes in the past have been shown to be predictive of more frequent and more severe recurrence (Hoy *et al.* 2010). Non-specific LBP is more important for its consequences than for its existence, with the most common being decreased physical activity, seeking health care and short-term work absence (Burton *et al.* 2006; Leboeuf-Yde *et al.* 2011). While nonspecific LBP is typically considered as a localised problem, the majority of individuals suffering from LBP experience additional musculoskeletal comorbidity (Rodríguez-Romero, Pita-Fernández and Carballo-Costa 2013).

2.5 EPIDEMIOLOGY OF LBP

According to the World Health Organisation's (WHO) Global Burden of Disease 2010, it is estimated that LBP is the second leading cause of years lived with disability globally (Vos *et al.* 2013). Although many people consider the burden of LBP to be minor, it is the leading cause of activity limitation and work absence worldwide, and has an enormous economic impact on individuals, communities, governments and businesses throughout the world (Hoy *et al.* 2010).

The epidemiological data regarding LBP varies dramatically depending on regions assessed, dates of the studies and study populations, as well as the definition of LBP that is used. A systematic review of the global prevalence of LBP conducted by Hoy *et al.* (2010) using 165 studies from 54 countries revealed, however, that LBP is most prevalent among females and persons aged 40–80 years, while according to WHO (Duthey, 2013), it peaks between 35 and 55 years of age. The lifetime prevalence of non-specific LBP is estimated at 60–70% in industrialised countries (Duthey 2013), with Balagué *et al.* (2012) reporting a lifetime prevalence as high as 84% in the United States of America adult populations. Interestingly, Bener *et al.* (2013) reported a prevalence of 64.7% in the United Arab Emirates adult population. Epidemiological studies carried out in South Africa (SA) revealed that the lifetime prevalence of LBP in a formal black South African township in 1997 was 57.6% (Van Der Meulen 1997). The Coloured and Indian populations of SA reported a lifetime prevalence of 76.6% and 78.2% respectively (Docrat 1999) and the White population of SA reported a lifetime prevalence of 48% (Dyer 2012).

2.6 NATURAL HISTORY OF LBP

The natural history of LBP, which is the development of a condition in the absence of treatment, has been observed to be extremely variable (Kent and Keating 2008). Since LBP is a symptom rather than a disease, the natural history of specific LBP is somewhat dependant on the cause of the back pain. For example the natural history of herniated discs is a favourable gradual improvement in the condition, while spinal stenosis has a less favourable outcome as it usually remains stable or gradually worsens (Deyo and Weinstein 2001). On the other hand non-specific LBP is an episodic condition for many patients, making it difficult to pinpoint or predict a beginning or an end for the problem. The symptoms, severity and presence of LBP have been noted to fluctuate over years, months, weeks and in some patients even days (Kongsted and Leboeuf-Yde 2009). The prognosis for acute LBP is reasonably favourable in most cases with only a minority of patients (up to 30%) going on to develop chronic LBP. Most commonly, the experience of LBP is fairly short-lived, self-limited and uncomplicated. Should the LBP reach the sub-acute phase, improvement will become less evident and upon reaching the chronic phase, little or no permanent improvement typically occurs (Burton *et al.* 2006; Urquhart *et al.* 2008; Wand and O'Connell 2008; Chou and McCarberg 2011). Although little is known about the long-term development and cycle of LBP, it is generally considered a “recurring or persistent condition with a fluctuating course over time” (Lemeunier, Leboeuf-Yde and Gagey 2012:33). In

addition to the biological factors which influence the natural course of LBP, psychological and behavioural factors too play a role.

2.7 THE BIOPSYCHOSOCIAL MODEL

In 1977 Engel proposed the biopsychosocial model framework to create room for the social, psychological and behavioral dimensions of illness, which were previously overlooked in the biomedical model. In 1987 Waddell suggested the biopsychosocial model as the theoretical framework for the management of LBP (Waddell 1987). As is evident by its title the biopsychosocial model is made up of three components, namely biological, psychological and social factors. Although each of these factors may independently provoke and perpetuate LBP they are often found to co-exist (Yilmaz and Dedeli 2014). Fittingly, the model suggests that back pain should be viewed from not only a biomedical perspective, but also by taking into account the patient's own, as well as society's, perceptions and reaction to pain as this constitutes the main problem for many individuals (Pincus *et al.* 2013). The biopsychosocial model further provides an understanding of the transition from acute to chronic LBP, subsequently providing information on the appropriate areas for intervention to prevent chronicity (Chou and McCarberg 2011).

2.8 RISK FACTORS FOR LBP

Specific risk factors for non-specific LBP are challenging to identify due to the discrepancy across research methods, case definitions and study populations. There are, however, a variety of physical, environmental and personal factors that have been shown to influence the onset and course of LBP (Hoy *et al.* 2010). Risk factors associated with non-specific LBP include a history of previous LBP, history of heavy lifting, bending, twisting, whole body vibration, obesity, poor job satisfaction, and emotional distress (Vadivelu *et al.* 2011). A study by Björck-van Dijken *et al.* (2008) found that those with LBP (especially women) were reported to have lower physical activity during leisure time compared with those without LBP, and tend to live in smaller communities. Evidence shows that persons with negative emotions and poor self-concept, low levels of social support in the workplace, a low level of job control, high psychological demands and work dissatisfaction as well as stress, anxiety and depression are more prone to non-specific LBP, indicating that psychosocial factors make up a significant portion of risk factors for nonspecific LBP (Duthey 2013). Psychosocial factors also play a substantial role in the transition from acute to chronic LBP, with the main associations being distress, heightened somatic concern, passive coping strategies and other psychological factors (Burton *et al.* 2006).

Psychosocial risk factors indicating a possibility of chronicity of pain, otherwise known as “yellow flags,” have consistently been found to be the strongest predictors of chronicity in persons with non-specific LBP, and evidence supports the effectiveness of early biopsychosocial interventions in the treatment of acute, non-specific LBP (Wand and O'Connell 2008).

2.8.1 Red and Yellow Flags

The main aim of any LBP clinical examination is the exclusion of red flags. Red flags encompass a relatively short list of symptoms which can assist in identifying potentially serious conditions such as Cauda Equina Syndrome, requiring immediate treatment. These warning symptoms include significant trauma, unexplained weight loss, recent fever and history of cancer, among others (as illustrated in Table 2.2). In cases where red flags are identified a specific, recommended approach will be taken, which may include urgent referral to a hospital or specialist, or further investigations. According to the New Zealand Acute LBP Guide (Accident Compensation Corporation and The National Health Committee 2004) in cases where red flags are not present yet the patient has shown little or no improvement after 4- 6 weeks, the clinician should re-check for red flags and screen for yellow flags. Whilst not as urgent as red flags, yellow flags can prove equally important in the treatment of LBP (Accident Compensation Corporation and The National Health Committee 2004).

Table 2.2 Red Flags

Serious Condition	Indications from Medical History	Recommended Approach
Fracture	Major trauma such as an MVA or fall from height. Minor trauma, including strenuous lifting in older or osteoporotic patients.	Investigate appropriately and refer to a specialist if indicated by clinical findings and test results.
Tumour or infection	Age below 20 or over 50 years. Family or personal history of cancer. Constitutional symptoms such as recent fever, chills or unexplained weight loss. Recent bacterial infection, IV drug use or immune suppression. Pain worse at night or when supine.	Investigate appropriately and refer to a specialist if indicated by clinical findings and test results.

Cauda Equina	Saddle anaesthesia. Recent onset of bladder dysfunction. Severe or progressive sensory alteration or weakness of the lower limb.	Refer urgently to hospital for orthopaedic or neurosurgical assessment.

*Adapted from New Zealand LBP Guide, Accident Compensation Corporation and The National Health Committee 2004 (2005), and Borenstein and Calen (2012)

Yellow flags, designed for use in acute LBP, are defined by the New Zealand Acute LBP Guide (Accident Compensation Corporation and The National Health Committee 2004: 26) as "factors that increase the risk of developing or perpetuating long-term disability and work loss associated with LBP". To put it simply, red flags are physical risk factors, while yellow flags are psychosocial risk factors (Chou and McCarberg 2011). Much like the identification of red flags should lead to appropriate medical intervention, the identification of yellow flags should lead to appropriate cognitive and behavioural management. Red and yellow flags are not exclusive – it may be necessary for both areas to be managed concurrently in one patient (Grimmer-Somers, Prior and Robertson 2008; Balagué *et al.* 2012).

The main goals of assessing and identifying yellow flags in LBP are to avoid the progression from acute to chronic pain and to prevent disability and decreased work productivity. The early assessment and identification of psychosocial yellow flags, followed by the appropriate early intervention is crucial, because once the undesirable consequences of untreated yellow flags have manifested they are very difficult to undo. Yellow flags may be identified using structured questionnaires, thorough clinical assessment, or a combination of both, dependent on the clinical setting and the clinician's personal preference (Accident Compensation Corporation and The National Health Committee 2004; Croft, Dunn and Raspe 2006).

Individuals considered at risk for long term work loss and disability fall into one of two groups: those who display a few very prominent psychosocial risk factors and those who display several less significant risk factors that tend to increase over time. These risk factors cover a wide variety of areas in life, from personal to social and corporate aspects, and for convenience can be compartmentalised into groups. Within these groups, there are a few factors which are considered most important and have been constantly found to predict poor outcome. These groups and the most significant predicting factors in each are listed in Table 2.3.

Missing yellow flags may have adverse consequences by causing an unintentional reinforcement of disabling factors. Failing to acknowledge a patient's feelings and behaviours concerning their LBP may result in withdrawal from social, occupational and recreational

activities, and ultimately adverse physiological consequences due to inactivity, the most common being muscle wasting. It is vital not only to identify and understand the issues associated with yellow flags, but most importantly to address them. This will result in effective physiological and psychosocial rehabilitation.

Table 2.3 Yellow Flags

Category	Important poor outcome predictors
Attitudes and beliefs about back pain	Belief that pain is harmful or potentially severely disabling.
Behaviours	Fear avoidance behaviour and reduced activity levels.
Compensation issues	Lack of financial incentive to return to work.
Diagnosis and treatment	An expectation that passive treatments rather than active participation will help.
Emotions	Tendency to low mood and withdrawal from social interaction.
Family	Over-protective partner, emphasising fear of harm or catastrophizing.
Work	Work history including: - history of manual work, most notably nurses, truck drivers, labourers, construction workers and farm workers. - patterns of frequent job changes, experiencing stress at work, job dissatisfaction, poor relationships with peers or supervisors, lack of vocational direction.

*Adapted from New Zealand Acute LBP Guide, Accident Compensation Corporation and The National Health Committee 2004 (2005)

2.8.2 Sociodemographic Risk Factors

There are a number of risk factors which serve as predisposing factors for the onset and chronicity of LBP. Most commonly, a number of risk factors are present and act in conjunction to influence and alter the course and progression of LBP. These risk factors may be non-modifiable, such as age and gender, or modifiable such as body mass index (BMI), level of

education, smoking status, alcohol consumption and physical activity (Kennedy *et al.* 2008; Huang *et al.* 2014).

2.8.2.1 *Age*

Low back pain affects all age groups, with adults and teenagers reporting a similar prevalence of LBP. Rather than an increase in the quantity of LBP sufferers with increased age, there is a change in the characteristics and consequences of the pain in individuals who have previously suffered from LBP. For example, the number of individuals on sick-leave does not increase with increasing age, but rather the duration of sick-leave increases. Only a minimal portion of individuals who did not suffer with LBP as teenagers or young adults will go on to experience an initial onset of LBP as older adults (Kennedy *et al.* 2008; Leboeuf-Yde *et al.* 2011). Surveys carried out in the United Kingdom and France both revealed that patients in the 45-64 year old age group presented most prevalently for LBP consultations (Balagué *et al.* 2012). Björck-van Dijken *et al.* (2008) reported the highest prevalence of LBP in a similar age group (55-64 year olds). Kaplan *et al.* (2013) stated that the prevalence of LBP increases and peaks between the ages of 35 and 55 years and attributed this to the deterioration of IV discs in the adult population. The most common aetiology of chronic LBP in the young adult population involves the IV disc, while in older adults the facet and sacroiliac joints are implicated as the most likely sources of pain (DePalma, Ketchum and Saullo 2011). Chronic LBP in adults, especially older adults, should be considered a multifactorial clinical syndrome (Weiner *et al.* 2006).

Age-related contributions to LBP are most commonly biological and physiological. Morphological and biochemical changes in the lower back associated with aging include loss of bone minerals, muscle atrophy and reduced joint range of motion (ROM), with these changes differing between males and females. Mobility decreases in all directions with advancing age, but especially in extension (Intolo *et al.* 2009). This is possibly due to the fact that movement in the direction of extension is the least commonly performed action in daily life, leading to weak abdominal and back muscles as well as tight hamstrings. Physical activity, which is beneficial in preventing LBP, has been found to decrease with increasing age. Limitations in spinal mobility may disrupt activities of daily living, including dressing, grooming and lifting objects, and also cause interference with the gaining of important practical skills and contribute to gait abnormalities (Saidu *et al.* 2011; Ojoawo and Awoniyi 2012). Psychosocially, LBP may worsen or become chronic with increasing age due to a decrease in general coping mechanisms, as described by the fear avoidance model of pain (see section 2.8.3.1) (Leboeuf-Yde *et al.* 2011). The typical older adult is socially perceived as being more sensitive to pain and more willing to

report LBP. Such social perceptions may have an effect on the way that both the LBP sufferers and practitioners interpret and manage LBP. Low back pain, as well as other pain, is thus often overlooked and untreated in older individuals, making way for it to progress to a chronic condition (Wandner *et al.* 2012).

2.8.2.2 *Gender*

Females represent a slightly higher population group of approximately 51% in SA than males (Statistics South Africa 2014). A systematic review of the global prevalence of LBP conducted by Hoy *et al.* (2010) using 165 studies from 54 countries revealed that LBP is most prevalent among females. Björck-van Dijken *et al.* (2008) reported that 6% more female than male patients suffered from chronic LBP in Northern Sweden. In a study covering seventeen countries across six continents with a total sample size of over 85, 000 adults, females were reported to have a higher prevalence of back pain, chronic pain and depression comorbid with chronic pain (Fillingim *et al.* 2009). Heuch *et al.* (2013), Huang *et al.* (2014) and Smuck *et al.* (2014), however, reported that gender is not an important predictor of LBP. While it is apparent that gender may have an effect on pain, and specifically LBP, the mechanisms thereof are not well understood. There are multiple components which may be responsible for this effect including biological factors such as hormonal influences, psychosocial factors such as gender role expectations, or a combination of both factors (Manson 2010; Leboeuf-Yde *et al.* 2011).

Sex hormones and the neural systems that transmit pain signals are biologically and anatomically different in males and females. Neurotransmitter levels, receptor binding and responsiveness to medications acting through these pathways have been found to differ between males and females (Manson 2010). Varying levels of oestrogen and progesterone, the sex hormones found predominantly in females, can either inhibit or stimulate pain and inflammation based on factors such as the immune stimulus and the differing concentration of estrogen during various life cycles. Since the levels of these hormones fluctuate throughout a woman's life based on menstrual cycles, pregnancy and ultimately menopause, the experience of pain may differ based on the life event that a woman is experiencing (Koley, Kaur and Sandhu 2010; Manson 2010). Testosterone, a sex hormone found predominantly in males, has been identified as having pain inhibiting properties (Pogatzki-Zahn 2013). Men and women have been found to differ in their perceptions of pain, experiences of pain, and coping mechanisms. Studies using the Gender Role Expectation of Pain Questionnaire revealed that both men and women view women as more willing to report pain, less able to endure pain and more sensitive to pain than men (Wandner *et al.* 2012). Societal perceptions may influence the

way in which individuals approach their pain. The level of LBP in men may be underestimated, since in order to meet social and professional role expectations men may deliberately suppress signs of pain in various situations (LeResche 1999; Alcântara *et al.* 2013).

2.8.2.3 *BMI*

Body mass index (BMI) is a basic, inexpensive measure of body fat which relies solely on height and weight for measurement and hence is non-invasive and requires little equipment. It is calculated by weight in kilograms divided by the square of the height in meters (Department of Health and Human Services and Centers for Disease Control and Prevention 2011). Since there are a few clinical limitations when using BMI, it should merely be considered as a rough guide for measuring body fat (World Health Organization 2014b). The BMI is limited in that it does not take into account individual factors which influence the relationship between BMI and body fat, such as age, gender, ethnicity and muscle mass. Women and older adults tend to have, on average, more body fat than men or younger adults respectively for the equivalent BMI. The BMI also does not provide information on or differentiate between excess fat, muscle or bone mass, however it is the most useful population-level measure of overweight and obesity (Department of Health and Human Services and Centers for Disease Control and Prevention 2011; World Health Organization 2014b). The parameters of BMI are displayed in Table 2.4 below.

Table 2.4 Weight status according to BMI

BMI (kg/m²)	Weight Status
Below 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30.0 – 35.9	Obese
36.0 and above	Morbidly obese

*adapted from the Department of Health and Human Services and Smuck et al., 2014

Overweight and obesity, defined as “abnormal or excessive fat accumulation that may impair health” (World Health Organization 2014b: 1), are potentially modifiable risk factors which contribute significantly to the afflictions of chronic medical conditions, including chronic LBP (Björck-van Dijken *et al.* 2008; Leclerc *et al.* 2009; Koley, Kaur and Sandhu 2010; Shiri *et al.*

2010a; Balagué *et al.* 2012). South Africa has been reported as having one of the highest rates of overweight and obesity worldwide (Ng *et al.* 2014). While 37.5% of the world's population were reported as overweight, 54% of the South African population were reported as overweight or obese (Ng *et al.* 2014). There is growing evidence supporting the association between obesity and LBP (Smuck *et al.* 2014). In a longitudinal study conducted by Heuch *et al.* (2013), obesity and overweight were discovered to be predisposing factors for chronic LBP after an eleven-year period, in both participants who did not initially experience LBP and those who did. The presence of LBP did not influence changes in BMI over this eleven-year period, however a decrease in BMI by weight loss programmes and surgical interventions for obesity were found to decrease the severity of LBP (Heuch *et al.* 2013; Smuck *et al.* 2014). Several possible mechanisms have been proposed for the association between obesity and LBP. Firstly, the mechanical load on the lumbar spine, especially during various activities, is increased due to the higher force and stress on lumbar spine structures during these activities. Body fat distribution may play an additional role in changing the mechanical load on the lumbar spine, since abdominal obesity is more commonly associated with LBP than general obesity. Secondly, obesity is associated with systemic chronic inflammation and inflammatory processes such as the activation of pro-inflammatory pathways, which may consequentially cause pain. Finally, anatomical and physiological changes associated with obesity include hormone-related obesity more common in women, disc degeneration and vertebral endplate changes, as well as decreased disc nutrition due to atherosclerosis and decreased spinal movement (Shiri *et al.* 2010a; Heuch *et al.* 2013). Evidence supporting the association between obesity and chronic LBP is continually growing. It is possible that individuals who are both obese and suffer with chronic LBP may possess common underlying risk factors which lead to both conditions (Heuch *et al.* 2013; Smuck *et al.* 2014).

