OCCUPATION-RELATED LOW BACK PAIN AND FUNCTIONAL ACTIVITIES OF MINEWORKERS FROM SOLWEZI DISTRICT, ZAMBIA

BY

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ABSTRACT

Low back pain (LBP) injury rates have been increasing over the years in the mining industry due to the physical nature of the work. It has been ranked among the most common occupational health problems worldwide, and regarded as a major contributor to high absenteeism rates at work, low productivity and high disability in the mining industry. The aim of the study is to determine the role of occupation-related LBP on the functional activities of mineworkers from the Solwezi District, Zambia. The study employed both quantitative and qualitative research approaches. A cross-sectional, descriptive design, using a survey, was employed to address the first three objectives while an exploratory design using focus group discussions was employed to address the last objective of the study. Simple random sampling was adopted in the survey and a total of 222 respondents who were workers at Kansanshi Mine in Solwezi District, Zambia participated in the study. Both descriptive and inferential statistics were employed in the study and data from the survey was analysed using the Statistical Package for Social Sciences (SPSS) version 22. The study indicated that 68% of the respondents suffered LBP in the past one year, one month prevalence was reported by 40.4% of the respondents, and a one-week prevalence by 33.1% of the respondents. LBP prevalence was attributed to bending which was indicated by 65% of the respondents. The relative risk of a mineworker having LBP during rest was 31.5% and the respondents recorded with the highest risk for LBP while at rest were aged ≤ 35 years and less. The results also indicated association between LBP and some demographic characteristics which included age, gender and BMI. Furthermore, LBP also correlated with bending during work activities and length of employment. Results also showed that 82.7% of the mineworkers took time off from work due to LBP. It was also revealed that LBP caused a significant amount of vocational as well as every day activity limitation amongst the mine workers. Similarly, chi-square test for proportion indicated an association between LBP and respondents' participation restriction. The knowledge and perception of kinetic handling among the participants showed that they had good knowledge of lifting and carrying objects, while there was limitation in their knowledge of pushing and pulling. Two themes emerged from the focus group discussion, namely assessment of an object as a primary safety precaution before manual handling and the use of equipment as the only feasible means of moving equipment in the absence of manual handling. There was a consensus that automated machinery was the only ideal means of moving loads in instances where manual handling was not possible. A better understanding of pushing and pulling and overall kinetic handling of objects is required among the mineworkers to reduce LBP occurrence among them. Recommendations include improving the knowledge regarding back care and ergonomics of all mine workers as well as education and training of all stake holders in the mining industry regarding back care prevention strategies.

DECLARATION

I hereby declare that "Occupation-related low back pain and functional activities of mineworkers from Solwezi District, Zambia" is my own work, that has not been submitted, or part of it, for any degree or examination in any other university, and that all sources I have used or quoted have been indicated and acknowledged by means of complete references.

Signature: ……….…………………

Suwilanji Chisenge

November 2016

Witness ……………………………

Dr Tania Steyl

DEDICATION

I dedicate this work to the Almighty GOD JEHOVA my Father, my source of refuge in times of trouble, my deliverer, my strength, you who never sleep nor slumber (Psalm 121). Indeed, He did not give me away to the hands of the enemy. I thank Him for His faithfulness, grace, love, kindness, blessings and favour over my life, for granting me the opportunity of reaching this far in my academics, indeed "IT IS THE LORDS DOING!" Indeed, Lord, You have been good to me and kept your word towards me (Psalm 20). To my mother, LYDIA SIMWANZA, who carried me in her womb and made sure that I attain good education. It was not easy but you always were strong. You have taught me to be a strong woman, a hard worker and to stay determined and focused in everything I do. I thank you for being a great mentor and a woman of character, a God-fearing woman, you are to me so many things to mention a few, thank you for the unconditional love and care you give to not only me but to all my siblings may GOD continue to increase, fill, sharpen, favour and bless you.

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CHAPTER ONE

1.0 INTRODUCTION

Chapter one gives a brief background about the study as well as a general summary on the economic impact of mining and its effects on the mine worker. The chapter also reports on the prevalence of low back pain (LBP), both in Africa and other continents, risk factors for the development of LBP, the role of physiotherapy in the management of LBP, as well as prevention measures for LBP. The objectives, aims of the study, significance and problem statement are also stated.

1.1 BACKGROUND

Zambia is a land-locked country located in Central Africa with an area of (752.612 km2). For a long time Zambia had been one of the leading producers of copper worldwide, representing 95% of the country's total exports (Garenne & Gakusi, 2006). The Zambian economy has mostly been dependent on copper mining. In the past years, before copper prices dropped and the global economic crisis, copper mining in Zambia accounted for 95% of the country's export earnings and contributed to approximately 45% of the countries revenue (National Aids Strategic Frame-work, 2010). The mining industry is a paramount sector in many countries in the United States of America (USA), 5% of the Gross Domestic Products (GDP) come from mining (Groves, Kercojevic & Komijenovic, 2007). Apart from providing foreign exchange and foreign investment to most countries, mining provides thousands of endogenous people with employment (Du Plessis & Du Plessis, 2006) making it a continually significant source of stress and musculoskeletal injuries such as LBP (Burgess-Limerick, Straker, Pollock, Dennis, Leveritt & Johnson, 2007).

The prevalence and incidence of LBP is increasing globally (Gallagher, 2008). Thirty-seven percent (37%) of low back pain worldwide is believed to be due to occupational risk factors, including the mining industry (Punnett, Prüss-Ütün, Nelson, Fingerhut, Leigh & Tak et al., 2005). Low back pain (LBP) is generally defined as pain that is restricted to the lumber region, an area between the lower margins of the last rib and the gluteal folds. It may be defined as subjective perception of pain in the lower back, irrespective of the presence or absence of leg pain (Louw, Morris & Grimmer-Somers, 2007; Snook, 2006) and is one of the most common complaints brought to the attention of doctors and physiotherapists (Shemory, Kiel, Pfefferle, Ian & Grandisar, 2016; WHO, 2003). LBP is a common health condition affecting about 80-85% of people in their life time. Unfortunately, LBP has not been given the same attention and funding as conditions such as HIV/AIDS (Ehrlich, 2003). LBP is one of the leading causes of disability if not managed properly (Bio, Sadhra, Jackson & Burge, 2007). The occurrence of LBP exists in all cultures globally, and negatively affects work performance, quality of life and the economy in general (Ehrlich, 2003).

Mechanical or Occupational LBP is a musculoskeletal disorder suspected to be triggered by a combination of chronic overuse or acute injuries (Hartvigsen, 2004). This condition affects the working population and its impact on the industry is significant (Kim, Hayden & Mior 2004). Workers suffering from LBP tend to experience great levels of disability, reduced quality of life, physical and psychological misery (Agunbode, Adebusoye & Alonge 2013). Factors that contribute to occupation-related LBP include poor handling of heavy loads or poor ergonomics, awkward posture such as kneeling and squatting, lifting, vibration as well as repetitive movement and long working hours (Rahman, 2014). According to Tamarin, Yokoyama & Jalaludin et al. (2007) occupations that involve improper body movements such as manual handling and driving play a major role in the prevalence of low back pain. LBP affects all sectors and all age groups in society (Mafuyai, Babangida, Mador, Bakway & Jabil, 2014; Watson, Papageorgiou, Jones, Taylor, Symmones, Silman & MacFarlen, 2002). The most affected are those involved in heavy manual work, for instance underground mine work which is a hands-on type of work (Ciriperu, Mhut, Branzan, Valas & Pleasan, 2010).

Mining is an ancient occupation which has long been recognised as a demanding and tiring kind of work involving different kinds of professions and trades (Donghue, 2004). Although mining has become increasingly mechanised, there is a substantive amount of manual handling still being used among mineworkers causing trauma disorders that result in prolonged disability (Donghue, 2004). For many countries, the mining industry is a very important sector which involves the extraction of minerals such as coal and other metals or non-minerals. 1t involves several other mining operations including maintenance, preparation, processing and repair in the production of minerals (Kecojevic, Komijenovic, Groves & Radomsky, 2007). In a recent study conducted in China sixty four percent (64%) of the coal mineworkers suffered from LBP (Xu, Pang, Liu, Pei, Wang & Li, 2012).

The situation of LBP among mineworkers in Africa should not be ignored, as Omokhodion (2000) reported that forty percent (40%) of Nigerian workers complained of LBP. In Ghana, a one year study which was conducted to identify the extent of LBP among gold mineworkers revealed a prevalence of 67% (Bio, et al., 2007). Zambia is not spared with LBP among mine workers, as more than forty percent (44.2%) of mine workers in Kitwe presented with LBP (Kunda, 2008).

Mineworkers are vulnerable to injuries due to the nature of their job, which is physically demanding. Their daily work routine includes activities such as drilling, lifting, bending of their backs, repeated twisting of the spine, prolonged standing and long working hours, all of which are associated with the incidence of LBP (Bio, 2007). Regardless of improved technology in the mining industry, equipment which is being used daily such as haul trucks, belt conveyors and front-end loaders have also been found to contribute to LBP (Kecojevic, Komljenovic, Groves & Kecojevic, 2007). The daily work routine activities of mineworkers cause vibrating mechanical pressure to the entire body which lead to an unusual stress on the back resulting in LBP (Tiwari & Saha, 2014).

LBP symptoms are accompanied by pain and disability. Mostly episodes of acute LBP have a favourable prognosis with recurrences in the same year (Koes, Tulder & Thomas, 2006). Guidelines for the management of LBP are available in several countries suggest that there is a need for more effort to be put in place in order to effectively manage LBP. In a study conducted by Maher (2000) it was reported that the only workplace intervention of LBP is exercise, while other interventions were ineffective or were not properly evaluated. The researchers recommended that more research should be conducted on the interventions used to prevent LBP in the work place. For example, the "back-school programme", a kind of therapy that utilises health education methods, where participants undergo a procedure of assessment education and skill development aimed at improving quality of life of those suffering from LBP (Tavafan, Jamshidi, Mohammad & Montazeri, 2007). The back-school programme is an outpatient programme which includes physical training, exercise and physical therapy. It is reported that this programme has shown to reduce absenteeism and improves patient functioning in 19 men and 24 women who participated in the programme. (Lonn, Glomsrod, Soukop & Larsen, 1999). The back-school programme had also shown to be effective in reducing back pain and improve postural behaviour among young people (Liona, Bocanegra, Garcia-Misfud, Bernad, Hernandez & Ayuso, 2014)

LBP is a serious health problem and physiotherapy involvement is very important in both prevention and management of LBP (Mosley, 2002). Physiotherapists are health professionals skilled in managing and prevention of LBP (Johns & Khumar, 2001). The primary role of physiotherapy focuses on intervention to reduce pain and prevent further occurrences and maintain optimal physical function. Furthermore, physiotherapists have a wide range of non-pharmacological treatment modalities that are used in the management of musculoskeletal conditions such as LBP. Modalities include massage therapy, joint mobilisation and exercise (Fransen, 2004).