2.8.2.4 *Level of Education*

The levels of education in SA have shown a significant increase over the past decade. The number of individuals aged 20 years and older who have attained matric over the past decade has increased by approximately 6% and the number of individuals who have attained some tertiary education over the past decade has increased by approximately 4% (Statistics South Africa 2014). Lower levels of education have been implicated in the development of LBP in some studies (Dionne *et al.* 2001; Björck-van Dijken *et al.* 2008; Leclerc *et al.* 2009; Karunanayake *et al.* 2013; Huang *et al.* 2014), although found to be insignificant in others (Chou and McCarberg 2011). Individuals with a moderate education level, specifically six to twelve

years of schooling, have up to double the risk of developing LBP than those with a tertiary education (Leclerc *et al.* 2009; Karunanayake *et al.* 2013; Huang *et al.* 2014). Conversely, Karunanayake *et al.* (2013) found that individuals with the lowest education group, no formal education or only up to five years of schooling, were unlikely to develop LBP.

The principal associations between LBP and education originate from lifestyle and occupational factors (Leclerc *et al.* 2009). Individuals with moderate education levels tend to lead less healthy lifestyles than individuals with higher education levels. They commonly possess additional risk factors for LBP, such as a positive smoking status, high BMI and little or no involvement in physical activity. This may be due to a limited knowledge and understanding of the benefits of a healthy lifestyle in individuals with moderate education levels. The level of education is a good predictor of occupation and consequently related physical work exposure. Individuals with lower education levels are typically involved in occupations which involve tiring postures and the handling of heavy loads, both predisposing factors for LBP. Variations in physical work exposure are found between males and females. Individuals with the lowest level of education, who were found to be unlikely to develop LBP, are more likely to earn a poor income leading to a lack of funds for transport and an increased frequency of walking to their destinations. Since walking is a beneficial activity in preventing LBP, this may be a reason for the decreased likelihood of LBP in these individuals (Leclerc *et al.* 2009; Karunanayake *et al.* 2013).

2.8.2.5 *Smoking*

Tobacco smoking, hereafter referred to as smoking, is a pressing public health concern in South Africa (SA) with numerous health implications. The prevalence of smoking in SA (31.7% for men and 9.0% for women) is high (Dutra *et al.* 2014). The associations between smoking and LBP vary across studies. Björck-van Dijken *et al.* (2008) and Balagué *et al.* (2012) identified LBP as a weak risk factor for LBP, while a systematic review by Ferreira *et al.* (2013) reported that over four twin studies revealed a significant association between smoking and LBP and one case control study revealed smoking to be insignificant in LBP. Kwon *et al.* (2006) found no statistically significant association between smoking and the development of LBP. Shiri *et al.* (2010b) found that former smokers had a higher prevalence of LBP than those who had never smoked, but a lower prevalence of LBP than current smokers, and reported the association to be slight. Current smoking had the strongest association with chronic and disabling LBP. Study limitations existed in that they did not include information on the severity and frequency of LBP or on the frequency and quantity of cigarettes being smoked (Shiri *et al.* 2010b).

It has been reported that the majority of smokers have a poorer mental health status than non-smokers, and that smoking may be used as a coping mechanism for stressful situations, hence smoking may be an indicator of an underlying psychological condition that causes LBP. Physically demanding jobs and multiple traumatic experiences are associated with higher smoking prevalence and greater smoking intensity (Shiri *et al.* 2010b; Dutra *et al.* 2014). Smoking has a detrimental effect on blood supply to spinal structures, which may interfere with healing and nutrition of the IV discs, causing and amplifying degeneration (Ojoawo and Awoniyi 2012; Shiri *et al.* 2013). Additionally, chronic coughing associated with prolonged smoking may cause repeated microtrauma to the IV discs, gradually leading to disc injury and herniation (Dagenais and Haldeman 2011). Although smoking is often used as a coping mechanism for stressful situations, it has an unfavourable physiological effect on stress hormones, and rather than assist it inhibits the ability to cope with stress, which is a predisposing factor for chronic LBP (Dutra *et al.* 2014).

2.8.2.6 *Alcohol Consumption*

Alcohol is a widely used substance which has the ability to affect the mind and behaviour and to produce dependence (World Health Organization 2014a). Leboeuf-Yde *et al.* (2011) and Ferreira *et al.* (2013) identified no association between moderate alcohol consumption and LBP, however heavy drinking and LBP have been found to have a correlation (MacGregor *et al.* 2004; Karunanayake *et al.* 2013; Zale, Maisto and Ditre 2015). Moderate alcohol consumption, which is quantified in SA as no more than one standard drink per day for females and no more than two standard drinks per day for males, is potentially beneficial. It has been shown to decrease the risk of mortality due to myocardial infarction and coronary heart disease (Jacobs and Steyn 2013; Zale, Maisto and Ditre 2015). Biochemical and vascular mechanisms which are responsible for a decrease in cardiovascular risk factors include a reduced risk of atherosclerosis via increased levels of high density lipoprotein, and a reduced risk of blood clotting by stimulating the production of proteins responsible for breaking down blood clots (Castelnuovo *et al.* 2010). The World Health Organization (2014a: 2) defines the harmful use of alcohol as “a pattern of alcohol use that is causing damage to health”. Heavy episodic drinking involves six or more standard drinks on at least one single occasion at least once a month, and results in damage to both physical and mental health. It has an effect on the incidence of disease and disability, as well as the course and outcome of various disorders. South Africa is among the nations with the most harmful alcohol consumption habits, with males

being more likely to consume alcohol than females (Jacobs and Steyn 2013; World Health Organization 2014a).

Factors influencing the magnitude and patterns of alcohol consumption are similar to risk factors for chronic LBP, and include age, gender, lack of physical activity and tobacco smoking. An association between excessive alcohol consumption and social and psychological problems has been identified, which may influence the development of chronic LBP and illness behaviour (World Health Organization 2014a). Alcohol has the ability to produce an analgesic effect, hence many people who experience pain use alcohol as a method of alleviating pain, and especially chronic pain (World Health Organization 2014a). As with tobacco smoking, alcohol is often used as a coping mechanism for stress and depression. It is biologically plausible that there is a causal link between LBP and alcohol. Alcohol consumption has a noxious effect on organs and tissues which may be responsible for direct or referred LBP. Excessive drinking, to the point of intoxication, leads to impaired cognition, perception and behaviour and unco-ordinated movements, which make the spine more susceptible to injuries. Excessive drinking also leads to alcohol-related crime, violence and traffic accidents and risky sexual behaviour. Injuries or diseases acquired in this manner may ultimately lead to LBP as a consequence (Leboeuf-Yde *et al.* 2011; Jacobs and Steyn 2013; World Health Organization 2014a).

2.8.2.7 *Work and Physical Activity*

According to the World Health Organization (2010), the lack of physical activity is currently a leading risk factor for international mortality. Physical activity is beneficial for both physical and mental health and has been recommended for maintaining and improving muscular fitness, bone and functional health and musculoskeletal health, among others. Physical activity includes recreational activities, transportation (e.g. cycling), occupational duties, chores within the home, sports practice or games, and planned exercise (World Health Organization 2010). Individuals with little or no physical activity during leisure time, and in contrast those partaking in frequent, strenuous physical or work activity, have a high risk of developing chronic LBP. Those with a combination of physically demanding occupations and little or no involvement in physical exercise during leisure time have the highest risk of LBP (Burton *et al.* 2006; Björck-van Dijken *et al.* 2008; Nilsen, Holtermann and Mork 2011; Balagué *et al.* 2012; Huang *et al.* 2014). The suggestion that both low levels of physical activity and strenuous levels of physical activity increase the risk of LBP, and moderate levels of physical activity decrease the risk of LBP, has been determined by Heneweer *et al.* (2011), Ojoawo and Awoniyi (2012) and Shiri *et al.* (2013).

Few studies suggest that the association between LBP and physical activity is insignificant (Nilsen, Holtermann and Mork 2011; Sitthipornvorakul *et al.* 2011).

Work-related LBP is dependent on an individual's occupation and the activities it entails. Moderate to strong work-related risk factors for LBP include physically demanding occupations with heavy workloads, manual handling, awkward postures of the lumbar spine, inability to regularly alter posture and prolonged standing. Prolonged sitting combined with frequent bending down or twisting at the waist greatly increases the risk of LBP. Specific occupational loads also have a moderate to strong association with LBP. For example, nurses have a high risk of LBP due to twisted and bent work positions, and the positioning and transfer of patients between beds during a shift (Kwon *et al.* 2006; Heneweer *et al.* 2011; Griffith *et al.* 2012; Yilmaz and Dedeli 2014). Work-related risk for LBP related to physical activity has been found to differ slightly between males and females. Men are more likely to lift more and heavier loads than women, causing a higher risk of LBP in men; however, LBP is more prominent in women when they are exposed to the same physical loads as men. Women have also been found to be more likely to leave their occupations earlier than men when experiencing LBP (Björck-van Dijken *et al.* 2008; Griffith *et al.* 2012). The mechanisms by which work activity prompts LBP are through excessive and repetitive loading of spinal structures (Yilmaz and Dedeli 2014). Heavy physical work leads to degenerative disc changes, which are largely responsible for LBP (Kwon *et al.* 2006). Awkward postures of the lumbar spine and the inability to alter posture during shifts increase intramuscular pressure in the paraspinal muscles. The increase in pressure in turn leads to muscle fatigue and ultimately LBP. In contrast, leisure time physical activity assists in strengthening the spinal and abdominal muscles, both vital for maintaining posture (Karunanayake *et al.* 2013).

Although determining that the intensity and frequency of physical activity performed by an individual poses a problem, physical exercise is conducive to the improvement of LBP even in small amounts and regardless of intensity (Heneweer *et al.* 2011; Nilsen, Holtermann and Mork 2011; Huang *et al.* 2014). Performing a minimum of 30 minutes of moderate physical activity per day, or fifteen minutes of vigorous physical activity per day, five times per week, is beneficial for health (Björck-van Dijken *et al.* 2008; World Health Organization 2010). Nilsen, Holtermann and Mork (2011) reported that even individuals who performed as little as one hour of physical activity per week had a reduced risk of developing chronic LBP. Table 2.5 describes and provides examples of moderate and vigorous intensity physical activity.

Table 2.5 Types of physical activity

Physical Activity	Description	Examples
Moderate intensity	Requires a moderate amount of effort, 3 – 6 times an individual's energy expenditure when sitting quietly, and noticeably accelerates the heart rate.	Brisk walking, dancing, gardening, housework and domestic chores, active involvement in sports with children, walking domestic animals, general building tasks, and carrying or moving loads weighing less than 20 kgs.
Vigorous intensity	Requires a large amount of effort, more than 6 times an individual's energy expenditure when sitting quietly, and causes rapid breathing and a substantial increase in heart rate.	Running, walking or climbing briskly up a hill, fast cycling, aerobics, fast swimming, competitive sports, heavy shovelling or digging ditches, and carrying or moving loads weighing more than 20 kgs.

*Table adapted from World Health Organization (2010)

There are a few mechanisms by which physical exercise may prevent LBP. Physical exercise increases the endurance of the back and trunk muscles by strengthening them. They stimulate the blood supply to spinal structures, including muscles, joints and IV discs, thus assisting and improving the process of repair. Since physical activity promotes the release of endorphins, it also has a beneficial psychological effect by improving an individual's disposition, and subsequently their perception of pain (Kwon *et al.* 2006; Koley, Kaur and Sandhu 2010; Sitthipornvorakul *et al.* 2011). While participating in regular physical exercises and activities is beneficial, it is important to note that constant strenuous physical activity, even during leisure time, may increase the risk of LBP. In addition, certain types of physical activity may predispose an individual to lumbar disc herniation (Karunanayake *et al.* 2013; Shiri *et al.* 2013). An example of this is that although golf is a low-intensity sport, overuse and poor swing mechanics place a significant abnormal mechanical load on the lumbar spine, potentially leading to injury and LBP (Reed and Wadsworth 2010).

2.8.3 Psychological Risk Factors

Numerous studies have discovered psychological factors, such as anxiety and depression, to co-exist with chronic pain (Adams 2006; Balagué *et al.* 2012; Alcântara *et al.* 2013; Bener *et al.* 2013). Psychological stressors can either exacerbate chronic LBP or chronic LBP can exacerbate psychological stressors. Both psychological processes and shared biological pathways and neurotransmitters play a role in the relationship between chronic LBP and psychological factors. It is more common for a number of psychological stressors and pain to exist concurrently than it is for just a psychological stressor to exist concurrently with pain (Bair *et al.* 2003; Kroenke *et al.* 2013; Koga *et al.* 2015). Attitudes and beliefs, such as fear avoidance and catastrophising; mood states such as anxiety and depression; and work-related factors such as job satisfaction, are psychological factors which play a role in interpreting pain signals as well as on both physical and mental health outcomes (Pincus *et al.* 2002; Viggers and Caltabiano 2012).

2.8.3.1 The fear avoidance model of pain and catastrophising

The fear avoidance model of pain is present in most, if not all, psychological conditions. It focuses on and explains the emotional and behavioural responses of individuals to pain and how this influences the chronicity of pain. It proposes that individuals respond to pain in one of two ways with differing outcomes. Some individuals with LBP will confront the pain, and despite its presence will continue with daily activities. This group of individuals tends to recover from acute pain fairly readily. Other individuals, however, may have negative beliefs about their pain and tend to catastrophise pain. Imagining the worst possible outcome for their pain, these individuals fear and hence avoid performing all tasks that they believe may cause additional pain or re-injury, including even menial daily activities. This leads to disuse, disability and often depression (Field, Newell and McCarthy 2010; Alappattu and Bishop 2011; Wertli *et al.* 2014).

Various components make up the fear avoidance model relating to LBP, including negative beliefs about LBP, catastrophising, fear avoidance beliefs and self-efficacy. Individuals with negative beliefs regarding LBP, such as the belief that their back pain will never improve, are more likely to develop chronic LBP than those who believe that their back pain will improve. Negative beliefs can stem from past personal experiences with pain or information received from secondary sources, and may lead to catastrophising (Field, Newell and McCarthy 2010).

Catastrophising, one of the best predictors for the development of chronic LBP, is a significant and often independent predictor of the development of chronic LBP (Ogunlana, Odole and Adejumo 2015). It has been broadly defined as "an exaggerated negative orientation toward pain stimuli and pain experience" (Sullivan 2012:32). Individuals who catastrophise irrationally amplify their pain and the outcomes associated with it - both current and in the future - and have a higher risk of developing chronic LBP than individuals who do not catastrophise. Fear avoidance beliefs, a result of catastrophising, refer to the apprehensions individuals have related to carrying out activities and the negative results this may have, such as re-injury. These beliefs subsequently lead to a ceasing or changing of activities and hence disability. Individuals who limit their activities due to fear are less likely to respond to treatment and more likely to develop chronic pain. On the other hand, individuals with a strong sense of self-efficacy tend to overcome their pain by confronting it and remaining active, and are less likely to develop chronic LBP than individuals with a poor sense of self-efficacy (Field, Newell and McCarthy 2010; Viggers and Caltabiano 2012).

Self-efficacy, originally defined by Bandura (1977) is an individual's belief in their own abilities to confront and manage a situation. Bandura (1977) proposed four factors influencing self-efficacy, including personal experience and accomplishments, observed accomplishments of others, encouragement or discouragement from others and the perception of physiological responses to a stressful situation. For individuals with negative beliefs about LBP, a tendency to catastrophise, fear avoidance beliefs and a low sense of self-efficacy, the fear of pain or injury may have a more detrimental effect on an individual than the pain itself. Ceasing activity due to fear could ultimately lead to musculoskeletal deconditioning, decreased pain tolerance and an indifference towards treatment (Linton and Shaw 2011; Viggers and Caltabiano 2012).

2.8.3.2 Anxiety

Anxiety is one of the most common psychological conditions affecting both the general population and patients in primary health care worldwide (Kroenke *et al.* 2013). The South African Stress and Health (SASH) study conducted by Herman *et al.* (2009) was the first large-scale population-based epidemiological study investigating common mental disorders in SA. Herman *et al.* (2009) reported that anxiety disorders were the most prevalent class of disorders experienced by the South African population and that SA was among the top ten countries in the world with the highest anxiety rates. Chronic LBP and anxiety are often found to co-exist. In a study by Castro *et al.* (2011) 18% of chronic LBP sufferers also experienced anxiety and 54%

of chronic LBP sufferers also experienced both anxiety and depression. Bener *et al.* (2013) conducted a study in which they reviewed the presence of psychological disorders in patients suffering from LBP and those without LBP. The presence of anxiety disorders was higher in patients with LBP than in those without LBP (Bener *et al.* 2013). Not only is pain commonly present in individuals who experience anxiety, it is more likely to be disabling in the presence of anxiety (Castro *et al.* 2011).

Anxiety has the same features and mechanisms as fear, however rather than being a response to an identifiable serious threat, anxiety is a physiological and emotional response by the CNS to a vague sense of threat or danger (Comer 2013). Fear and anxiety, although not pleasant sensations, are useful mechanisms in that they prepare an individual to act when danger threatens. Anxiety disorders occur when these mechanisms are persistent and excessive, causing individuals to despair over numerous activities and events. Individuals who suffer from one anxiety disorder will most commonly suffer from a second one as well, and many individuals who suffer from anxiety also suffer from depression (Comer 2013). There are a number of anxiety disorders which the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) lists under three broad categories, namely anxiety disorders, obsessive-compulsive and related disorders, and trauma- and stressor-related disorders (American Psychiatric Association 2013; Kroenke *et al.* 2013). The most common clinically presenting anxiety disorders include generalised anxiety disorder, panic disorder, social anxiety disorder and post-traumatic stress disorder, which are briefly presented in Table 2.6 (Donner and Lowry 2013; Kroenke *et al.* 2013).

Chronic pain has the ability to induce anxiety and anxiety has the ability to increase and prolong pain (Koga *et al.* 2015). Common neurobiological mechanisms are shared by pain, depression and anxiety. Neurotransmitters such as serotonin and norepinephrine are active in the development of both pain and anxiety (Castro *et al.* 2011). Koga *et al.* (2015) reported that both pain processing and anxiety cause increased activity in the ACC, one area of the brain which is responsible for LTP and the potential development of chronic pain. Individuals who suffer from anxiety disorders tend to catastrophise situations, with LBP being no exception. As described by the fear avoidance model of pain, this leads to fear avoidance behaviour which causes physical symptoms and exacerbates psychological symptoms, in this case anxiety. Furthermore, these individuals tend to have a poor sense of self-efficacy and hence their healing may be prolonged or even prevented due to anxiety (Castro *et al.* 2011; Gerrits *et al.* 2014).