Sufferers of LBP should be involved in independent health promotion activities and independent self-management activities such as exercise and self-medication. It has been further emphasised that exercise and education/advice should be the core of self-management strategies in the management of LBP (May, 2010). Soukup et al. (2001) recommended education with exercise as one of the effective ways in reducing LBP. Workers handling heavy material should be educated and trained regarding manual handling by providing manual handling programmes where they would be trained and encouraged to use equipment aids when handling heavy and awkward loads (Jager, Griefahn, Liebers, Steinberg & Fur, 2003 pg. 17).

Most studies concerning LBP among mineworkers are related to developed and high income countries. The lack of research leaves a gap in what is known about low back pain in a large part of the world as there is little information on LBP in the mineworker population in developing and low income countries; hence the motivation for the present study.

1.2 PROBLEM STATEMENT

Mineworkers are vulnerable to injuries due to the nature of their job that is physically demanding. For the past two years, the researcher has observed a rise in the number of employees with low back pain from the mine in Solwezi District, attending Solwezi General Hospital. This precedent, in addition to inadequate information regarding occupation-related low back pain and functional activities of the mineworkers has, prompted the researcher to undertake the study. In addition, there is a need to identify specific risk factors for occupation-related LBP in this population in order to develop prevention strategies and implement health promotion interventions to curb the emergence of LBP in the mineworkers.

1.3 AIM OF THE STUDY

The main aim of the study is to determine the role of occupation-related low back pain (LBP) on the functional activities of mineworkers from the Solwezi District, Zambia.

1.4 RESEARCH QUESTION

What is the role of occupation-related low back pain (LBP) on the functional activities of mineworkers from the Solwezi District, Zambia?

1.5 OBJECTIVES OF THE STUDY

- To determine the prevalence of occupation-related low back pain among mineworkers from the Solwezi District, Zambia.
- To identify the common risk factors for occupation related low back pain among mineworkers from the Solwezi District, Zambia.
- To determine the association between occupation-related low back pain and functional activities of mineworkers from the Solwezi District, Zambia.

- To explore the knowledge of mineworkers from Solwezi District, Zambia regarding kinetic handling in their daily occupational activities.

1.6 SIGNIFICANCE

The results of the study could help physiotherapists, medical professionals, government and mine industries plan specific measures on how to reduce the magnitude of the problem through the development of specific preventive education strategies and policies. Information obtained could also assist with the development of specific interventions to minimise occupation-related LBP among mineworkers and therefore contribute to a decrease in absenteeism rates from work. Recommendations for changes in ergonomics at the workplace could furthermore reduce production losses arising from absenteeism.

1.7 DEFINITION OF KEY WORDS AND TERMS

Ergonomics

Ergonomics is a science of work of designing or fitting the job to the worker and product to the user (Jager, Griefahn, Liebers, Steinberg & Fur, 2003).

Low back pain

Low back pain (LBP) is defined as subjective perception of pain in the low back which may include the buttocks or legs (Louw, Morris & Grimmer-Somers, 2007; Snook, 2006).

Occupation related low back

It is low back pain (LBP) that is caused or significantly aggravated by events or exposure in the work environment (Bureau of Labour Statistics, 2007).

Functional activities

An act that is essential for one to meet the daily demands of the environment one's daily life. A functional activity is an activity that is essential to support the physical social and psychological well-being of a person and allows the person to function in the society (Scott & Presmanes, 2001).

Manual handling

Any transportation or supporting of loads by one or more employees which includes carrying lifting, pushing pulling as well as supporting or putting down (Jager, Griefahn, Liebers, Steinberg & Fur, 2003).

1.8 ACRONYMS

LBP - Low back pain

BS - Low Back-School Programme

FGD - Focus group discussion

GDP - Gross Domestic Product

NIOSH - National Institute of Occupation Safety and Health

WMSD - Work related musculoskeletal disorder

WHO - World Health Organisation

1.9 SUMMARY OF CHAPTERS

CHAPTER ONE

Chapter One gives a brief background of the research this includes the research question, the study aim, research objectives as well as the problem statement and significance of the research.

CHAPTER TWO

This chapter reviews literature regarding studies on low back pain among mineworkers. The chapter discusses prevalence and impact of low back pain among mineworkers and other occupations, the chapter also explores factors associated with low back pain and in conclusion covers a section on kinetic handling as a preventive measure.

CHAPTER THREE

This chapter addresses the methodological concerns relevant to the study and explains the research setting where the study was conducted, as well as the study design used in the study. Incorporated in the study are details regarding the study population and sampling methods for both quantitative and qualitative data. It includes a description of data collection methods and the instrument used in data collection as well as the data collection procedures and issues regarding reliability, credibility, validity, and trustworthiness are also addressed. Lastly the method of data analysis and ethical issues are also specified.

CHAPTER FOUR

Chapter Four presents outcomes obtained from the mineworkers. It includes demographic characteristics of the respondents that took part in the study. This is followed by prevalence of LBP among the respondents, it also displays the years of employment in relation LBP past 12 months of those who suffered LBP. The chapter also presents the age of the respondents and LBP in the past 12 months, positions mostly adopted by mineworkers during their daily work and prevalence according to posture. Functional limitations of mineworkers as a result of LBP are also presented. Time off due to LBP and the influence of LBP on participation work activities. The chapter also gives the influence of LBP on certain life style activities, as well as relative risk of developing LBP on some individuals suffering from LBP.

CHAPTER FIVE

The results of the contest analysis of the focus group discussions that attempted to explore the mineworker's knowledge and application of kinetic handling in their daily work environment. The emerging themes are illustrated with the use of verbatim quotes.

CHAPTER SIX

Chapter six discusses the findings of both quantitative qualitative study results. The researcher engages in a conversation with other literature identifying the differences and similarities in other studies as well as taking note of the gaps for future studies.

CHAPTER SEVEN

Chapter seven provides the summary, conclusion as well as recommendations based on findings of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

LBP is among the most common health problems faced worldwide. It causes victims to experience mental, social, anxiety and physical disturbances or disruptions (Tuzun, 2007). Other reported complaints include lack of sleep, deterioration in health and poor physical performance. LBP is experienced in the low back, gluteal (buttocks) region and lower limbs and may be accompanied by numbness radiating down the lower limbs (Snook, 2006) or muscle tension and stiffness localised below the coastal margin and above the inferior gluteal folds. LBP is a common health problem which consequently affects work performance and overall the wellbeing of an individual (Duthey, 2013). It has been reported that at least 70-85% of people have had LBP in their lifetime (Koes, Tulder & Thomas, 2006).

2.2 GLOBAL PREVALENCE OF LOW BACK PAIN IN THE WORK ENVIRONMENT

Research stated that 80% of the population will experience at least one episode of LBP in their life (Freburger, Holmes & Angas et al., 2009) and 60% to 80% of the adult population in Western countries are likely to suffer from LBP (Gordon & Bloxham, 2016). In 2010 LBP was ranked amongst the top ten conditions that causes disease and injuries (Duthey, 2013) and about 40% of absenteeism from work is due to LBP, a condition ranking second after the common cold (Guo, 2002). In the United States of America, low back pain is among the most common complaints among adults (Chavakula & Chi, 2016). In a global review conducted by Hoy et al (2012), low back pain prevalence was highest in the female population with a point prevalence of 2.0% among those aged 40 to 80 years. LBP is very common in the workplace (Omokhodion, 2003). Hoy et al (2010) indicated that the global prevalence of low back pain was 9.4% and the prevalence is likely to increase with age thus causing more global disability. Himalowa (2010) reported a 25% prevalence of LBP with a one month and one-week prevalence of 69% and 54% respectively among construction workers in South Africa. In Nigeria, more than seventy percent of nurses had LBP, a condition linked to poor back care ergonomics and occupation hazards (Sikiru & Shimaila, 2009). In Turkey, almost two thirds (65.8%) of hospital staffs were reported having low back pain, 77% and 54% reported by nurse and secretaries respectively (Karahan, Kav, Abbasoglu & Dogan, 2009). 80% of nurses reported having LBP in the Philippines (de Castro, Cabrera, Gee, Fujishiro & Tagalog, 2009). Sikiru & Hanifa (2010) reported a prevalence of 73.53% among nurses at a Nigerian hospital. This was linked to lack of knowledge on back care ergonomics. Drivers such as truck drivers are among the many workforces affected by LBP (Andrusaitis, Oliveira, Eloy & Barros Fiho, 2006). The researchers reported a LBP prevalence of 59% in Brazilian drivers. More than forty five percent (45.4%) of professional drivers in Israel were diagnosed with LBP (Alperovitch-Najenson, Masharawi, Katz-Leurer, Ushvaev & Kalichman, 2010). Ndivudzannyi (2003) also showed that the lower back was the most commonly affected part among the brick-making factory workers in South Africa with 36.8% the respondents reporting LBP in the last 12 months. In a study conducted by Nurul Izzah, Abdullah, Moin and Shamsul Bahri and Hashim (2010), the researchers reported a prevalence of 40.4% among teachers mostly due to lifting heavy loads.

LBP among people from Africa is a major concern as the prevalence is increasing rapidly. This statement is supported by the Global Burden of Disease conducted in 2007 by Louw Morris and Grimmer-Sommers (2007). The mean point prevalence among adolescents was 12% while in adults a 32% prevalence was reported. The average one-year prevalence among adolescents and adults were 33% and 50% respectively while the average lifetime prevalence of 36% and 62% were reported respectively in adolescents and adults (Louw Morris & Grimmer-Sommers, 2007). In a recent global review of LBP, the highest prevalence was reported among females in the age group 40-80 years old (Hoy et al., 2012). In addition, the researchers concluded that LBP is an enormous unending problem and likely to increase significantly in the coming years as the population grows.