Table 2.6 Common anxiety disorders

Disorder	Features
Generalised anxiety disorder	Excessive anxiety and worry, which is difficult to control, occurring most days for six months or more regarding numerous events or activities.
Panic disorder	Abrupt, severe, and unexpected panic attacks from either a calm or anxious state.
Social anxiety disorder	Fear or anxiety provoked by social situations in which an individual is exposed to possible scrutiny by others, including social interactions, being observed and performing in public.
Post-traumatic stress disorder	Significant distress of at least one month duration when recalling past exposure to an event that involved or almost involved death or serious injury that was considered a threat to self or others. Symptoms typically begin within the first three months after the trauma, although there may be a delay of months, or even years, before criteria for the diagnosis are met.

*Table adapted from DSM-V (American Psychiatric Association 2013)

2.8.3.3 *Depression*

Depression is a common and often chronic psychiatric disorder with numerous symptoms, including pain. Pain and depression, despite being independent disorders, frequently co-occur and when they do, they negatively affect one another and subsequently negatively affect the quality of life, disability and the effectiveness of treatment (Gambassi 2009; Kroenke *et al.* 2011). Depression has been identified as a risk factor for both the development and the perpetuation of LBP, and as a factor which adversely influences treatment outcomes (Melloh *et al.* 2013). Up to 92% of majorly depressed patients experience symptoms of pain (Bär *et al.* 2007) and almost 50% of individuals with chronic pain also suffer from depression (Tartakovsky 2013). The SASH study conducted by Herman *et al.* (2009) in SA, reported a 9.8% lifetime and twelve-month prevalence of a major depressive disorder and reported a major depressive episode to be the most common individual disorder with a 4.9% prevalence. Bener *et al.* (2013) conducted a study which compared LBP sufferers to healthy counterparts and found that LBP sufferers had a 13.7% prevalence of depression while the individuals without LBP had a much lower 8.5% prevalence of depression. In a quasi-experimental study using a total of 46 participants, Adams (2006) discovered that on diagnosis LBP patients had no history of clinical depression, but began to display depressive symptoms once the pain became chronic.

Unlike understandable passing feelings of sadness as reactions to daily events, depressive disorders tend to last for extended periods and interfere with normal functioning (Comer 2013). As described by the DSM-V (American Psychiatric Association 2013: 155), “the presence of sad, empty or irritable mood accompanied by somatic and cognitive changes that significantly affect the individual’s capacity to function” is the common feature of the disorders characterised as depressive. They differ in terms of duration, timing and cause (American Psychiatric Association 2013). Common depressive disorders as well as disorders which present with depressive symptoms are briefly presented in Table 2.7.

Much like the relationship between anxiety and chronic LBP, depression may be a symptom, a cause or a consequence of chronic LBP (Schneider *et al.* 2011). Physiological similarities have been found to exist between the mechanisms of pain and depression. This includes common nociceptive and affective pathways, and shared neurotransmitters such as serotonin and norepinephrine, which are involved in the gate-control mechanism of pain. As described by the fear avoidance model of pain, poor coping skills, low self-efficacy and a negative outlook towards pain and its outcome are all factors which are present and heightened in depressive disorders (Gambassi 2009; Dunne 2011; Kroenke *et al.* 2011; Nekovarova *et al.* 2014). Chronic pain affects moods, thoughts and behaviours, which often lead to voluntary psychological and social isolation of an individual. This impacts not only on everyday activities but also on independence, work efficacy and relationships with others. Experiencing these negative changes in everyday life may lead to depression (Schneider *et al.* 2011; Alcântara *et al.* 2013; Nekovarova *et al.* 2014). Additionally, the relationship between depression and chronic LBP may be heightened by predisposing or perpetuating factors common to both conditions, for example lack of physical activity, smoking and work status (Kroenke *et al.* 2011).

Table 2.7 Depressive disorders and disorders that present with depression

Disorder	Features
Major depressive disorder	Five or more of the following symptoms must be present almost daily for at least two weeks, with one symptom being either depressed mood, or loss of interest or pleasure: - Depressed mood. - Loss of interest or pleasure in usual activities. - Significant loss or gain of weight. - Insomnia or hypersomnia. - Psychomotor agitation or retardation. - Fatigue or loss of energy. - Feelings of worthlessness or inappropriate guilt. - Inability to concentrate and make decisions. - Recurrent thoughts of death or suicide.
Persistent depressive disorder	Predominantly depressed mood and other depressive symptoms present for at least two years, but criteria for major depression are not met.
Bipolar I disorder	At least one lifetime manic episode alternating with either hypomanic or major depressive episodes. Manic episodes entail a distinct period lasting at least one week during which mood is easily recognised as excessive and characterised by unrestrained and arbitrary enthusiasm for interpersonal, sexual or occupational interactions.
Bipolar II disorder	At least one lifetime episode of hypomania and at least one lifetime episode of major depression. Hypomanic episodes are milder and of shorter duration than manic symptoms and do not dramatically affect work or social life. Major depressive episodes are characterised by depressed mood or a loss of interest or pleasure.
Cyclothymic disorder	Alternating periods of hypomanic symptoms and periods of depressive symptoms over at least two years with symptom-free intervals lasting no longer than two months.

*Table adapted from DSM-V (American Psychiatric Association 2013)

2.8.3.4 *Work satisfaction*

Work-related psychosocial factors affect not only the duration of pain, but also the number of painful anatomical sites in which pain is present (Solidaki *et al.* 2010). A low level of work satisfaction is among the main risk factors for a recurrence of LBP (Coggon *et al.* 2013; Ratinaud *et al.* 2013). In a study investigating disabling musculoskeletal pain in working populations, Coggon *et al.* (2013) reported that 23.6% of participants who were suffering from LBP were not satisfied with their jobs. In comparing participants with acute and chronic LBP, Grotle *et al.* (2010) noted that 22% (n = 45) of participants with acute LBP (N = 258) had poor work satisfaction, while a slightly higher 29% (n = 132) of participants with chronic LBP (N = 668) had poor work satisfaction. Similarly, Hoogendoorn *et al.* (2002) and Heymans *et al.* (2009) found that longer work absence was largely related to poor job satisfaction.

The definition of work satisfaction varies across research studies. Following an analysis of work satisfaction by numerous authors, Aziri (2011: 78) described work satisfaction as "a feeling that appears as a result of the perception that the job enables the material and psychological needs". Ratinaud *et al.* (2013: 466) described work satisfaction as "general attitude towards work". Brodke *et al.* (2009: 3), who developed and revised the Abridged Job in General Scale (aJIG) utilised in this study, defined work satisfaction as "the feelings workers have about their jobs". The aJIG is a self-reported measure of work satisfaction which consists of adjectives that describe the participant's job overall. The participant is instructed to select 'Yes', 'No' or '?' in response to each word indicating that the adjective describes the job situation, the adjective does not describe the job situation, or the participant cannot decide respectively. Based on the responses, a work satisfaction score out of fifty is calculated, with fifty indicating good work satisfaction and a lower score indicating poor work satisfaction (Brodke *et al.* 2009).

While poor work satisfaction has been shown to affect the chronicity of pain (Balagué *et al.* 2012; Coggon *et al.* 2013; Ratinaud *et al.* 2013), the effect of chronic pain on work satisfaction has not been adequately investigated. As described by the fear avoidance model of pain, poor coping skills and low self-efficacy have an effect on the chronicity of pain. When confronted with challenging situations, an individual with pain in the workplace may allow negative beliefs about pain and coping influence their judgement of their work situation, causing them to feel dissatisfied with their job (Hülsheger *et al.* 2013).

Being aware of which socio-demographic and psychological risk factors play a role in the development and perpetuation of LBP plays a vital role in evaluating and managing a LBP patient appropriately.

2.9 EVALUATION AND MANAGEMENT

The evaluation and management of LBP go hand-in-hand, especially when treating a patient from a biopsychosocial perspective. It is difficult to administer an optimal management plan without an appropriate diagnosis (Dagenais and Haldeman 2011).

2.9.1 Evaluation

A thorough history and physical examination should be carried out in order to determine the nature of a patient's LBP (Bronfort *et al.* 2010). The main goals when assessing LBP are to rule out potentially serious spinal pathology by identifying red flags (presented in Table 2.2); to rule out specific causes of LBP; to rule out significant neurologic involvement; to determine the severity of symptoms and functional limitations; and to identify yellow flags (presented in Table 2.3) (Dagenais and Haldeman 2011). When potentially serious spinal pathology is suspected (based on a thorough medical history and physical examination) patients should be sent for laboratory assessments, urinalysis, magnetic resonance imaging (MRI) or computerised tomography (CT) scans, and subsequently referred to a specialist. Magnetic Resonance Imaging and CT scans may also be considered for patients whose symptoms do not resolve after six weeks of treatment, or patients who are potential candidates for surgery (Last and Hulbert 2009; Bronfort *et al.* 2010). Significant neurologic involvement may be caused by spinal nerve root compression, central canal stenosis, inflammation and other neurologic conditions, and is ruled out by patient history and neurologic examination. This includes an examination of dermatomes, myotomes and deep tendon reflexes together with orthopaedic tests such as the straight leg raise (Dagenais and Haldeman 2011). The straight leg raise is performed by fully extending the leg at the knee and flexing the hip between 30 and 70 degrees. Pain extending from the lower back into the lower limb indicates a positive straight leg raise (Last and Hulbert 2009). Yellow flags can be identified based on medical history and by utilising psychometric testing tools such as the SBST and BQ (Dagenais and Haldeman 2011). Identifying yellow flags is vital in predicting which patients will go on to develop chronic LBP, so as to intervene early and limit the impact of chronic LBP (Carey and Freburger 2014).

2.9.2 Management

The management of LBP, and especially chronic LBP, is challenging for a number of reasons ranging from the complex nature of pain to the non-standardised approach by physicians to clinical decision making (Chou and McCarberg 2011). Although these challenges are real and plenty, they can be overcome in a number of ways, including acknowledgement of the biopsychosocial model of pain, adopting a multidisciplinary approach and applying the guidelines provided by evidence-based medicine (Dagenais and Haldeman 2011).

The recommended first line of treatment for acute LBP currently consists of brief patient education, reassurance and simple analgesics or spinal manipulation therapy (SMT) (Balagué *et al.* 2007; Machado *et al.* 2010), together with the discouragement of prolonged bed rest and the recognition of psychosocial factors as risk factors for chronicity. Many physicians also include exercises in their initial care recommendations (Koes *et al.* 2010). For chronic LBP, treatment includes patient education including advice on lifestyle changes and fear avoidance behaviour, cognitive behavioural therapy (CBT), supervised exercises and multidisciplinary treatment, including SMT (Chou *et al.* 2007; Machado *et al.* 2010).

2.9.2.1 Patient education and lifestyle modification

Patient education is amongst the most highly recommended treatments for both acute and chronic LBP (Machado *et al.* 2010). The prognosis and consequences of LBP, as well as appropriate treatment options and self-management options for LBP, are often misunderstood by patients (Last and Hulbert 2009). The goal of patient education should be to provide a basic explanation of each of these factors. Reassurance and fear avoidance training are both aspects of patient education which focus on the necessity to remain active. Reassurance involves explaining to the patient that acute LBP is a common problem with a favourable prognosis, reducing a patient's anxiety about their back pain and in turn reducing the risk of developing fear avoidance behaviour (Chou *et al.* 2007). Fear avoidance training, usually utilised in chronic LBP, involves correcting harmful and inappropriate beliefs about a patient's pain and the way in which they react to the pain, and replacing them with positive and realistic thoughts and actions (Dagenais and Haldeman 2011). Patient education additionally involves informing patients of evidence-based options for self-management (Chou *et al.* 2007). Little or no involvement in physical activity, being overweight/obese and smoking are all risk factors for chronic LBP, hence

clinicians should also educate their patients on the dangers of these risk factors as well as on practical ways in which these risk factors can be modified (Dagenais and Haldeman 2011).

Physical activity assists in improving muscle and soft tissue function, restoring ROM and reducing fear of movement (Last and Hulbert 2009; World Health Organization 2010). It improves chronic LBP by releasing endorphins, which play a role in the gate control mechanism, improving confidence for daily activity, encouraging social interaction and decreasing general anxiety. Physical activity may also assist in weight loss (Dagenais and Haldeman 2011). Weight loss improves LBP by reducing exposure to the harmful effects of overweight and obesity, including additional weight on the load bearing spine and abnormal changes in normal posture which cause premature spinal degeneration (Björck-van Dijken *et al.* 2008). The cessation of smoking decreases exposure to the harmful effects of smoking on the lumbar spine (Shiri *et al.* 2010b).

2.9.2.2 Medication

Guidelines for the diagnosis and treatment of LBP suggest that following the assessment of the patient, together with the potential benefits, risk and efficacy of medications, clinicians should consider the use of first-line medication options namely, acetaminophen, non-steroidal anti-inflammatory drugs or muscle relaxants (Chou *et al.* 2007).

2.9.2.3 Manual therapy

Almost 50% of patients who suffer from LBP will seek chiropractic care as their first treatment option (Last and Hulbert 2009). In their LBP diagnosis and treatment guidelines, The American College of Physicians and the American Pain Society exclusively recommend SMT for acute LBP patients who do not improve with self-care; this is in conjunction with other non-pharmacological therapy, such as acupuncture and massage therapy, for sub-acute or chronic LBP (Chou *et al.* 2007). Bronfort *et al.* (2010) reported that SMT is effective in treating acute, sub-acute and chronic LBP. Dagenais and Haldeman (2011: 229) define SMT as “the application of high-velocity, low-amplitude manual thrusts to the spinal joints slightly beyond the passive range of joint motion”. After manually palpating the lumbar spine to assess local tenderness and inflammation, the practitioner identifies areas of segmental hypomobility to which the SMT will be applied. The mechanism of action for SMT is not fully understood, however it is suggested that applying an external force to the tissues of the spine elicit

immediate biomechanical effects such as the release of entrapped structures and disruption of adhesions, as well as improved neurologic and cellular responses (Dagenais and Haldeman 2011). Last and Hulbert (2009) suggest that in addition to providing relief of LBP, SMT improves psychological well-being and increases functioning.

Another common manual therapy is massage. Studies show that massage is effective in relieving chronic LBP in adults (Bronfort *et al.* 2010), especially when combined with exercise and delivered by a licensed therapist (Dagenais and Haldeman 2011). Massage refers to the manipulation of soft tissue using either the hands or a mechanical device to aid in relaxation, promote a sense of well-being and ease muscular tension (Dagenais and Haldeman 2011).

2.9.2.4 Physical modalities

Physical modalities can be instruments, machines and tools used in physical therapy to treat conditions such as chronic LBP (Dagenais and Haldeman 2011). The most commonly utilised physical modalities for LBP include transcutaneous electrical nerve stimulation, interferential current, the superficial application of heat or ice and therapeutic ultrasound (Saper *et al.* 2014). Each of these physical modalities acts as counterirritant stimuli, and relieves pain through the gate control mechanism. Superficial heat application, which is most commonly recommended for acute LBP, additionally causes muscle relaxation due to vasodilation (Chou *et al.* 2007; Bronfort *et al.* 2010). Superficial ice or cold application reduces inflammation by vasoconstriction. Therapeutic ultrasound can penetrate soft tissue structures more deeply than superficial heat and ice application. This allows it to promote soft tissue healing by improved blood flow and altered cell membrane activity (Bronfort *et al.* 2010; Dagenais and Haldeman 2011). Airaksinen *et al.* (2006) did not recommend the use of physical modalities in the treatment of chronic LBP.

2.9.2.5 Acupuncture

Acupuncture is a non-pharmacological therapy with pain relieving benefits (Chou *et al.* 2007) and when used in addition to other therapies, acupuncture provides relief of chronic LBP and improves functioning (Last and Hulbert 2009). Acupuncture involves using thin, solid, metallic needles to penetrate the skin and stimulate specific points along the body which are proposed to be related to various bodily functions. It is suggested that acupuncture assists in relieving

LBP by prompting the production of endorphins and neurotransmitters that control pain (Dagenais and Haldeman 2011).

2.9.2.6 Cognitive behavioural therapy

Patients with chronic LBP often develop maladaptive behaviours. These are detrimental behaviours which stem from irrational thoughts and beliefs and prevent an individual from appropriately adjusting to situations. The main aim of CBT is to identify these irrational beliefs and detrimental behaviours and assist the patient to rectify them. In the context of chronic LBP, the aim of CBT is to address psychological barriers to recovery (Dagenais and Haldeman 2011). It should be administered in conjunction with the appropriate previously discussed interventions (Balagué *et al.* 2007; Chou *et al.* 2007). Table 2.8 presents the procedure involved in CBT. While certain aspects of CBT can be provided by all clinicians, such as discussing the importance of remaining active, it must be noted that CBT itself should only be administered by licensed mental health professionals such as therapists, psychologists and psychiatrists (Dagenais and Haldeman 2011; Carey and Freburger 2014).

Table 2.8 Cognitive behavioural therapy

Phase	Goal and procedure
Assessment	The therapist identifies the extent of psychosocial impairment and determine the most appropriate course of action by: - Interviewing the patient and family. - Self-reported measures.
Reconceptualisation	The therapist assists patients to challenge and question the rationality of maladaptive thoughts such as 'I am never going to get better'.
Skills acquisition	The therapist teaches the patient to deal with daily obstacles and to avoid falling into the pattern of maladaptive thoughts.
Skills consolidation and application training	Patients are given homework which helps them reinforce the skills they have acquired through therapy.
Generalisation and maintenance	The therapist and the patient discuss the future and coping once the patient has left treatment.
Post-treatment assessment and follow-up	The therapist monitors and evaluates the patient's application of CBT skills to their lives.

*Table adapted from Dagenais and Haldeman (2011)

Nekovarova *et al.* (2014) suggested that psychological factors, specifically depression, are often overlooked in primary care settings while somatic or pain symptoms in patients with depression are not given adequate attention by psychiatrists. Hence, as suggested by Kroenke *et al*. (2009) and echoed by many other studies (Dagenais and Haldeman 2011; Foster and Delitto 2011), the optimal approach to successfully managing chronic LBP is a multidisciplinary approach based on the biopsychosocial model of pain and involving more than one provider. Last and Hulbert (2009) reported a number of benefits of adopting a multidisciplinary approach including subjective alleviation of disability, marked pain reduction, faster return of the patient to work and less absence from work once the patient has returned.

2.10 SUMMARY

Despite a growing body of research into LBP over the past few decades, LBP continues to be a growing concern in health care. Low back pain, and especially chronic LBP, has the ability to adversely affect an individual biologically, psychologically and socially. Biological, psychological and social factors can in turn have an effect on the progression of LBP. Sociodemographic risk factors which affect LBP include age, gender, and smoking, among others. Psychosocial risk factors, termed yellow flags, have a significant effect on perpetuating LBP and these include fear avoidance behaviour and catastrophising, work satisfaction, anxiety and depression

Studies have indicated that the most effective way in which LBP can be managed is by taking into account both psychological and physical factors and taking a collaborative and integrative treatment approach, which may entail working with more than one health care provider. Correct assessment and diagnosis of biopsychosocial factors affecting a patient is therefore essential in determining the correct treatment approach. A useful and objective manner for determining psychological risk for chronic LBP is psychometric testing using questionnaires such as the SBST and the BQ. Psychometric testing can further be used to evaluate a patient's outcome and response to treatment.