2.3 PREVALENCE OF LOW BACK PAIN AMONGST MINE WORKERS

Low back pain (LBP) among mine workers has increased over the years and the consequential disability it causes continues to cripple the mining industry (Gallagher, 2008). The problem of low back pain amongst mineworkers is evident in both developed and developing countries. A study conducted in Kosovo found a prevalence of 61% of LBP among mineworkers (Murtezani, Ibraimi, Sllamniku, Osmani & Sherifi, 2011). Similarly, 64% of coal mineworkers suffered LBP in China (Xu et al., 2012). The situation is not different in Turkey where almost eighty percent (78%) of the Turkish coal mineworkers reported to suffer with LBP (Sarikaya, Ozdolap, Gumustass & Koc, 2007). There is overwhelming evidence that mineworkers are more plagued with work-related musculoskeletal disorders (WMSDs) than those working in other industries, more disability and absenteeism is reported by mineworkers (Bandyopadhyay & Gangopadhyay, 2012). In a study conducted in India, almost two-thirds (65.45%) suffered musculoskeletal disorders in several body parts, (58.18%) of the coal mineworkers experiencing maximum pain in the lower back of the coal mineworkers (Bandyopadhyay & Gangopadhyay, 2012). Likewise, Mandal and Srivastova (2009) reported a LBP prevalence of eighty-five percent (85%) amongst dumper operators in India. Africa is not spared the LBP burden, as reported by several researchers. In Ghana, in a study conducted to identify the extent of LBP among gold mineworkers, a prevalence of 67% of was reported (Bio et al., 2007). In a more recent study conducted in another goldmine, LBP was reported to have the highest percentage among other body parts with 30% in the 12-month prevalence of musculoskeletal disorders (Tawiah, Oppong-Yeboah & Bello, 2015). In addition, according to Kunda (2008), the body part mostly affected in underground mineworkers in Zambia was the lower back (44.2%).

The impact of low back pain on the mining population is huge (Kim, Hayden & Mior, 2004). LBP has been ranked among the most common and difficult occupational health problems and is a major contributor to the high absenteeism rates in the mining industry (Dias, 2014). As a consequence, absenteeism among affected mineworkers may lead to increasing financial cost as sufferers of LBP spend huge amounts money on health care. In the United States of America (USA) alone, one hundred to two hundred billion United States dollars are spent annually on medical treatment of occupation-related LBP (Carey & Freburger, 2014), while in Australia occupation-related LBP was ranked the most expensive condition with an estimated annual cost of more than nine billion dollars (Walker, Muller & Grant, 2003). Overall, back pain is one of the most costly conditions in the UK (Hoy et al., 2010), The cost of LBP could only be reduced if factors causing the problem could be identified and measures taken to curb the problem among the sufferers (Kent & Keating, 2005).

2.4 OCCUPATION-RELATED RISK FACTORS FOR THE DEVELOPMENT OF LOW BACK PAIN (LBP)

Several researchers alerted us that repetitive movements, exposure to awkward postures such as kneeling and squatting, physical activity such as manual lifting, handling and whole body vibrations contributes to low back pain (Sarikaya et al; 2007; Torma-Krajewewski et al., 2007; Murtezani et al., 2011). Bio (2007) and Tawiah, Oppong-Yeboah and Bello (2015) observed that low back pain is particularly common among mineworkers as their work requires bending of their backs and repeated twisting of the spine. Mineworkers are also often subjected to carrying heavy loads such as batteries and oxygen devices suspended at their waist height, including manual handling of heavy cables, a very demanding task and a likely contributor to LBP in mineworkers. Tiwari and Saha (2014) reported a higher prevalence of low back pain in those working in standing and awkward positions than those in sitting positions. Prolonged standing as well as walking in a confined space is among the factors influencing low back pain (National Research Council, 2001). Furthermore, workers exposed to prolonged standing may experience a decrease in balance reactions which may result in failure to effectively resist side loads of the trunk (Nelson-Wong & Callaghan, 2010).

It has been shown that working in restricted or vertical constrained spaces increases the linear increase in flexion resulting in kyphotic posture or kyphosis of the lumber spine which may be directly linked to the development of LBP (Friedrich, Kranzl, Heiler, Kirtley & Cermak, 2000). Gallagher, Marras, Litsky and Burr (2005) reported that many injuries in the lumber area come as a result of bending the trunk forward while trying to lift heavy objects. It has also been found that forward bending causes spinal tissues to fail when an extra load is introduced. It is difficult for mineworkers to avoid bending forward. This causes ligaments to stretch, thus causing muscles to lose strength, making them prone to muscle spasms and further decreases muscular function (Solomonow, 2004). Furthermore, musculoskeletal disorders such as LBP are triggered mostly by overuse of body parts which are subjected hard work that exceeds the level that it is prepared for, although the initial direct impact may not be great but when done repetitively it may cause great harm to the body (Bandyopadhyay et al., 2012).

Researchers have also found a direct relationship between LBP and whole body vibrations experienced in mine work. Vibration can be defined as an oscillatory motion involving an object moving in constant acceleration first in one direction and then the opposite direction, this can be from a vehicle or tool (Griffin, 1998; Troxel, Helmus, Tsang & Price 2015). Whole body vibration is an occupational hazard, and constant exposure to it increases the risk of LBP, degenerative changes in the spine, sciatic pain as well as lumber intervertebral disc disorder. Whole body vibration is mainly associated with mine work due to the nature of the machinery such as jackhammers which are used both in open pit and underground mines, scrapers locomotive handles, grinders and drillers. All these machines have a huge bearing on the health of a mineworker (Mandle & Sirivastava, 2006).