CHAPTER THREE

MATERIALS AND METHODS

3.1 INTRODUCTION

This chapter describes the design, sample size and characteristic and measurement tools utilised in this study, as well as the procedures followed for data collection and statistical analysis.

3.2 STUDY DESIGN

The design of this research was a descriptive, quantitative, survey-based study. Approval to conduct this study and ethical clearance was obtained from the Institutional Research and Ethics Committee (IREC) at DUT (Durban University of Technology) (ethics clearance certificate number: 063/14 [Appendix A]), indicating that the proposal and hence the research to be undertaken is compliant with the Helsinki Declaration of 1975.

3.3 STUDY POPULATION AND RECRUITMENT METHOD

The study population consisted of all patients presenting to the DUT CDC (Chiropractic Day Clinic) with non-specific LBP as new patients, or as former or current patients presenting with non-specific LBP as a new complaint. Treatment at the DUT CDC is available to all members of the public at reduced rates. Patients that present to the DUT CDC are treated by students completing their Master's Degree in Technology of Chiropractic. Students are supervised by qualified chiropractic clinicians (Chiropractic at DUT 2015). The patients had to be over the age of eighteen. Recruitment took place during October and November 2014, and February 2015. The patients were approached directly by the researcher when they presented to the DUT CDC and asked if they would like to participate in the research (prior to their consultation). Those who agreed to participate in the research were asked four screening questions to ensure that they qualified for the study. The questions and their desired responses are presented in Table 3.1. The information gathered from the interview remained confidential regardless of whether the patient was included or excluded from the study; the information was stored in a secure file. The patients who qualified for the study were then handed the Letter of Information and

Informed Consent (Appendix E), as well as the three questionnaires (Appendices F, G and H) to complete.

3.4 SAMPLE SIZE

The study took place over a three month period with an estimated population size of 200 patients. A minimum sample size of 132, determined by Singh (2014) and based on previous studies by Jaman (2007) and McDonald (2012), was required.

3.5 SAMPLE CHARACTERISTICS

To be included in the study, the participants had to meet the following criteria:

3.5.1 Inclusion Criteria

- The participants had to be aged eighteen years and over.
- All participants had to present at the DUT CDC.
- Participants experiencing non-specific LBP, with or without musculoskeletal pain in *addition* to the LBP.

3.5.2 Exclusion Criteria

- Patients who were attending the clinic in order to participate in a different research study.
- Patients with LBP that was attributable to a recognisable, known specific pathology.

3.6 MEASUREMENT TOOLS

Three pre-validated questionnaires were used for this study.

3.6.1 Demographic and Social History Questionnaire

A pre-validated questionnaire was used (Appendix F), addressing demographic and social factors which contribute to the chronicity of LBP. This questionnaire was derived from a similar study by Dyer (2012) conducted at the DUT (permission was granted to use the questionnaire – Appendix B). The questionnaire was combined with the Abridged Job in General Scale,

developed and updated by the Bowling Green State University (permission was granted – Appendix C), which determined job satisfaction. The pre-validated questionnaire addressed questions such as age, sex, level of education, living conditions, alcohol use, smoking status, levels of physical activity and job satisfaction.

3.6.2 Psychometrics

The term psychometrics is an abbreviation for psychological measurement (Coaley 2010). From clinical to occupational settings, psychometrics seeks to understand and measure the psychology of an individual by using psychological assessments in the form of quantitative inventories, tests or questionnaires. These assessments are designed to describe, predict, explain, diagnose and make decisions concerning an individual (Coaley 2010). Psychometric tools for assessing psychosocial risk factors in LBP are important, as primary health care practitioners are often poorly equipped in identifying these risk factors and frequently do not have the time to conduct interview assessments (Heneweer *et al.* 2010). While insights provided through interviews and observations are vital and informative, they are often influenced by factors personal to the individual doing the assessment, and therefore subjective. Alternatively, psychological assessments use a standardised, straightforward set of rules to quantify attributes of people, objects or events, rather than focusing on the subjects themselves (Aguinis, Henle and Ostroff 2001). By minimising subjective judgment in this manner, psychometrics provides a fundamental benefit of objectivity (Aguinis, Henle and Ostroff 2001). Psychological assessments, specifically in the form of questionnaires, are convenient to administer, require little skill and allow for unambiguous, unbiased interpretation (Accident Compensation Corporation and The National Health Committee 2004). Both the BQ and SBST are multidimensional psychological assessments in the form of validated questionnaires which aim to describe, identify and predict risk factors for the chronicity of LBP. Both are PROMs designed to assist primary care clinicians, such as GPs and chiropractors in decision-making concerning initial treatment options for LBP by identifying the presence of yellow flags (Hill *et al.* 2008).

3.6.2.1 The Keele STarT Back Screening Tool

The SBST (Appendix G) is a nine-item brief validated tool (Hill *et al.* 2008) consisting of nine questions covering aspects of fear avoidance beliefs, depression, disability and presence of leg pain and neck/shoulder pain. It is designed with the intention of assisting primary care clinicians

in their initial treatment choices for LBP. This is achieved by categorising patients with LBP into relevant sub-groups graded by their risk for developing persistent disabling symptoms, or yellow flags, which will perpetuate their LBP (Kongsted *et al*., 2011). By examining modifiable prognostic psychosocial factors such as fear avoidance, anxiety, catastrophising, depression and 'bothersomeness', patients are found to be at low-, medium- or high-risk of chronicity of LBP (Hay *et al.* 2008; Hill *et al.* 2008). Categorising patients into these relevant sub-groups allows clinicians to employ appropriate and specific treatment protocols to each patient to decrease the possibility of poor outcome. This targeted approach is more effective in areas of both treatment and cost (Main *et al.* 2012). Although concise, the SBST covers the necessities for gathering sufficient information about psychosocial risk factors and can be filled in directly by the patient. Questions one to eight require 'agree' or 'disagree' responses, while question nine, the 'bothersomeness' question, uses a Likert scale. Total scores range from zero to nine; sub-scores, which are used to sub-group patients, range from zero to five. Patients with a sub-score of four or five are classified as at high-risk of chronicity (Irgens *et al.* 2013). Kongsted, Johannesen and Leboeuf-Yde (2011: 10) explored the feasibility of the SBST in chiropractic clinics and determined that "the SBST questionnaire was feasible to use in chiropractic practice and risk groups were related to the presence of well-established psychological prognostic factors." Kongsted, Johannesen and Leboeuf-Yde (2011) also suggested that based on future success in predicting prognosis the SBT could, in time, be used by clinicians as a relevant alternative to other more comprehensive questionnaires.

3.6.2.2 The Bournemouth Questionnaire

Much like the SBST, the BQ is a validated questionnaire focusing on anxiety, depression and fear-avoidance in relation to physical activity and own pain control, and pain and disability. The BQ (Appendix H) has been developed to be a simple yet comprehensive tool for use in routine practice settings in back pain patients and is widely used in chiropractic clinical settings and research. It is a multidimensional patient-reported outcome consisting of seven questions measured on a ten-point scale (Bolton and Breen 1999). Although primarily designed to measure change in LBP symptomatology, the Bournemouth pre-treatment questionnaire has been found effective in predicting chronicity of LBP and the risk of sick leave one year after initial treatment by chiropractors. All seven questions of the BQ use eleven-point numerical rating scales (0-10) as responses, which added together provide a total BQ score out of ten, with a maximum of 70. Higher scores represent higher pain and dysfunction, with a score of

over 35 indicating a medium to high risk of chronicity (Newell and Bolton 2010). The BQ has been tested for consistency, dependability, validity, and comprehension for patients, and found to be useful in these areas (Larsen and Leboeuf-Yde 2005).

3.7 STUDY PROCEDURE

Permission was obtained from the clinic director of the DUT CDC to conduct the research study at the DUT CDC (Appendix D). Once the prospective patients had been approached by the researcher and asked the screening questions in order to ensure that they qualified for the study (Table 3.1), they were handed a Letter of Information and Informed Consent (Appendix E) which they were required to sign in order to participate in the study, as well as the three questionnaires (Appendices F, G and H). The qualifying questions were asked, by the researcher, in the clinic room in which the patient was to be treated and the questionnaires were completed in the same venue. All documents were to be filled in by the end of the first consultation. The questionnaires took approximately ten to fifteen minutes to complete and participants were given the choice to complete them either before or after their appointment so as not to interrupt the treatment time.

Table 3.1: Screening questions and desired responses

Screening Question		**Answer**
1.	How old are you?	Patients had to be over eighteen years old.
2.	Where is your pain?	Pain had to be located in the lumbar region of the spine below the ribcage and above the pelvis (Dagenais and Haldeman 2012).
3.	Do you have a history of surgery or trauma?	This indicated a known cause of back pain or fracture and would exclude the patient from the study.
4.	Do you have fever, loss of bowel or bladder function, numbness in your legs, night pain and/or unexplained weight loss?	If the patient answered Yes, they were excluded from the study as these symptoms suggest specific and serious causes for LBP (Dagenais and Haldeman 2012).

Before the participant began their consultation with the Master's student treating them, they were weighed and measured in height by the researcher in order to determine body mass index (BMI). The BMI was calculated by dividing the individual's body weight by the square of his/her

height. Once the consultation and treatment had been completed the participant's diagnosis given by the Master's student was confirmed; those who had a pathological cause for their LBP were excluded from the study.

3.8 STATISTICAL ANALYSIS

Raw data was transferred from the data collection sheets onto an excel spread sheet by the researcher for statistical analysis. The IBM SPSS version 22 was used for the analysis. Variables measured in the demographic and psychometric profiles of the participants were analysed using descriptive analysis, such as percentages, frequencies, mean, standard deviation and range. They were presented using bar graphs, pie charts and cross-tabulations. Associations between demographic and psychometric were described using cross-tabulations. A p value <0.05 was considered as statistically significant. Chi square and Fisher's exact tests were used to compare proportions between groups.

3.9 ETHICAL CONSIDERATIONS

All participants were required to read and sign the Letter of Information and Informed Consent (Appendix E). Participants' name/s and other identifiers were not placed on the questionnaires. All questionnaires were coded to ensure participant anonymity and confidentiality. All data was recorded, reported and analysed using a code allocation in order to ensure participant confidentiality.

The Letter of Information and Informed Consent (Appendix E) was stored in a ballot box separate from the three questionnaires (Appendices F, G and H) in order to ensure that the questionnaires could not be linked to specific participants; thus participant confidentiality was maintained.

The researcher, research supervisor and research co-supervisor had exclusive access to the research data, which was locked away in safe storage during the research process. The research data, along with the confidential information gathered from the interview, will be kept safe in the DUT Chiropractic department for approximately five years, after which all data will be disposed of by means of shredding.

Participation in the study was voluntary and no remuneration was awarded. The participants were afforded the opportunity to withdraw from the study at any point in time.

3.10 LIMITATIONS

All participants are required to report honestly in their responses to the questionnaire. It is not possible to determine, however, if the participant did in fact elect to respond honestly (unless blatant), and therefore such responses would still be included in the outcomes of this study.

CHAPTER FOUR

RESULTS

This chapter presents the results of the information gathered from the questionnaires distributed in this study. It presents the demographic profile and psychometric profile of participants and thereafter describes any associations between the two.

4.1 RESPONSE RATE

Of the 132 patients invited to participate in the study, 132 met the inclusion criteria and agreed to participate in the study. The 132 questionnaires were dispatched to those willing participants and 132 were returned, providing a 100% response rate.

4.2 DEMOGRAPHIC PROFILE

4.2.1 Age

The mean age of respondents recorded for the study was 41.9 years with a standard deviation of 16.9. Ages of respondents ranged from nineteen to 77 years.

4.2.2 Gender

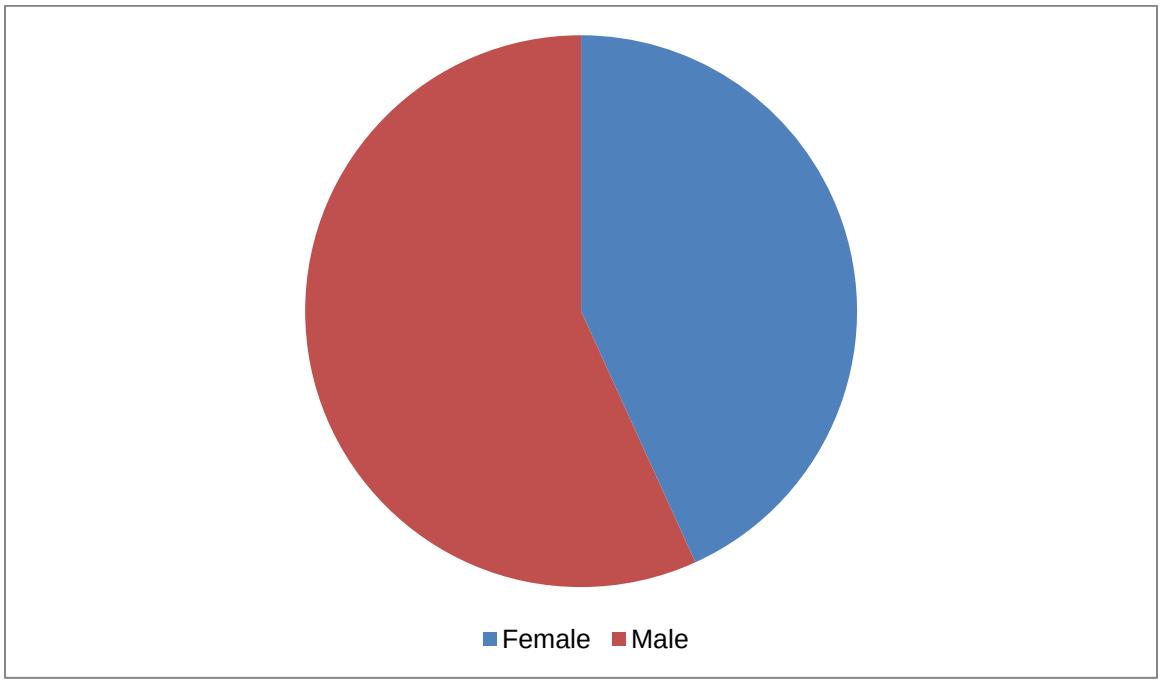

Figure 4.1 Pie chart representing the gender distribution of participants

Figure 4.1 is a pie chart representing the gender distribution of the participants in this study. A greater portion of the total participants presenting with LBP (N = 132) were male, 56.8% (n = 75), and 43.2% (n = 57) were female.

4.2.3 BMI

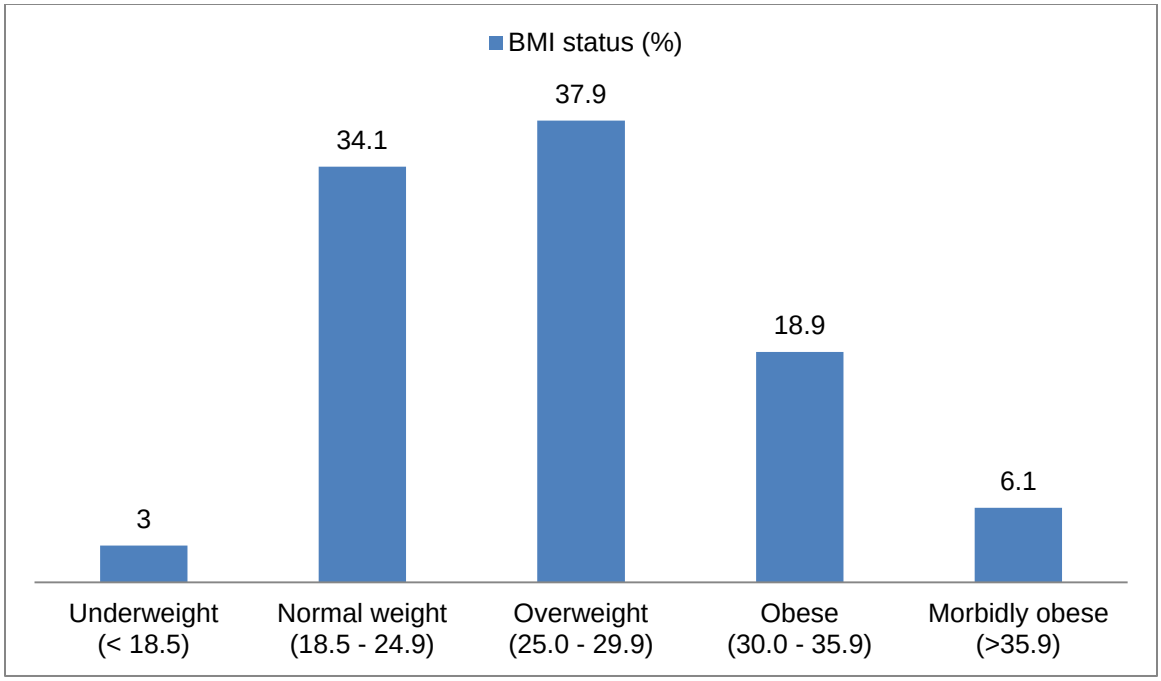

Figure 4.2 Bar graph representing BMI status of participants (%)

As represented by the bar graph in Figure 4.2, the BMI values of participants in this study ranged from 16.8 to 49.6 kg/m² with a mean value of 27.5 and a standard deviation of 5.4. Of the total number of participants (N = 132), the majority of participants, 37.9% (n = 50) were classified as overweight, while the minority, 3.0% (n = 4) were classified as underweight.

4.2.4 Level of education

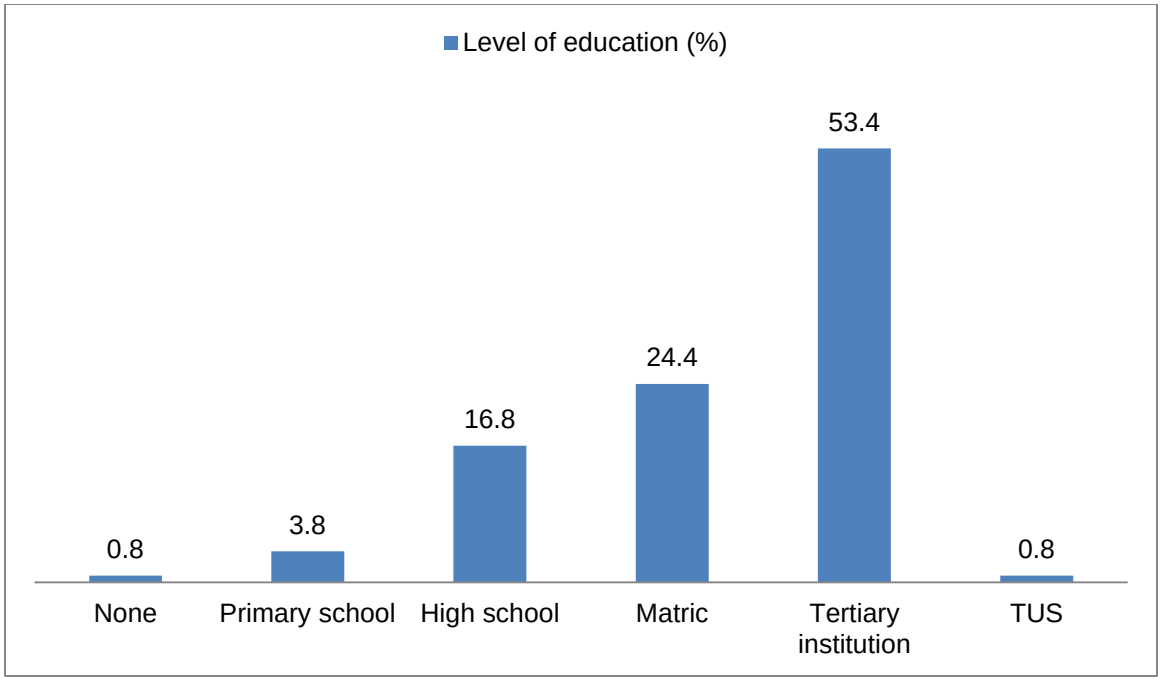

Figure 4.3 Bar graph representing the highest level of formal education attained by participants (%)

Figure 4.3 represents the highest level of formal education attained by participants. Of the total participants (N = 132), almost half of the sample, 53.4 % (n = 70), had attended or graduated from a tertiary institution, 24.4 % (n = 32) had matriculated, 16.8 % (n = 22) had attended high school, and the remaining participants had received a primary school education or lower.

4.2.5 Smoking and Alcohol Consumption

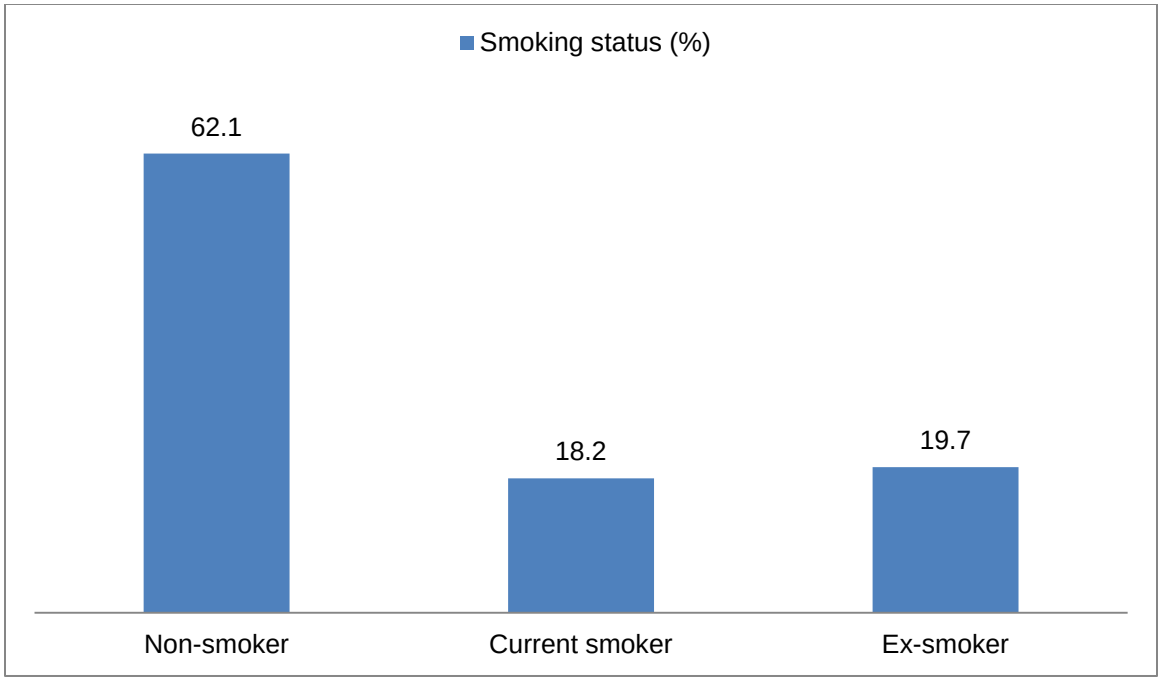

Figure 4.4 Bar graph representing participants' smoking status (%)

The above bar graph (Figure 4.4) represents the smoking status of participants in this study. Two thirds of the participants, 62.1 % (n = 82), were non-smokers; 19.7 % (n = 26) were ex-smokers and 18.2 % were current smokers.

Table 4.1 Alcohol consumption and amount

Alcohol Consumption % (n)		Amount (units/ week)		
		1 – 3	**4 – 6**	**>6**
Yes	43.8 (57)	64.9 (37)	17.5 (10)	17.5 (10)
No	56.2 (73)	-	-	-

As represented in Table 4.1, just over half (56.2%; n = 73) of the total participants (N = 132) did not consume alcohol, while 43.8% (n = 57) did consume alcohol. Of those who consumed alcohol (n = 57), the majority 64.9% (n = 37) consumed between one and three units per week.

4.2.6 Physical Activity

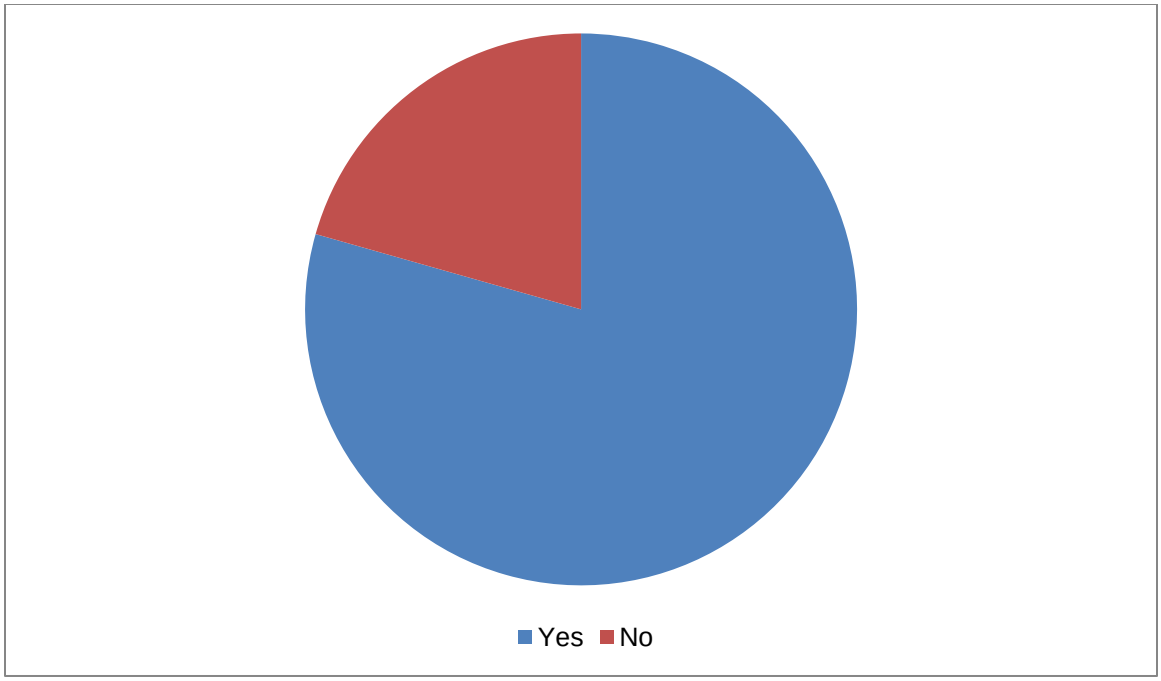

Figure 4.5 Pie chart representing participants partaking in physical activity

Figure 4.5 represents the portion of participants taking part in physical activity. A majority of 79.4% (n = 104) of the total participants (N =132) took part in some form of physical exercise, while 20.6% (n = 27) took part in no physical exercise. Of those who took part in physical exercise (N = 104), the most common activities were walking 19.9% (n =46), and cardio 15.2% (n = 35).

Table 4.2 Time spent on physical activity

	25th percentile	Median	75th percentile
Time spent exercising (Hours/ week)	2.5	4.0	6.0

As presented in Table 4.2, less than 25% (n = 33) of the total participants (N = 132) spent an average of less than 2.5 hours exercising per week. Less than 50% (n = 66) spent less than four hours exercising per week and less than 75% (n = 99) spent less than six hours exercising per week.

4.2.7 Work Status and Activity

Table 4.3 Work status

Employed	% (n)	**Unemployed**	% (n)
Full time	34.1 (45)	Student	15.9 (21)
Self-employed	18.9 (25)	Retired	14.4 (19)
Part time	7.6 (10)	Housewife	7.6 (10)
		Unemployed	1.5 (2)
TOTAL % (n)	**60.6 (80)**		**39.4 (52)**

Table 4.3 displays the work status of the participants in this study. Of the total participants (N = 132), 60.6 % (n = 80) were currently in full time or part time employment or were self-employed, while 39.4% (n = 52) were unemployed.

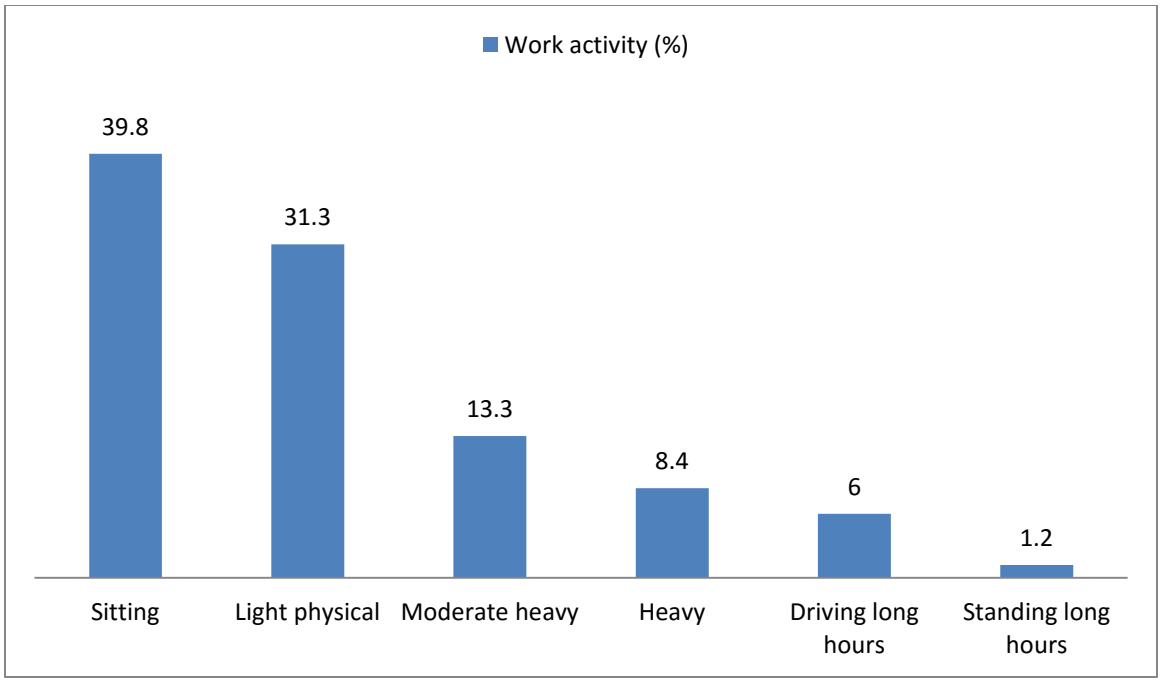

Figure 4.6 Bar graph representing the work activity performed by participants (%)

Figure 4.6 represents the work activity performed by the employed participants in this study in the form of a bar graph. Of the participants who were employed (N = 80), just over one third, 39.8% (n = 33) selected sitting as their most common work activity; 31.3% (n = 26) were most commonly involved in light physical work, 13.3% (n = 11) in moderate heavy work and 8.4% (n =7) in heavy work. The minority listed either driving long hours, 6% (n = 5), or standing long hours, 1.2% (n = 1), as their most common work activity.

4.3 PSYCHOMETRIC PROFILE

4.3.1 Work Satisfaction

Table 4.4 Work satisfaction scores

	25th percentile	Median	75th percentile
aJIG score	39.0	43.0	48.0

As indicated by Table 4.4, less than 25% (n = 20) of the working population (N = 80) scored below 39 on the work satisfaction questionnaire. Less than 50% (n = 40) scored below 43 and less than 75% (n = 60) scored below 48. The highest score possible on the abridged Job In General scale was 50, with higher scores indicating greater work satisfaction. The results indicate that the majority of the working population (n = 80) was satisfied with their jobs.

4.3.2 Risk of Chronicity

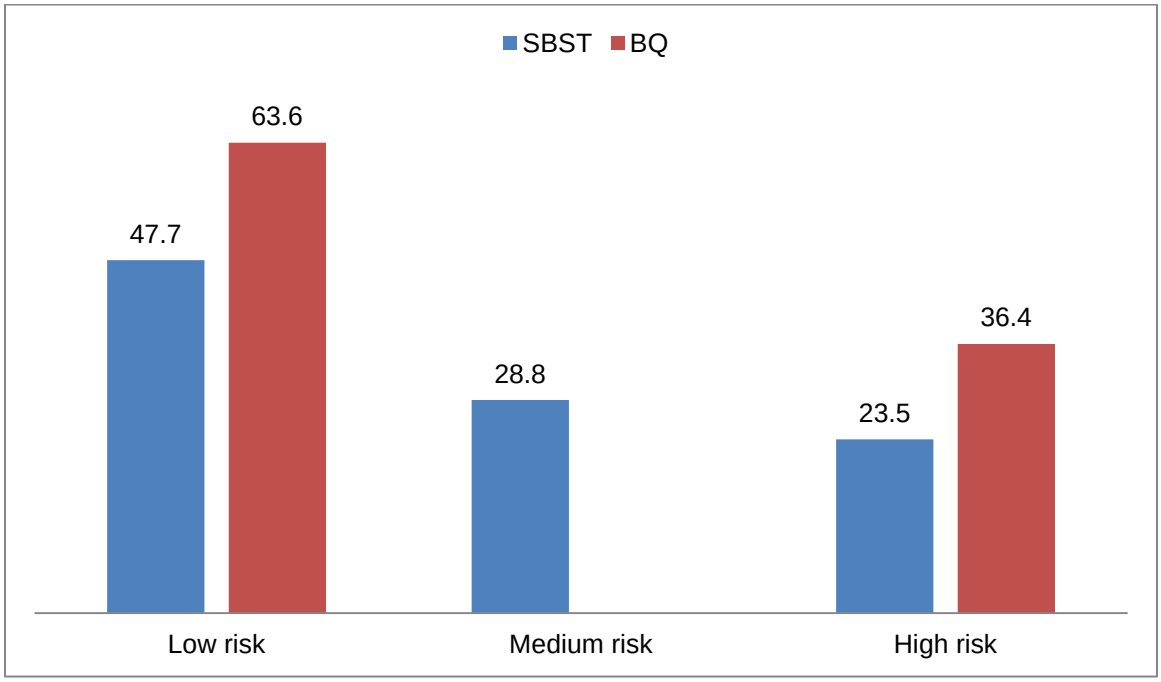

Figure 4.7 Bar graph representing participants' risk of developing chronic LBP (%) based on the Keele STarT Back Screening Tool and the Bournemouth Questionnaire

Figure 4.7 represents the participants' risk of developing chronic LBP based on the SBST and BQ in the form of a bar graph. Based on the Keele STarT Back Screening Tool (SBST), 47.7% (n = 63) of the total population (N = 132) had a low risk of developing chronic LBP; 28.8% (n = 38) had a medium risk of developing chronic LBP, and 23.5 % (n = 31) had a high risk of developing chronic LBP.

The Bournemouth Questionnaire (BQ) indicated that 63.6% (n = 84) of the total population (N = 132) scored 35 or less and thus had a low risk of developing chronic LBP, while 36.4% (n = 48) scored above 35 and thus had a medium to high risk of developing chronic LBP.

Table 4.5 Cross tabulation comparing SBST and BQ risk groups

		BQ category		Total
		Low risk of chronicity	High risk of chronicity	
SBST category	Low	96.8 (61)	3.2 (2)	100 (63)
	Medium	50.0 (19)	50.0 (19)	100 (38)
	High	12.9 (4)	87.1 (27)	100 (31)
Total % (n)		63.6 (84)	36.4 (48)	100 (132)

Pearson's chi square = 67.5, p <0.001

Using cross-tabulation, SBST and BQ risk groups are compared in Table 4.5. About 96.8% (n = 61) of the participants who had a low risk of chronicity of LBP according to the SBST (N = 63) were also found to have a low risk of chronicity according to the BQ, while the remaining 3.2% (n = 2) were found to have a high risk of chronicity of LBP according to the BQ. Of the 38 participants who were found to have a medium risk of chronicity of LBP according to the SBST, 50% (n = 19) had a low risk of chronicity for LBP according to the BQ and 50% (n = 19) had a high risk of chronicity according to the BQ. The results indicated that 87.1% (n = 27) of the participants who had a high risk of chronicity according to the SBST (N = 31) also had a high risk of chronicity according to the BQ, and the remaining 12.9% (n = 4) had a low risk of chronicity according to the BQ. With a p value of < 0.001, a very strong association was found between the SBST and the BQ risk groups.

4.4 ASSOCIATIONS BETWEEN DEMOGRAPHIC AND PSYCHOMETRIC CHARACTERISTICS

4.4.1 Age

Table 4.6 Association between age and risk of chronicity

	Risk of chronicity	Age (years)			*p* value
		N	Mean	SD	
SBST	Low	63	39.7	18.1	0.141
	Medium	38	41.3	16.0	
	High	31	47.0	14.9	
BQ	Low	84	40.6	18.1	0.256
	High	48	44.1	14.5	

As presented in Table 4.6, age was not found to be significantly associated with an increased risk of chronicity for LBP. It can be noted, however, that the mean age in the low risk groups was similar for the SBST, 39.7 years, and the BQ, 40.6 years. Additionally, it can be noted that the groups with a high risk of chronicity in both the SBST and the BQ had the highest mean age. The standard deviation for each risk group was greater than 14.5, indicating that the risk of chronicity was distributed throughout the age groups (from nineteen to 77).