Good posture is difficult to achieve in mineworkers, as their work requires working in awkward positions such as extreme bending posture and confined spaces may lead to increased intra-disc pressure (Lacour, Bernard-Demanze & Dumitrscu 2008). As Evcik and YuceI (2003) reported, it is very challenging for the mineworkers to maintain a good upright posture due to the nature of their work. The abnormal posture directly exposes muscles and ligaments to strain which indirectly affects the curvature of the lumber spine. According to literature the onset of low back pain is triggered by manual handling of heavy materials, performing heavy physical work as well as forceful movement (Elders & Burdorf, 2001; Andrusitis, Oliveira, Eloy & Barros Filho, 2006). In addition, long working hours is a common trend in the mining industry as most mines operate 24 hours per day, seven days per week. Thus, mineworkers are subjected to various tasks over the course of the working day (Donoghue, 2004) where shift lengths of 10 to 12 hours accompanied with high workloads could contribute to LBP amongst the workers (McPhee, 2004). In addition, an increase in age is associated with LBP. According to Bio (2007) the mean age of the mineworkers affected by LBP was 40 years old, a tendency also reported by Tiwari and Saha (2014).

2.5 LOW BACK PAIN AND FUNCTIONAL ACTIVITIES

According to the International Classification of Functioning Disability and Health (ICF), the problems faced by the sufferers of LBP are described in terms of disability, impairment and participation restriction. Disability can be referred to any difficulty, experienced in performing an activity such as walking, bending, or reaching for an object. The definition was later revised by the World Health Organisation (WHO) in the International Classification of Function and Disability as an umbrella term covering three aspects of health which include body functions and structures, activity limitation and participation restriction (WHO, 2007) Functional limitation is activity limitation experienced by an individual as a result of LBP problems, whereas activity limitation is the level of difficulty that is experienced by an individual in carrying out an activity due to their LBP (Bjorklund, Hamberg, Heiden & BarneKow-Bergvisk, 2007). Patients with LBP face many challenges, including normal participation in their social and work place environment.

LBP is a major cause of musculoskeletal disability in heavy physical work such as mining (Ciriperu, et al., 2010). Apart from the high financial losses to both the patient and the employers, low back pain negatively affects everyday life. Activities of daily living such as toileting, performing house hold chores, driving, and sport and leisure time activities could be affected by LBP (Mattila, Leino, Kemppi & Tuominen, 2011). The researchers also found that sport activities where more affected than leisure time activities and that men where more affected since they are the ones who more often participate in sport activities than women. Frantz and Himalowa (2012), in a study on construction workers, a field similar to minework, concluded that occupation activities significantly caused LBP and consequently causes activity limitation, participation restriction and absenteeism as a result. Several aspects of a patient's work life are affected by LBP, resulting in absenteeism from work and causing great economic losses as well as loss of quality of life (Punett et al., 2005). LBP significantly disables an individual's ability to work by restricting their usual activity and participation, for instance, the ability to work normally (Van Vuuren et al., 2006). Other activities include walking, standing, bending, lifting, carrying and sex life (Bjorklund et al., 2007). As a result, mobility is restricted. LBP also affects sleep, and in most cases patients fear to participate in strenuous activities and leisure activities due to fear of recurrence of episodes of LBP (Wooll & Pfleger, 2003).

Among the many problems that patients with LBP face include physical, social, occupational and mental disturbance. Depression, anxiety and sleeplessness are some of the mental problems that reported as a result of LBP while a decline in health and poor physical performance are as a result of physical disturbance (Nurul et al., 2010). The disability that comes with LBP is due to the pain and loss of function imposed or inflicted on the sufferers. Patients suffering from LBP are unable to participate in many social activities and their ability to perform in various occupational activities is decreased, especially in the adult working age group (Ogunbode, Adebusoye & Alonge, 2013). The researchers further highlighted that there is little available information on LBP in developing countries, especially in Africa. This can be attributed to the fact that LBP is regarded to be of little importance in relation to other non-communicable diseases such as hypertension and diabetes mellitus.

2.6 PREVENTION OF OCCUPATION RELATED LOW BACK PAIN

2.6.1 ERGONOMICS AND KINETIC HANDLING

Occupation injuries have for too long been a result from manual handling of materials (Addison & Burgess, 2002). The authors further stated that manual handling injuries are a major burden to the economy and the sufferers themselves. Manual handling can be defined as "an activity that uses force exerted by a person to lift, push, pull, and carrying an object" (Occupation Health Department, 2007, p. 2). Most of the accidents that occur in workplaces arise from manual handling of loads through lifting, pushing and pulling which causes strains to body parts such as the lower back (Ramadan, Hashim, Kamat, Mokhtar, Najib & Asmai, 2014). Simpson (2000) suggested for the need for manual tasks risks to be seen as an occupation health issue other than an occupation safety issue. Literature suggests that workers performing manual tasks should be involved in the participation of an ergonomic approach to manual risk management. Furthermore, the workers should take the leading role in effectively identifying hazards in the workplace, risk control activities as well as risk assessment (Mines and Petroleum Resources Safety, 2010). Research has reported that in order for the problem of low back pain to be eradicated, the most effective interventions are those that involve persons at all ranks of the organisation (Snook, 2006).