4.4.2 Gender

Table 4.7 Association between gender and risk of chronicity

	Risk of chronicity	Gender % (n)			*p* value
		Female	Male	Total	
SBST	Low	38.6 (22)	54.7 (41)	47.7 (63)	0.176
	Medium	35.1 (20)	24.0 (18)	28.8 (38)	
	High	26.3 (15)	21.3(16)	23.5 (31)	
BQ	Low	49.1 (28)	74.7 (56)	63.6 (84)	0.003*
	High	50.9 (29)	25.3 (19)	36.4 (48)	

*significant *p* value

Table 4.7 presents the association between gender and risk of chronicity of LBP based on the SBST and BQ. According to the SBST, 38.6% (n = 22) of total female participants (N = 57) and 54.7% (n = 41) of all male participants (N = 75) had a low risk of developing chronic LBP; 35.1% (n = 20) of the female participants and 24.0% (n = 18) of the male participants had a medium risk of developing chronic LBP; with 26.3% (15) of the female participants and 21.3% (n = 16) of the male participants having a high risk of developing chronic LBP. Although there was no significant association between gender and the SBST risk groups, it can be noted that the percentage of female participants was higher in both the medium and high risk groups for developing chronic LBP.

Gender was found to be significantly associated with an increased risk of developing chronic LBP according to the BQ. Of the total male participants (N = 75), 74.7% (n = 56) had a low risk of chronicity of LBP and only 25.3% (n = 19) had a high risk of chronicity of LBP according to the BQ. Of the total female participants (N= 57), 49.1% (n = 28) had a low risk of chronicity of LBP and 50.9% (n = 29) had a high risk of chronicity of LBP according to the BQ. Females were at greater risk of developing chronic LBP than males.

4.4.3 BMI

Table 4.8 Cross tabulation presenting association between BMI and risk of chronicity

	Risk of chronicity	BMI category % (n)						*p* value
		Underweight	Normal	Overweight	Obese	Morbidly obese	Total	
SBST	Low	75 (3)	57.8 (26)	44 (2)	40 (10)	25 (2)	47.7 (63)	0.521
	Medium	-	20 (9)	34 (17)	36 (9)	37.5 (3)	28.8 (38)	
	High	25 (1)	22.2 (10)	22 (11)	24 (6)	37.5 (3)	23.5 (31)	
	Total	100 (4)	100 (45)	100 (50)	100 (25)	100 (8)	100 (132	
BQ	Low	75 (3)	75.6 (34)	60 (30)	60 (15)	25 (2)	63.6 (84)	0.073
	High	25 (1)	24.4 (11)	40 (20)	40 (10)	75 (6)	36.4 (48)	
	Total	100 (4)	100 (45)	100 (50)	100 (25)	100 (8)	100 (132)	

Table 4.8 is a cross tabulation presenting the association between BMI and risk of chronicity of LBP based on the SBST and BQ. There was no statistically significant association between BMI and risk of chronicity of LBP according to the SBST. Of the participants who presented as underweight (N = 4), 75% (n = 3) had a low risk of developing chronic LBP and the remaining 25% (n = 1) had a high risk of developing chronic LBP according to the SBST. Of the participants who presented as normal weight (N = 45), 57.8% (n = 26) had a low risk of developing chronic LBP, 20% (n = 9) had a medium risk of developing chronic LBP and 22.2% (n = 10) had a high risk of developing chronic LBP according to the SBST. Of the participants presenting as overweight (N = 50), 44% (n = 2) had a low risk of developing chronic LBP, 34% (n = 17) had a medium risk of developing chronic LBP and 22% (n = 11) had a high risk of developing chronic LBP according to the SBST. In the obese category (N = 25), 40% (n = 10) of the participants had a low risk of developing chronic LBP, 36% (n = 9) had a medium risk of developing chronic LBP and 24% (n = 6) had a high risk of developing chronic LBP according to

the SBST. In the morbidly obese category (N = 8), 25% (n = 2) of the participants had a low risk of developing chronic LBP, 37.5% (n = 3) had a medium risk of developing chronic LBP and 37.5% (n = 3) had a high risk of developing chronic LBP according to the SBST. Although there was no statistical significance between BMI and risk of chronicity according to the SBST, it can be noted that the percentage of participants in the obese and morbidly obese categories was highest in the medium and high risk groups for developing chronic LBP. Additionally, it can be noted that participants in the underweight and normal weight categories had the lowest risk of developing chronic LBP.

There was a borderline non-significant association between BMI category and risk of LBP chronicity according to the BQ (p = 0.073). In the underweight category (N = 4), 75% (n = 3) of the participants had a low risk of developing chronic LBP and 25% (n = 1) had a high risk of developing chronic LBP according to the BQ. In the normal weight category (N = 45), 75.6% (n = 34) of the participants had a low risk of developing chronic LBP and the remaining 24.4% (n = 11) had a high risk of developing chronic LBP according to the BQ. Of the participants in the overweight category (N = 50), 60% (n = 30) had a low risk of developing chronic LBP and 40% (n = 20) had a high risk of developing chronic LBP according to the BQ. Of the participants in the obese category (N = 25), 60% (n = 15) had a low risk of developing chronic LBP and 40% (n = 10) had a high risk of developing chronic LBP according to the BQ. Of the participants in the morbidly obese category (N = 8), 25% (n = 2) had a low risk of developing chronic LBP and 75% (n = 6) had a high risk of developing chronic LBP according to the BQ. Similar to the results from the SBST it can be noted that according to the BQ, underweight and normal weight participants had the lowest risk of developing chronic LBP, whereas participants in the overweight, obese and morbidly obese categories had the highest risk of developing chronic LBP.

4.4.4 Level of Education

Table 4.9 Association between level of education and risk of chronicity

	Risk of chronicity	Level of education % (n)				*p* value
		None and primary school	High school	Matric	Tertiary	
SBST	Low	16.7 (1)	40.9 (9)	56.3 (18)	49.3 (35)	0.183
	Medium	33.3 (2)	18.2 (4)	28.1 (9)	31 (22)	
	High	50 (3)	40.9 (9)	15.6 (5)	19.7 (14)	
	Total	100 (6)	100 (22)	100 (32)	100 (71)	
BQ	Low	50 (3)	59.1 (13)	71.9 (23)	63.4 (45)	0.656
	High	50 (3)	40.9 (9)	28.1 (9)	36.6 (26)	
	Total	100 (6)	100 (22)	100 (32)	100 (71)	

Table 4.9, presenting the association between level of education and risk of chronicity of LBP, indicates that no significant association was found between the highest level of education that participants had acquired and the risk of developing chronic LBP. It can be noted, however, that participants who had no formal schooling or had only attended primary school (N = 6) had the highest risk of developing chronic LBP, and participants who had matriculated (N = 32) had the lowest risk of developing chronic LBP according to both the SBST and the BQ.

4.4.5 Smoking and Alcohol Consumption

Table 4.10 Association between smoking status and risk of chronicity

Risk of chronicity		Smoking status % (n)			*p* value
		Non-smoker	Current smoker	Ex-smoker	
SBST	Low	58.5 (48)	25 (6)	34.6 (9)	0.031*
	Medium	23.2 (19)	41.7 (10)	34.6 (9)	
	High	18.3 (15)	33.3 (8)	30.8 (8)	
Total		100 (82)	100 (24)	100 (26)	
BQ	Low	73.2 (60)	45.8 (11)	50 (13)	0.014*
	High	26.8 (22)	54.2 (13)	50 (13)	
Total		100 (82)	100 (24)	100 (26)	

*significant *p* value

Table 4.10 presents the association between smoking status and risk of chronicity of LBP. There was a significant association between smoking and an increased risk of chronic LBP according to both the SBST and BQ. Of the non-smoking participants (N = 82), 58.5% (n = 48) had a low risk of developing chronic LBP, 23.2% (n = 19) had a medium risk of developing chronic LBP and 18.3% (n = 15) had a high risk of developing chronic LBP according to the SBST. Of the participants who were current smokers (N = 24), 25% (n = 6) had a low risk of developing chronic LBP, 41.7% (n = 10) had a medium risk of developing chronic LBP and 33.3% (n = 8) had a high risk of developing chronic LBP according to the SBST. Of the ex-smoker participants (N = 26), 34.6% (n = 9) had a low risk of developing chronic LBP, 34.6% (n = 9) had a medium risk of developing chronic LBP and 30.8% (n = 8) had a high risk of developing chronic LBP according to the SBST. Non-smokers tended to be in the low risk category for chronic LBP, while current smokers tended to have a higher risk of chronic LBP.

Of the non-smoking participants (N = 82), 73.2% (n = 60) had a low risk of developing chronic LBP and 26.8% (n = 22) had a low risk of developing chronic LBP according to the BQ. Of the current smokers (N = 24), 45.8% (n = 11) had a low risk of developing chronic LBP and 54.2% (n = 13) had a high risk of developing chronic LBP according to the BQ. Of the ex-smoker participants (N = 26), 50% (n = 13) had a low risk of developing chronic LBP and 50% (n = 13) had a high risk of developing chronic LBP according to the BQ. Similar to the SBST, a low risk

of chronic LBP was highest in non-smokers and high risk was highest in current smokers, according to the BQ.

Table 4.11 Association between alcohol consumption and risk of chronicity

	Risk of chronicity	Alcohol Consumption % (n)		*p* value
		Yes	No	
SBST	Low	50.9 (29)	45.2 (33)	0.801
	Medium	28.1 (16)	30.1 (22)	
	High	21.1 (12)	24.7 (18)	
Total		100 (57)	100 (73)	
BQ	Low	63.2 (36)	64.4 (47)	0.885
	High	36.8 (21)	35.6 (26)	
Total		100 (57)	100 (73)	

The association between alcohol consumption and risk of chronicity of LBP is presented in Table 4.11. There was no statistically significant association between alcohol consumption and risk of chronicity of chronic LBP. It can be observed, however, that there was a slightly higher percentage of participants who did not consume alcohol in the medium and high risk categories of the SBST, whereas the percentage of participants who did not consume alcohol in the high risk category of the BQ was slightly higher than those who did consume alcohol.

4.4.6 Physical Activity

Table 4.12 Association between exercise and risk of chronicity

	Risk of chronicity	Exercise % (n)		*p* value
		Yes	No	
SBST	Low	51.9 (54)	29.6 (8)	0.040*
	Medium	28.8 (30)	29.6 (8)	
	High	19.2 (20)	40.7 (11)	
Total		100 (104)	100 (27)	
BQ	Low	67.3 (70)	48.1 (13)	0.066
	High	32.7 (34)	51.9 (14)	
Total		100 (104)	100 (27)	

*significant *p* value

Table 4.12 presents the association between exercise and risk of chronicity of LBP. Exercise was significantly associated with risk of chronicity of LBP, according to the SBST. Of the participants who took part in some form of exercise (N = 104), 51.9% (n = 54) had a low risk of chronicity of LBP, 28.8% (n = 30) had a medium risk of developing chronic LBP and 20% (n = 19.2) had a high risk of developing chronic LBP according to the SBST. Of the participants who did not take part in any exercise (N = 27), 29.6% (n = 8) had a low risk of developing chronic LBP, 29.6% (n = 8) had a medium risk of developing chronic LBP and 40.7% (n = 11) had a high risk of developing chronic LBP according to the SBST. Participants who did not exercise had a higher risk of developing chronic LBP.

There was a borderline non-significant association between risk of chronicity and exercise according to the BQ. Of the participants who took part in physical exercise (N = 104), 67.3% (n = 70) had a low risk of developing chronic LBP while 32.7% (n = 34) had a high risk of developing chronic LBP according to the BQ. Of the participants who did not take part in physical exercise (N = 27), 48.1% (n = 13) had a low risk of developing chronic LBP and 51.9% (n = 14) had a high risk of developing chronic LBP according to the BQ. Those who exercised had a lower risk of developing chronic LBP while those who did not exercise had a higher risk of developing chronic LBP.

4.4.7 Work Status and Activity

No statistical comparison was possible between work status and risk of chronicity or between work activity and risk of chronicity due to many categories with small counts.

4.4.8 Work Satisfaction

Table 4.13 Association between work satisfaction and risk of chronicity

	Risk of chronicity	Work satisfaction score			*p* value
		N	Mean	SD	
SBST	Low	38	42.8	7.1	0.084
	Medium	22	42.3	7.1	
	High	20	36.9	15.1	
BQ	Low	51	42.7	7.0	0.130
	High	29	38.6	13.4	

Work satisfaction was not found to be significantly associated with risk of chronicity of LBP, as presented in Table 4.13. However, it can be observed that the high risk groups in both the SBST and the BQ had the lowest work satisfaction score mean. This indicates that the less satisfied participants had a higher risk of developing chronic LBP.

CHAPTER FIVE

DISCUSSION

This chapter discusses the results presented in Chapter 4 and compares them with previous similar studies. It includes the demographic findings, psychometric findings and associations between the two.

5.1 RESPONSE RATE

The total sample size required for this study was 132 DUT CDC patients. A total of 132 questionnaires were dispatched and 132 were returned, providing a 100% response rate. Similar studies were conducted on larger population groups. A study by Björck-van Dijken *et al.* (2008) was conducted on a total of 5798 randomly selected participants from a specific geographic region in Northern Sweden. Kennedy *et al.* (2008) distributed surveys examining the relationship between LBP and psychological stressors and received 973 responses. Irgens *et al.* (2013) collected data from a total of 501 LBP patients visiting twelve chiropractors in Southern England and eighteen chiropractors in Norway over a one-month period. Huang *et al.* (2014) analysed risk factors for LBP in a total of 969 Taiwanese participants.

The total population size for this study was significantly smaller than the majority of similar studies. However, constraints in resources such as time, budget and target population group required that the smallest statistically acceptable number of participants be used. While this may have presented challenges in making comparisons between this and other studies, comparisons could be made between ratios and percentages since this study was sufficiently statistically acceptable.

5.2 DEMOGRAPHIC PROFILE

5.2.1 Age

The mean age of respondents recorded for this study was 41.9 years with a standard deviation of 16.9. Ages of respondents ranged from 19 to 77 years. Participants in a study by Björck-van Dijken *et al.* (2008) ranged from 25 to 79 years of age. DePalma, Ketchum and Saullo (2011) conducted a study examining the role of age as a risk factor in LBP on individuals with a mean

age of 52.8 years and a standard deviation of 15.0. Leboeuf-Yde *et al.* (2011) similarly conducted a study examining the effects of age and gender on LBP on individuals between the ages of 20 to 71 years. Ojoawo and Awoniyi (2012) examined associations between demographic variables and chronic LBP using a population aged between 20 and 79 years. Wandner *et al.* (2012) conducted a study on the effect of age on the perception of pain in participants from the ages of 18 to 68 years. The mean age of participants in a study by Kennedy *et al.* (2008) was 19.8 years and the ages ranged from 18 to 81 years. The age range and mean age for this study were comparable with those of similar studies.

Although the age range for this study was comparable with the age range of other similar studies, it can be noted that there is a relatively young age distribution of LBP sufferers starting from 19 years of age. In investigating the demographic characteristics of patients presenting to the DUT CDC, McDonald (2011) noted that the average age of patients presenting to the DUT CDC is lower than the majority of international private clinics. This can potentially be attributed to the location of the clinic on a University campus, near student populations. In addition, the students who provide treatment at the DUT CDC may recruit their peers as patients. The extension of the age range to 77 years of age can be expected due to the increasing negative consequences of LBP with increasing age (Kennedy *et al.* 2008; Leboeuf-Yde *et al.* 2011). Being accessible and affordable to many members of the public, the DUT CDC caters to and attracts patients from a wide range of age groups.

5.2.2 Gender

A greater percentage of the total participants presenting with non-specific LBP in this study were male (56.8%); 43.2% were female. The respondents with LBP in a study by Björck-van Dijken *et al.* (2008) included 45.4% male and 54.6% female participants. A Danish study by Leboeuf-Yde *et al.* (2011) investigating the effects of gender on LBP had a slightly higher percentage of women (54.4%) than men (45.6%). Heuch *et al.* (2013) conducted a study on risk factors for chronic LBP in a Norwegian county on a population which was 46.3% male and 53.7% female. Of the total patients with back pain in the Norwegian population of a psychometric study by Irgens *et al.* (2013) 53.1% were female, with 57.3% of the patients with back pain in the English population of the same study being female. In a study investigating the interaction between risk factors for LBP (Huang *et al.*, 2014), 40.4% of the participants were male and 59.6% were female.

Although studies similar to this study had a higher percentage of female participants than male participants, the male to female ratio was not vastly different. This is cohesive with the female to male ratio in the South African population, although females represent a slightly higher population group of approximately 51% in SA (Statistics South Africa 2014). Statistics South Africa (2014) reported that the male population in KwaZulu-Natal is higher than the female population until 24 years of age. This may be a reason for the greater percentage of male than female participants in the younger participants of this study. This study was consistent with McDonald's (2011) findings that despite an overall almost equal distribution of male and female patients presenting to the DUT CDC, LBP complaints present slightly more frequently in males at the DUT CDC. In contrast to studies suggesting that females are more likely to develop LBP (Björck-van Dijken *et al.* 2008; Fillingim *et al.* 2009; Hoy *et al.* 2010), Heuch *et al.* (2013), Huang *et al.* (2014) and Smuck *et al.* (2014) reported that gender is an unimportant predictor of LBP. The existence of discrepancies across studies may explain why this study does not correlate with similar studies in terms of gender distribution.

5.2.3 BMI

BMI values in this study ranged from 16.8 to 49.6 kg/m² with a mean value of 27.5 and a standard deviation of 5.4. The majority of participants, 37.9%, were classified as overweight; 34.1% were of normal weight; 18.9% were classified as obese; 6.1% were classified as morbidly obese; the minority, 3.0%, were classified as underweight. A majority of 65.5% of the participants presenting with LBP in a study by Björck-van Dijken *et al.* (2008) had a BMI greater than 25kg/m², placing them in either the overweight, obese or morbidly obese categories. In a study conducted by Leclerc *et al.* (2009), 45% of the participants presenting with LBP were considered of a normal weight, 28% were considered overweight and 27% fell into the obese or morbidly obese categories. The mean BMI in a study by Koley, Kaur and Sandhu (2010) was 22.9 kg/m². In a study conducted by Heuch *et al.* (2013) investigating BMI as a risk factor in the development of chronic LBP, 38% of the participants presenting with LBP fell into the underweight or normal categories, 46% fell into the overweight category and 16% fell into the obese category.

With the exception of the study by Koley, Kaur and Sandhu (2010), the distribution of participants in the BMI categories in this study were comparable with similar studies and corresponded with the prevalence of obesity in SA. Ng *et al.* (2014) reported that the majority of South Africans (54%) fell into the overweight and obese categories of BMI. Since older adults

tend to have, on average, more body fat than younger adults for the equivalent BMI (Department of Health and Human Services and Centers for Disease Control and Prevention 2011; World Health Organization 2014b), the reason for the discrepancy between this study and the study by Koley, Kaur and Sandhu (2010) may be that their study was conducted on a group of participants aged between 19 to 25 years.