Prevention efforts should be multi-faceted. Other recommendations made in literature include increasing the state of knowledge regarding kinetic handling in the mining industry as priority number one. This can be achieved by developing information products and increasing education activities among mine workers (Prieticola, 2008). Thorma-Krajewiski, Steiner, Lewis, Gust and Johnson (2006), stressed the importance of hazard identification as one of the key tasks that should be carried out in mine work. This process may involve identifying jobs that are of at most risk. It may also involve a systematic analysis of job risks which may include observing problem jobs, reviewing past accident statistics by using a job risk factor check list specific to low LBP, interviewing workers and supervisors as well as gathering information through focus group discussions with the workers affected.

Traditionally occupation injuries have been prevented through training in manual handling. According to McPhee (2004) ergonomics training should also be encouraged in the workplace, as it promotes the wellbeing of workers and assisting in more efficiency in the work environment. Ergonomics is an applied science that should be employed to reduce the risks and consequences of injuries due to falls and slips that usually occur in minework. It has been noted that the contribution of ergonomics in mining has been poorly understood as mineworkers are still subjected to manual work which includes installing overhead pipes, roof support systems, cables, dismantling and erecting conveyor systems and maintaining machinery in underground mines. Ergonomic training is a vital practice that should be used in mining in order to overcome problems of prolonged sitting and heavy work. Pope, Goh and Magnusson (2002) reported that exposure to mechanical loads is one of the contributing factors influencing occupation related low back pain, especially lifting heavy objects and lifting in awkward position. The researchers further recommended prevention to be the ideal treatment choice and that heavy lifting should be avoided by the workers. Lifting aids should be provided to the mineworkers. Other recommendations made were that workers should be urged to report LBP problems if at all they feel that their work is harmful to them. It was further noted that the problem of LBP can only be dealt with through combined efforts of the medical community management and labour forces (Pope, Goh & Magnusson, 2002).

Manual handling of materials has been reported to be the number one cause of musculoskeletal disorders (Ramadan et al., 2014), and the mining industry is one of the major sources of musculoskeletal injuries and stress resulting from manual handling of materials. This has been a major concern to occupation health, for instance, frequent heavy lifting is associated with increased risk of development of LBP (Nurmianto, Ciptomulyono & Kromodihardjo, 2015; Plamondon, Delisle, Trimble, Desjardins & Rickwood, 2006). Principles of ergonomics can make major contributions in managing occupation safety and health risks. Although ergonomics is currently being applied on a small scale in African mines, poor ergonomics can result into musculoskeletal disorders and work fatigue (Schutte, 2005). In addition, the researcher concluded that the application of sound ergonomic principles has the ability to enhance the efficiency and effectiveness in the way human tasks are carried out and furthermore reduce significant occupation health hazards. Literature has recommended the use of participative ergonomics for manual tasks. This is a simple programme that involves identification of hazards before performing a task or job. It also includes the evaluation of risks, the assessment of a risk and control of a risk. Furthermore, design changes of tasks are done by modifying jobs that have been reported to be high risk to lessen hazards (Norman & Wells, 2000). Participative ergonomics approach to manual tasks requires workers to be knowledgeable about risk management frame work which includes having skills and tools to assess manual tasks, Burges-Lemerick, Straker, Pollock, Dennis, Leveritt and Johnson, (2007). A substantial amount of evidence suggests that worker participation is very critical in risk management cycle (Torma-Krajewski, Steiner, Lewis, Gust & Johnson, 2007; Burges-Lemerick et al., 2007) Participative ergonomics also involves using already existing information to help identify hazardous jobs that are of highest risk for LBP, by going through past accident statistics as well as interviewing workers and their supervisors concerning problem areas in their work places (Thorma-Krajewiski et al., 2006).

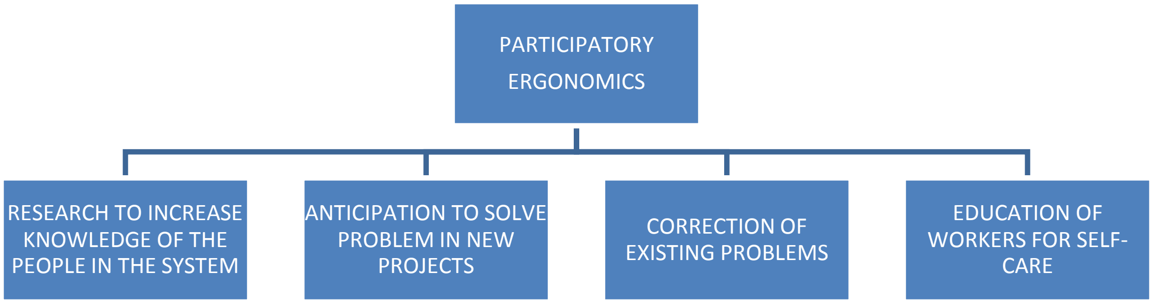

Figure 0.1 Suggested participatory ergonomics in mining (Apud, 2012)

Participative ergonomics has been reported to improve flow of useful information in an organisation, improvement in meaningfulness of work and reduces work-related health problems (Van Eerd et al., 2010). The benefits of participative ergonomics are that workers are taught to identify postural overload problems as well as proper work techniques. Workers are also taught to analyse individually how to perform team work from an ergonomic point of view and evaluate their workplaces (Apud, 2012). In conclusion, the researcher stated that participative ergonomics should be incorporated in all projects as mining work is hazardous. This includes educating workers in self-care to identify situations which they can manage to tackle and those that require system redesign. Weston, Nasarwanji and Pollard (2016) concluded that work-related musculoskeletal disorders such as LBP are a huge burden to the mining industry and significantly affect a mineworker's quality of life. The researchers further recommended for prevention measures to be more fixated on both surface and underground mines by use of correct recommended tools, proper housekeeping and also modification of equipment that commonly causes injury to the worker.