5.2.4 Level of Education

Almost half of the participants in this study, 53.4 %, had attended or graduated from a tertiary institution; 24.4 % had matriculated; 16.8 % had attended high school; 3.8 % had attended primary school; 0.8% had attended a Trade Union School; and 0.8% had received no formal education. A study by Björck-van Dijken *et al.* (2008) included 36.3% of participants whose highest level of education was primary school, 47.3% of participants whose highest level of education was secondary school (including high school) and 36.3% of participants whose highest level of education was a tertiary institution. Leclerc *et al.* (2009) conducted a study in France where 25.3% of the participants had received a high education; 13.7% had received a moderate education; 27.3% had received lower vocational training; 18.9% had received a low education; and 14.8% had received no formal training. In a study investigating risk factors for chronic LBP in Sri Lankan males conducted by Karunanayake *et al.* (2013), 86% had not received a tertiary education. The LBP sufferers in a study by Huang *et al.* (2014) comprised of 29.8% with a low education level, 37.1% with a moderate education level and 33.1% with a high education level.

Unlike other studies in which the highest level of education for the majority of participants was a moderate education, the majority of participants in this study had received a high education. Over the past decade the percentage of individuals who have attained matric or tertiary education in SA has increased by approximately 6% and 4% respectively, while the percentage of individuals with no formal education has decreased by approximately 5% (Statistics South Africa 2014). This increase in South African individuals who have attained or are attaining a tertiary education may account for the large percentage of individuals who had received a high education. An additional reason for the large student population in this study is the location of the DUT CDC. Being situated on a University campus, the DUT CDC is surrounded by student populations. The students who provide treatment at the DUT CDC may recruit their peers, a large number of whom are likely to be students themselves, as patients.

5.2.5 Smoking and Alcohol Consumption

The majority of participants in this study, 62.1 %, were non-smokers, 19.7 % were ex-smokers and 18.2 % were current smokers. MacGregor *et al.* (2004) investigated the influences of various factors on LBP, including smoking, in a population of which 46% were smokers. The participants in a study by Kwon *et al.* (2006) comprised of 23.8% non-smokers, 43% ex-smokers and 33.2% current smokers. Leclerc *et al.* (2009) conducted a study in which 54.3% of the participants were non-smokers, 17.6% were ex-smokers and 28.1% were current smokers. The study of Björck-van Dijken *et al.* (2008) indicated that 17.6% of the participants were regular smokers. Huang *et al.* (2014) investigated the interaction between risk factors for LBP and found that 77.6% of the participants who suffered from LBP were non-smokers, while the remaining 22.4% were either ex- or current smokers.

In this study 56.2% of the participants did not consume alcohol while 43.8% of the participants did consume alcohol. Of those who consumed alcohol 64.9% consumed between one and three units per week, 17.5% consumed between four and six units per week, and 17.5% consumed more than six units of alcohol per week. The results of the study by MacGregor *et al.* (2004) showed that 7.3% of participants consumed more than ten units of alcohol per week. Karunanayake *et al.* (2013) investigated risk factors for chronic LBP in Sri Lankan adult males, of which 57% of the LBP sufferers consumed no alcohol or consumed less than one unit of alcohol per week; 18% of LBP sufferers consumed alcohol on a weekly but not daily basis; and 25% of LBP sufferers consumed alcohol on at least a daily basis. The results of the study by Huang *et al.* (2014) highlighted that 70.8% of participants suffering from LBP did not consume alcohol and the remaining 29.2% did consume alcohol.

This study was comparable with other similar studies in which the majority of participants were non-smokers and the majority of participants consumed no alcohol or less than one unit of alcohol on a weekly basis. Over the past several decades, the social and health consequences of smoking and alcohol consumption have gained substantial awareness, leading to movements on both an individual and social level to limit these activities (World Health Organisation 2014a). This may be a reason for a smaller proportion of participants in both this and other studies who consume alcohol and who are smokers than those who do not consume alcohol and are non-smokers respectively.

5.2.6 Physical Activity

In this study, 79.4% of the total participants took part in some form of physical exercise, while 20.6% took part in no physical exercise. The majority of participants who took part in physical exercise (75%) exercised for up to six hours per week. It was reported by Björck-van Dijken *et al.* (2008) that 78.9% of the participants suffering from LBP in their study took part in less than 1.5 hours of physical exercise per week. In a study by Nilsen, Holtermann and Mork (2011) investigating risk factors for LBP, 62.8% of the participants were reported to be inactive, while 37.2% of the participants reported to have taken part in at least one hour of physical exercise per week. Ojoawo and Awoniyi (2012) investigated the association between risk factors for LBP on a population of which 34.4% of the participants had low physical activity levels, 61.5% of the participants had moderate physical activity levels and 4.1% of the participants had high physical activity levels. Huang *et al.* (2014) examined the interaction between risk factors for LBP and found that 59.1% of the participants suffering from LBP took part in regular physical exercise, while 40.9% of the participants suffering from LBP did not take part in regular exercise.

The number of participants who took part in physical exercise and the amount of physical exercise which was performed varied across studies. This study, as well as studies by Nilsen, Holtermann and Mork (2011) and Huang *et al.* (2014), categorised participants according to whether they did or did not participate in physical exercise. On the other hand, studies by Björck-van Dijken *et al.* (2008) and Ojoawo and Awoniyi (2012) categorised participants according to their levels of physical activity. In most of these studies, the majority of participants were involved in some form of physical exercise. Since exercise has been shown to be beneficial for improving LBP, it is unlikely that this larger portion of physically active participants can be attributed to exercise causing LBP. Rather, it represents the physical activity status of the local population. Over the past few decades, the health benefits of physical activity have gained awareness motivating a greater portion of the population to partake in physical activity (Björck-van Dijken *et al.* 2008 and World Health Organisation 2010).

5.2.7 Work Status and Activity

In this study 60.6% of the total participants were currently full-time, part-time or self-employed, while 39.4% were unemployed. Of the participants who were employed, the majority, 39.8%, selected sitting as their most common work activity, 31.3% were most commonly involved in light physical work, 13.3% in moderate heavy work and 8.4% in heavy work. The minority listed

driving long hours, 6%, or standing long hours, 1.2%, as their most common work activity. Björck-van Dijken *et al.* (2008) conducted a study in which 23.7% of the employed participants selected sitting as their most common physical activity at work, 39.1% selected light physical work, 30.3% selected moderate heavy work and 6.9% selected heavy work as their most common physical activity at work. The study by Leclerc *et al.* (2009) indicated that of the participants suffering from LBP 59.7% were employed, while 40.3% were listed as unemployed; this included participants who were retired, housewives, and those who received permanent disability benefits. In addition, 34.2% of participants in the study by Leclerc *et al.* (2009) reported having experienced tiring postures at work and 30.8% of participants reported having handled heavy loads at work.

The work population and work activity in this study were similar to those in other similar studies in which the majority of employed participants are in non-manual professions. Since physical activity has beneficial effects on improving LBP (World Health Organisation 2010), spending a large portion of the day performing little or no physical activity in a sedentary state has a detrimental effect on LBP, accounting for the large percentage of employed patients with LBP. There was also a fairly large percentage of unemployed patients presenting to the DUT CDC with LBP. The initial consultation by students often takes a minimum of two hours it is possible that unemployed individuals who do not have time restraints due to work commitments are likely to attend the DUT CDC. A large number of the unemployed participants are students and, as previously mentioned, can easily access the DUT CDC due to its location.

5.3 PSYCHOMETRIC PROFILE

5.3.1 Work Satisfaction

Less than 25% of the working population scored below 39 on the work satisfaction questionnaire; less than 50% scored below 43; and less than 75% scored below 48. The highest score possible on the abridged Job In General scale was 50, with higher scores indicating greater work satisfaction. The results indicate that the majority of the working population were satisfied with their job. Hoogendoorn *et al.* (2002) investigated the relationship between LBP and work satisfaction where 726 patients reportedly suffered from LBP, of which 59.2% were satisfied with their jobs, 34.6% were reasonably satisfied with their jobs and 6.2% were not satisfied with their work. Heymans *et al.* (2009) investigated work-related risk factors affecting return to work and found that in their population of 628 LBP sufferers 3.5% were not

satisfied with their jobs, 50.7 % were moderately to reasonably satisfied with their jobs and the remaining 43% were satisfied with their jobs. Grotle *et al.* (2010) reported that of 258 participants who were suffering from acute or sub-acute LBP, 22% had a low work satisfaction. Additionally, Grotle *et al.* (2010) reported that of 668 participants who were suffering from chronic LBP 29% had low work satisfaction. In a population of 562 participants investigated by Solidaki *et al.* (2010), 20.3% were reported to have low work satisfaction while 79.7% were reported to have high work satisfaction.

Similar to other studies, the majority of participants in this study were satisfied with their work. The relationship between overall job satisfaction and satisfaction with various aspects of the job is complex, however, hence there are limitations in measuring work satisfaction. While individuals may be satisfied with certain aspects of their jobs they may not be satisfied with their job overall, and vice versa (Ratinaud *et al.* 2013). The unexpected proportion of participants suffering from LBP who were satisfied with their work may be attributed to the measurement of overall work satisfaction rather than measuring satisfaction with each aspect of their work.

5.3.2 Risk of Chronicity

Based on the Keele STarT Back Screening Tool (SBST), 47.7% (n = 63) of the total population of this study (N = 132) had a low risk of developing chronic LBP, 28.8% (n = 38) had a medium risk of developing chronic LBP and 23.5 % (n = 31) had a high risk of developing chronic LBP. In a study investigating the relationship between the SBST and the prognosis for LBP Field, Newell and McCarthy (2010) reported that in a population of 404 LBP sufferers, 41.6% had a low risk of chronicity, 31.9% had a medium risk of chronicity and 26.5% had a high risk of chronicity. Fritz, Beneciuk and George (2011) similarly investigated the relationship between categorising patients using the SBST and the prognosis for LBP, and reported that 33.2% (N = 214) of participants were at low risk of developing chronic LBP, 47.7% were at medium risk of developing chronic LBP and 19.2% were at high risk of developing chronic LBP. Kongsted, Johannesen and Leboeuf-Yde (2011) conducted a study on a population of 475 LBP sufferers of which 41.6% had a low risk of developing chronic LBP, 31.9% had a medium risk of developing chronic LBP and 11.4% had a high risk of developing chronic LBP. The study of Beneciuk *et al.* (2013) revealed that 36.3% (N = 166) of LBP sufferers had a low risk of chronicity, 37.7% had a medium risk of chronicity and 26% had a high risk of chronicity. Irgens *et al*. (2013) developed a psychometric profile of a total of 400 Norwegian and English patients

presenting to chiropractic clinics; 11% of the Norwegian patients were at high risk of chronicity and 28% of English patients were at high risk of chronicity.

The Bournemouth Questionnaire (BQ) indicated that 63.6% (n = 84) of the total population of this study (N = 132) had a low risk of developing chronic LBP, while 36.4% (n = 48) had a high risk of developing chronic LBP. The study of Field, Newell and McCarthy (2010) was conducted on a population of 404 LBP sufferers and revealed that 41.6% of the participants had a low risk of chronicity while the remaining 58.4% of participants had a medium to high risk of chronicity. Bolton and Hurst (2011) investigated prognostic factors for the short term improvement of LBP in 2394 LBP sufferers and reported that based on the BQ, the mean score for the 55.8% of patients with acute LBP was 34.8 and the mean score for the 44.2% of participants with persistent LBP was 31.2. Irgens *et al.* (2013) reported that in a total population of 510 patients the average BQ score for LBP patients in Southern England was 37, versus an average BQ score of 31 in Norwegian LBP patients.

The percentage of participants in the low-, medium- and high-risk groups of the SBST was comparable with similar studies, where the majority of the populations had a low risk of chronicity while the minority of the population had a high risk of chronicity. The percentage of participants in the low-risk and medium- to high-risk groups of the BQ, however, differed across studies. This may be attributed to the different manner in which the BQ scores were presented. While some studies presented the BQ score as a median score, others presented it as an average or categorised it into risk groups. This study was comparable with studies by Bolton and Hurst (2011) and Irgens *et al.* (2013), in that the larger percentage of participants had a lower median or average score, thereby placing them in a lower risk category.

Participants who fell into the SBST low-risk group in this study were found to have scored lower in the BQ, while participants who fell into the SBST medium and high-risk groups scored higher on the BQ. With a p value of < 0.001, a very strong association was found between the SBST and the BQ risk groups in this study. Studies by Field, Newell and McCarthy (2010) and Irgens *et al.* (2013), which also assessed patients using both the SBST and the BQ, similarly reported a strong association between participants in the high risk groups of both questionnaires.

5.4 ASSOCIATIONS BETWEEN DEMOGRAPHIC AND PSYCHOMETRIC CHARACTERISTICS

5.4.1 Age

Kennedy *et al.* (2008) and Leboeuf-Yde *et al.* (2011) reported that LBP affects all age groups. In line with these findings, age was distributed fairly evenly throughout the age groups (from 19 to 77) and not found to be significantly associated with an increased risk of chronicity for LBP in this study. It can be noted, however, that the mean age in the low risk groups was similar for the SBST (39.7 years) and the BQ (40.6 years). These findings are similar to those reported by Balagué *et al.* (2012) and Kaplan *et al.* (2013) that the prevalence of LBP peaked between the ages of 45 and 64 years, and 35 and 55 years of age, respectively. Ojoawo and Awoniyi (2012) reported an association with age and chronic LBP, stating that the incidence of chronic LBP peaks between 50 to 59 years of age and declines around 70 years of age. Rather than an increase in the prevalence of LBP with increasing age, Leboeuf-Yde *et al.* (2011) reported that there is an increase in the severity of the consequences of LBP, such as the duration of sick leave, with increasing age. This has been attributed to morphological and biochemical changes in the lower back associated with aging (Intolo *et al.* 2009). The results of this study are consistent with the reports that suggest that patients around 40 years of age have a high risk of chronicity of LBP.

5.4.2 Gender

A systematic review of the global prevalence of LBP conducted by Hoy *et al.* (2010) using 165 studies from 54 countries revealed that the female gender is associated with an increased risk of LBP. There was no significant association found between gender and the SBST risk groups in this study, however the percentage of female participants was higher in both the medium- and high-risk groups for developing chronic LBP. According to the BQ gender was found to be significantly associated with an increased risk of developing chronic LBP. Compared to this study, in which 5% more females than male patients had a high risk of developing chronic LBP according to the SBST, Björck-van Dijken *et al.* (2008) reported that 6% more female than male patients suffered from chronic LBP in Northern Sweden. This study also found that females had a twofold greater risk of developing chronic LBP than males, according to the BQ. In contrast, Heuch *et al.* (2013), Huang *et al.* (2014) and Smuck *et al.* (2014) reported that gender is not an

important predictor of LBP. While gender-specific biological factors (such as hormonal influences) may play a role in exacerbating and perpetuating LBP, the discrepancy across studies suggests that the effect of gender may be more significantly influenced by psychosocial factors (such as gender role expectations) which differ across countries and cultures. As a country with a unique social history and a population with many different cultural backgrounds, the gender roles in SA are similarly unique.

5.4.3 BMI

Björck-van Dijken *et al.* (2008), Leclerc *et al.* (2009), Koley, Kaur and Sandhu (2010) and Heuch *et al.* (2013) listed overweight/obesity as a potentially modifiable risk factor which contributes significantly to an increased risk of chronic LBP. Despite the 37.9% majority of participants (n = 50) in this study falling into the overweight category according to BMI, there was no statistically significant association between BMI and risk of chronicity of LBP according to the SBST; there was a borderline non-significant association between BMI category and risk of LBP chronicity according to the BQ (p = 0.073). Overweight and obesity contribute to the chronicity of LBP by placing increased mechanical load on the lumbar spine over time, as well as by hormone-related anatomical and physiological changes (Shiri *et al.* 2010a; Heuch *et al.* 2013). Since mechanical changes in the lumbar spine due to altered body fat distribution occur over time, it is possible that some of the participants in this study had not yet fully experienced these mechanical changes and hence had not reached their peak of pain and discomfort due to LBP. Additionally, the majority of participants in this study took part in some form of physical exercise; as discussed in section 5.4.6, physical activity decreases the risk of chronicity of LBP through a number of mechanisms, which may have assisted in relieving the LBP in the overweight and obese individuals.

5.4.4 Level of Education

Comparable with studies by Chou and McCarberg (2011), this study found no significant association between the highest level of education the participants had acquired and the risk of developing chronic LBP. It is of note that participants in this study who had no formal schooling or had only attended primary school (N = 6) had the highest risk of developing chronic LBP, which is similar to studies by Björck-van Dijken *et al.* (2008), Leclerc *et al.* (2009), Karunanayake *et al.* (2013) and Huang *et al.* (2014), who implicated lower levels of education in the development of chronic LBP. While Leclerc *et al.* (2009), Karunanayake *et al.* (2013) and

Huang *et al.* (2014) reported that individuals with six to twelve years of schooling had a higher risk of developing chronic LBP than individuals with a tertiary education, this study found the opposite, i.e. individuals with a tertiary education had a higher risk of developing chronic LBP than those with twelve years of formal schooling. A number of factors have been found to be responsible for the association between level of education and the risk of chronicity of LBP, most significantly lifestyle and occupational factors. Tertiary education is more likely to cause general stress than lower levels of education which may cause individuals to turn to coping mechanisms such as smoking, a statistically significant risk factor for LBP. Rather than the level of education itself causing an increased risk of chronic LBP, it may be the action of related risk factors that exacerbate this risk (Leclerc *et al.* 2009; Karunanayake *et al.* 2013). Different syllabi and extramural activity in different schools, and especially in different countries, may be responsible for the discrepancies between this study and similar studies.

5.4.5 Smoking and Alcohol Consumption

The associations between smoking and chronic LBP vary across studies. Björck-van Dijken *et al.* (2008) and Balagué *et al.* (2012) identified LBP as a weak risk factor for LBP, while a systematic review by Ferreira *et al.* (2013) reported that over four twin studies revealed a significant association between smoking and LBP. Similarly, this study found a significant association between smoking and an increased risk of chronic LBP, according to both the SBST and BQ. Shiri *et al.* (2010b) also reported a strong association between smoking and chronic and disabling LBP. Based on studies by Shiri *et al.* (2010b) and Dutra *et al.* (2014) smoking may be used as a coping mechanism for stressful situations, hence smoking may be an indicator of an underlying psychological condition that causes LBP. Smoking has a detrimental effect on blood supply to spinal structures, which may interfere with healing and nutrition of the IV discs, causing and amplifying degeneration (Shiri *et al.* 2010b; Ojoawo and Awoniyi 2012). Additionally, chronic coughing associated with prolonged smoking may cause repeated microtrauma to the IV discs gradually leading to disc injury and herniation (Dagenais and Haldeman 2011).

In line with studies by Leboeuf-Yde *et al.* (2011) and Ferreira *et al.* (2013) there was no statistically significant association between alcohol consumption and risk of chronicity of LBP, however heavy drinking and chronic LBP have been found to have a correlation (Karunanayake *et al.* 2013; Zale, Maisto and Ditre 2015). Moderate alcohol consumption, which is quantified in SA as no more than one standard drink per day for females and no more than two standard

drinks per day for males, is potentially beneficial. It has been shown to decrease the risk of mortality due to myocardial infarction and coronary heart disease (Jacobs and Steyn 2013; Zale, Maisto and Ditre 2015). The 64.9% majority of the participants in this study who did consume alcohol (N = 57) consumed a moderate amount of less than three units per week. These statistics may be responsible for the observation in this study, although not statistically significant, that there was a slightly higher percentage of participants who did not consume alcohol in the medium and high risk categories of the SBST, with the percentage of participants who did not consume alcohol in the high risk category of the BQ slightly higher than those who did consume alcohol.

5.4.6 Physical Activity

Physical activity is beneficial for both physical and mental health and has been recommended for maintaining and improving muscular fitness, bone and functional health and musculoskeletal health, among others (World Health Organization 2010). This study found a statistically significant association between exercise and the risk of chronicity of LBP according to the SBST, and a borderline non-significant association between risk of chronicity and exercise according to the BQ. Participants who did not exercise had a higher risk of developing chronic LBP. While few studies suggest that the association between LBP and physical activity is insignificant (Nilsen, Holtermann and Mork 2011; Sitthipornvorakul *et al.* 2011), a number of studies comparable with this study have reported that individuals with a combination of physically demanding occupations and little or no involvement in physical exercise during leisure time have the highest risk of LBP (Burton *et al.* 2006; Björck-van Dijken *et al.* 2008; Nilsen, Holtermann and Mork 2011; Balagué *et al.* 2012; Huang *et al.* 2014). Heneweer *et al.* (2011), Nilsen, Holtermann and Mork (2011) and Huang *et al.* (2014) reported that physical exercise is conducive to the improvement of LBP, even in small amounts and regardless of intensity. Physical exercise increases the endurance of the back and trunk muscles by strengthening them, and stimulates blood supply to spinal structures, including muscles, joints and IV discs, thus assisting and improving the process of repair. Since physical activity promotes the release of endorphins it also has a beneficial psychological effect by improving an individual's disposition, and subsequently, their perception of pain (Kwon *et al.* 2006; Koley, Kaur and Sandhu 2010; Sitthipornvorakul *et al.* 2011).

5.4.7 Work Status and Activity

No statistical comparison was possible between work status and risk of chronicity or between work activity and risk of chronicity due to many categories with small counts.

5.4.8 Work Satisfaction

Work satisfaction was not found to be significantly associated with risk of chronicity of LBP. It can be observed however that the high risk groups in both the SBST and the BQ had the lowest work satisfaction score mean. This indicates that in line with studies by Coggon *et al.* (2013) and Ratinaud *et al.* (2013), the less satisfied participants had a higher risk of developing chronic LBP. In comparing participants with acute and chronic LBP, Grotle *et al.* (2010) noted that 22% (n = 45) of participants with acute LBP (N = 258) had poor work satisfaction, while a slightly higher 29% (n = 132) of the participants with chronic LBP (N = 668) had poor work satisfaction. While poor work satisfaction has been shown to affect the chronicity of pain (Balagué *et al.* 2012; Coggon *et al.* 2013; Ratinaud *et al.* 2013), the effect of chronic pain on work satisfaction has not been adequately investigated. As described by the fear avoidance model of pain, poor coping skills and low self-efficacy have an effect on the chronicity of pain. When confronted with challenging situations in the workplace, an individual with pain may allow negative beliefs about pain and coping influence their judgement of their work situation, thus causing them to feel dissatisfied with their job (Hülsheger *et al.* 2013).

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

In a population of 132 participants attending the Durban University of Technology (DUT) Chiropractic Day Clinic (CDC) with non-specific low back pain (LBP) during a four-month period, ages ranged from 19 to 77 years and the majority of participants were male (56.8%). The majority of these participants (34.1%) were classified as overweight based on their BMI values. A 53.4% majority had attended or graduated from a tertiary institution, while a minority of less than approximately 1% had received no formal education. Non-smokers comprised the majority of the population (62.1%) and similarly, participants who did not consume alcohol comprised a larger percentage (56.2%) of the population. A majority (79.4%) of the total participants took part in some form of physical exercise. Employed participants comprised the majority of the population (60.6%) and of those, the majority was employed full-time (45%). The employed participants selected sitting as their most common work activity, followed by light physical work.

The majority of patients presenting to the DUT CDC with non-specific LBP during a four-month period were satisfied with their jobs. Patients who had a low risk of developing chronic LBP as a result of psychosocial and behavioural risk factors comprised the largest sub-group, while those who had a high risk of developing chronic LBP based on these factors comprised the smallest sub-group. Despite the high risk group being the smallest, the percentage of participants in this sub-group was significant with approximately 24% of participants having a high risk of chronicity according to the SBST, and approximately 36.4% of participants having a high risk of chronicity according to the BQ.

Age, level of education, alcohol consumption and work satisfaction were not significantly associated with a risk of chronicity of LBP. On the other hand, female gender, tobacco smoking and moderate participation were significantly associated with an increased presence of yellow flags resulting in an increased risk of developing chronic LBP. Overweight and obesity had a borderline non-significant association with an increased risk of developing chronic LBP.

The results in this study suggest that patients presenting to the DUT CDC are comparable with patients presenting to other chiropractic clinics worldwide, and supports the notion that chronic LBP is a multifactorial condition with significant psychosocial implications and should be approached as such. Placing patients into sub-groups assists in developing a more effective and specific treatment strategy for each group of patients.

6.2 RECOMMENDATIONS

Since chronic LBP is a multifactorial condition, future studies may focus on determining additional risk factors within statistically significant risk factors; for example, by examining psychosocial risk factors in females versus psychosocial risk factors in males. Future studies may also compare the psychosocial risks of DUT CDC patients with patients presenting to chiropractors in private practice. It is further recommended that in order to assist in formulating an optimal management plan for patients with LBP, psychometric tools such as the SBST and the BQ are implemented as part of the mandatory paperwork at the DUT CDC.

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APPENDICES

Appendix A: Ethical Clearance Certificate

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

P O Box 1334, Durban, South Africa, 4001

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

www.dut.ac.za

11 September 2014

IREC Reference Number: **REC 64/14**

Ms V Bramuzzo
148 Josiah Gumede Road
8 Domeca Village
Pinetown

Dear Ms Bramuzzo

A psychometric profile of patients attending the Durban University of Technology Chiropractic day clinic with non-specific low back pain

I am pleased to inform you that Full Approval has been granted to your proposal REC 64/14.

The Proposal has been allocated the following Ethical Clearance number **IREC 063/14**. Please use this number in all communication with this office.

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

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the IREC according to the IREC SOP's. In addition, you will be responsible to ensure gatekeeper permission.

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

Yours Sincerely

[redacted]

Prof J K Adam
Chairperson: IREC

Appendix B: Permission letter from Dr Brinique Dyer

From: Valentina Bramuzzo, valbramuzzo@gmail.com
To: Dr Brinique Dyer, bdyer1@its.jnj.com
Date: Mon, Jun 2, 2014 at 8:50 PM
Subject: Chiropractic Research
mailed-by: gmail.com

Hi Brinique,

My current research topic has been approved by the Chiropractic Departmental Research Committee and is titled: "The Psychometric Profile of Patients Presenting to the Durban University of Technology Chiropractic Day Clinic with Non-specific Lower Back Pain."

I am in the process of completing my PG4a document and hereby request your permission to use the questionnaire you formulated for your research for the purposes of my research. The questionnaire will not be copied directly. It will be used and altered making it applicable to the demographic information required for my study.

If you would like any further information regarding my topic, I would be more than willing to share any information with you.

Thank you for your time.
Kind regards,
Valentina Bramuzzo.

Reply Forward

From: Brinique Dyer, bdyer1@its.jnj.com
To: Valentina Bramuzzo, valbramuzzo@gmail.com
Date: June 2, 2014
Subject: Re: Chiropractic Research

Hi Valentina,

I have no problem with you using my questionnaire!
Good luck!

Kind regards,
Brinique

Appendix C: Permission from Bowling Green State University (BGSU)

Bowling Green State University

Job Descriptive Index (JDI) Office
214 Psychology Building
Department of Psychology
Bowling Green State University
Bowling Green, OH 43403

June 19, 2014

The Job Descriptive Index (JDI) and family of measures – including the Job In General scale (JiG), abridged Job Descriptive Index (aJDI), abridged Job In General scale (aJiG), Trust in Management scale (TiM), Intent to Quit (ITQ), Stress in General (SiG) scale, Scale of Life Satisfaction (SOLS), and Survey of Work Values, Revised, Form U. (SWV) are owned by Bowling Green State University, copyright 1975-2012.

Permission is hereby granted to **Valentino Bramuzzo** to use these measures in her **research**.

The aforementioned scales may be administered to as many participants as deemed necessary.

[redacted]

Christopher S. Bialko
JDI Research Assistant
Tel: 419.372.4400
Fax: 419.372.6013
jdi_ra@bgsu.edu

Appendix D: Permission letter from the DUT CDC

MEMORANDUM

To : Prof Puckree
Chair : RHDC

Prof Adam
Chair : IREC

From : Dr Charmaine Korporaal
Clinic Director : Chiropractic Day Clinic : Chiropractic and Somatology

Date : 04.06.2014

Re : Request for permission to use the Chiropractic Day Clinic for research purposes

---

Permission is hereby granted to :

Ms Valentina Bramuzzo (Student Number: 20705613)

Research title : "The Psychometric Profile of Patients Presenting to the Durban University of Technology Chiropractic Day Clinic with Non-specific Lower Back Pain".

It is requested that Ms Bramuzzo submit a copy of her RHDC / IREC approved proposal to the Clinic Administrators before she starts with her research in order that any special procedures with regards to her research can be implemented prior to the commencement of her seeing patients.

Thank you for your time.

Kind regards

[redacted]

Dr Charmaine Korporaal

Clinic Director : Chiropractic Day Clinic : Chiropractic and Somatology

Cc: Mrs Pat van den Berg : Chiropractic Day Clinic
Dr L O'Connor : Research co-ordinator
Dr D Varathajullu : Research supervisor

Appendix E: Letter of Information and Informed Consent

Letter of Information and Informed Consent

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

Title of the Research Study: A psychometric profile of patients attending the Durban University of Technology Chiropractic day clinic with non-specific low back pain.

Principal Investigator/s/researcher: Valentina Bramuzzo (B. Tech: Chiropractic)

Co-Investigator/s/supervisor/s: Dr. P.Z. Twala (M. Tech: Chiropractic) and Ms. Ariana Essack (M. Ed (Ed. Psych.))

Brief Introduction and Purpose of the Study:

Low back pain is a major health problem and leading cause of disability worldwide, and accounts for numerous medical consultations. Risk factors for developing, as well as perpetuating low back pain have been recognised.

The aim of this study is to determine a psychometric profile of patients presenting to the Durban University of Technology Chiropractic Day Clinic with low back pain using the Keele STarT Back screening tool and Bournemouth Questionnaire.

Outline of the Procedures: If you are willing and have signed the informed consent (see below), you are encouraged to complete the questionnaires which will be handed to you at the Durban University of Technology Chiropractic Day Clinic. Participation in the study will not interrupt your treatment time and will take a short time to complete and hand in. The researcher will be present while the questionnaire is being completed so that any questions or queries can be addressed.

Risks or Discomforts to the Participant: There are no foreseeable risks, discomforts or adverse consequences if you choose to partake in completing the questionnaire.

Benefits: This study will aim to add to the existing body of knowledge in relation to psychosocial factors affecting low back pain, and especially those influencing a transition from acute to chronic pain, in a South African context. This will aid in developing a more effective treatment for patients with low back pain which is valuable for both health care professionals and patients.

Reason/s why the Participant May Be Withdrawn from the Study: Please note that you are free to withdraw from the study at any time. However, once the questionnaire is completed and placed into a sealed box it may not be reopened as this will infringe on the confidentiality of the study.

Remuneration: Participation in the study is voluntary and no remuneration will be awarded.

Costs of the Study: There is no cost associated with participating in the study.

Confidentiality: All answers are confidential and will not be linked to you. The informed consent and questionnaires will be kept in separate sealed boxes as to ensure that no questionnaire can be linked you. The questionnaire will be analysed by a statistician and all information will only be used for research purposes.

Research-related Injury: You are only required to fill in a questionnaire and therefore there is no risk of injury.

Your participation in my study is vital and will be greatly appreciated.
If you are willing to participate in the filling of the questionnaire please fill in the consent form below.

Persons to Contact in the Event of Any Problems or Queries:

Supervisor: Dr. P.Z. Twala	031 373 6312
Principle Investigator: Valentina Bramuzzo	031 373 2205
Institutional Research Ethics administrator	031 373 2900
Complaints can be reported to the DVC: TIP, Prof F. Otieno on	031 373 2382 or dvctip@dut.ac.za

CONSENT

Statement of Agreement to Participate in the Research Study:

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

_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature**

I, Valentina Bramuzzo, herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

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

_____	_____	_____
Full Name of Witness (If applicable)	**Date**	**Signature**

Thank you for participating in my study.

Sincerely,
Valentina Bramuzzo.

Appendix F: Pre-validated demographic questionnaire

DEMOGRAPHIC AND SOCIAL HISTORY QUESTIONNAIRE							
Instructions: Please put an 'X' in the applicable box.							
PART A: DEMOGRAPHICS							
1	How old are you?	_____ years					
2	Gender	Female	Male				
3	Height (cm)	_____ (*to be filled in by researcher*)					
4	Weight (kg)	_____ (*to be filled in by researcher*)					
5	BMI	_____ (*to be filled in by researcher*)					
6	Where do you live?	Central Business District	Residential area	Rural area	Other (specify) _____		
7	What is the highest level of education you have obtained?	No formal education	Primary school	High school	Matriculated	Tertiary	Other (specify)
8	What is your current smoking status?	Current smoker	Ex-smoker	Non smoker			
9	Current smokers only	On average, how many cigarettes do you smoke per day?					
		Duration of smoking? (how many years)					
10	Ex-smokers only	How long ago did you quit smoking? (how many years)					
		For how long did you smoke before you quit? (how many years)					
11	Do you drink alcohol?	Yes	No				

12	If YES, how many alcoholic drinks do you consume per week?	1-3		4-6		More than 6	
13	Do you do any exercise?	Yes			No		
14	What type of exercise do you do most of the time?	Aerobics	Badminton	Boxing	Cardio (Gym)	Cricket	Cycling
		Fishing	Golf	Martial Arts	Road Running	Rugby	Squash
		Soccer	Surfing	Swimming	Tennis	Walking	Weight Training
		Yoga / Pilates	Other (specify) _____				
15	On average, what amount of time is spent exercising per week?	_____ hours					
16	What is your current work status?	Employed full time	Employed part time	Housewife	Retired	Self Employed	Student
		Unemployed	Other (specify) _____				
17	If employed, what is your occupation?	Artisan/ Tradesman	Business person	Clerical	Farmer	House Executive	Managerial
		Sales Person	Student	Other (specify) _____			
18	How long have you been in this occupation?	_____ years					

19	If retired/ unemployed, what was your previous occupation?	Artisan/ Tradesman	Business person	Clerical	Farmer	House Executive	Managerial
		Sales Person	Student	Other (specify) _____			
20	For how long were you in this occupation?	_____ years					
21	Which best describes your physical activity at work in the last year?	Sitting work	Light physical work	Moderate heavy work	Heavy work	Driving for long hours	Other (specify) _____

PART B: WORK SATISFACTION

Job In General

1	Think of your job in general. All in all, what is it like most of the time? In the blocks alongside, beside each word or phrase, write: Y for "Yes" if it describes your job N for "No" if it does not describe your job ? if you cannot decide	Pleasant	Bad	Great
		Waste of time	Good	Undesirable
		Worthwhile	Worse than most	Acceptable
		Superior	Better than most	Disagreeable
		Makes me content	Inadequate	Excellent
		Rotten	Enjoyable	Poor

Appendix G: Keele STarT Back Screening Tool

Thinking about the **last 2 weeks** tick your response to the following questions:

		Disagree	**Agree**
		0	1
1	My back pain has **spread down my leg(s)** at some time in the last 2 weeks	☐	☐
2	I have had pain in the **shoulder** or **neck** at some time in the last 2 weeks	☐	☐
3	I have only **walked short distances** because of my back pain	☐	☐
4	In the last 2 weeks, I have **dressed more slowly** than usual because of back pain	☐	☐
5	It's not really safe for a person with a condition like mine to be physically active	☐	☐
6	**Worrying thoughts** have been going through my mind a lot of the time	☐	☐
7	I feel that **my back pain is terrible** and **it's never going to get any better**	☐	☐
8	In general I have **not enjoyed** all the things I used to enjoy	☐	☐

9. Overall, how **bothersome** has your back pain been in the **last 2 weeks**?

Not at all	Slightly	Moderately	Very much	Extremely
☐	☐	☐	☐	☐
0	0	0	1	1

Total score (all 9): _____ **Sub Score (Q5-9):**_____

Funded by Arthritis Research UK

Appendix H: The Bournemouth Questionnaire (Back Pain)

Put a CROSS in ONE box for EACH of the following statements that best describes your painful complaint and how it is affecting you NOW. Please read each question carefully before answering.

Q1 Over the past few days, on average, how would you rate your back pain on a scale where '0' is 'no pain' and '10' is 'worst pain possible'?

No pain	0	1	2	3	4	5	6	7	8	9	10

Q2 Over the past few days, on average, how has your back pain interfered with your daily activities (housework, washing, dressing, lifting, walking, driving, climbing stairs, getting in/out of bed/chair, sleeping) on a scale where '0' is 'no interference' and '10' is 'completely unable to carry on with normal daily activities'?

No interference	0	1	2	3	4	5	6	7	8	9	10

Q3 Over the past few days, on average, how much has your back pain interfered with your normal social routine including recreational, social and family activities, on a scale where '0' is 'no interference' and '10' is 'completely unable to participate in any social and recreational activity'?

No interference	0	1	2	3	4	5	6	7	8	9	10

Q4 Over the past few days, on average, how anxious (uptight, tense, irritable, difficulty in relaxing/concentrating) have you been feeling, on a scale where '0' is 'not at all anxious' and '10' is 'extremely anxious'?

Not at all anxious	0	1	2	3	4	5	6	7	8	9	10

Q5 Over the past few days, how depressed (down-in-the-dumps, sad, in low spirits, pessimistic, lethargic) have you been feeling, on a scale where '0' is 'not at all depressed' and '10' is 'extremely depressed'?

Not at all depressed	0	1	2	3	4	5	6	7	8	9	10

Q6 Over the past few days, how do you think your work (both inside the home and/or employed work) have affected your back pain, on a scale where '0' is 'make it no worse' and '10 is 'make it very much worse'?

Make it no worse	0	1	2	3	4	5	6	7	8	9	10

Q7 Over the past few days, on average, how much have you been able to control (help/reduce) and cope with your back pain on your own, on a scale where '0' is 'I can control it completely' and '10' is 'I have no control whatsoever'?

I can control it completely	0	1	2	3	4	5	6	7	8	9	10

THANK YOU VERY MUCH FOR YOUR TIME IN COMPLETING THIS QUESTIONNAIRE