Heavy lifting of objects creates substantial risk for the development of musculoskeletal injuries to the back (Waters, Piacitelli, Werren & Deddens, 2011). There is a direct relationship between lifting and low back pain. Pope, Goh and Magnusson (2002) highlighted that in order to reduce the risk of injury to the lower back, whole body lifting and also lifting with jerking of the arms should be avoided in order to reduce the dynamic load effect on the spine. Exposure to risk factors has consistently been the leading cause of occupational disability due to LBP in the mining industry. LBP prevention efforts in mining and other industries have often been related to a slogan that is very well known among those involved in load lifting and that is to lift with your legs and not with your back (Snook, 2006). This slogan requires full ownership because prevention of low back injuries in the mining industry is dependent on the worker performing a lifting task (Snook, 2006).

Before one attempts to lift, it is important to plan the lifting task, making sure that one wears footwear that will prevent slipping when carrying or lifting heavy loads. The floor should also be in a good condition with no tripping hazards that may cause other injuries. Before one attempts to lift a heavy load, it is advised to try the load for steadiness or stability. The load to be lifted should also have hand grips if possible, and the person performing a lifting task should use both hands to lift (Occupation Health and Department, 2007). It is recommended that one should establish a good base of support, keeping a wide balanced stance with one foot in front of the other, bending the knees as you kneel and be as close to the object to be lifted as possible. Hold the object to be lifted firmly in your hands, and use your legs to push up and lift the load while keeping the back straight (Arya, 2014; National Institute of Occupation Safety and Health (NIOSH), 2007). When lifting heavy loads, it is important to keep the load as close to the body as possible, avoiding prolonged lifting as this may cause more strain to the back muscle (Occupation Health Department, 2007; Jager, Griefahn, Liebers, Steinberg & Fur, 2003).

Literature recommends the use of both hands, and avoiding bending forward as it is also one of the reported risk factors for LBP. In addition, it is recommended to keep the heaviest side of the load as close to the body as possible. When carrying a heavy load use your body weight to move the load, when pushing or pulling allows the momentum or motion of the load to help in doing some of the work (Occupation Health Department, 2007). Further recommendations include avoiding twisting of the trunk while carrying out activities such as lifting, pushing and pulling (NIOSH, 2007).

Currently there has been a change in the handling of materials from lifting to pushing and pulling (Knapik & Marras, 2009). Van der Beek, Kluver, Frings-Dresen, and Hoozemans (2000) reported that when one attempts to move a load, pushing should be recommended to pulling because oxygen consumption is higher in pulling than in pushing for both male and female. Knapik and Marras (2009) also reported that pulling induced greater spine compressive loads than pushing. Pushing can be defined as when the hand force is directed away from the body, while pulling is when the hand force is directed towards the body (Martin & Chaffin, 1972). There is need for education for proper pushing and pulling tasks to avoid back loading since attempts to set load limits for pushing and pulling are challenging (Lett & McGill, 2006). Todd (2005) also commented on the lack of standardised methodology in push-pull research, but the National Institute of Occupation Safety and Health (NIOSH) (2007) recommends for employers to train their employees on proper equipment use. When pushing and pulling loads, it is recommended that one pulls or push with the entire body instead of just arms and shoulders. When the load is too heavy it is advisable to reduce the load, or use equipment to avoid physical strain as pushing and pulling is linked with the development of LBP (Griefahn, Liebers, Steinberg & Fur, 2003 pg. 19). Literature recommends use of equipment such as carts, tracks, wheel barrows that have been put in place in order to eliminate problems related with manual material handling such as physical stress (Jung, Haight & Freivalds, 2005).

2.6.2 THE ROLE OF PHYSIOTHERAPY IN THE MANAGEMENT OF LOW BACK PAIN (LBP)

Occupation-related LBP is a serious concern among mineworkers. The involvement of physiotherapy is very vital in the management and prevention of low back pain. Physiotherapists are skilled with knowledge regarding assessment, treatment as well as prevention of occupation-related LBP, thus reducing the risk of disability and chronicity of the condition (Jones & Kumar, 2001). Physiotherapy management also includes pain reduction and engaging in education programmes on self-management strategies within the workplace.

Occupational safety training alone is not effective as a single intervention as prevention efforts should be multi-faceted or approached in many ways (Prieticola, 2008). Prevention strategies can effectively take place with the awareness of current identified risk factors favouring the occurrence of LBP. Other recommendations made in literature include increasing the state of knowledge of kinetic handling in the mining industry as first priority (Prieticola, 2008). The primary role of physiotherapy management involves interventions that focus on pain relief, returning to work, and most of all prevention of future occurrence. Physiotherapists have an important role to play at all stages in the management of LBP. They offer advice, education and explanations to patients found or identified with psycho-social barriers to recovery (Moffet & Mclean, 2006). They help in early return to work in the later stages in managing LBP. Physiotherapists provide intensive rehabilitation interventions which include manual therapy and exercise therapy (Moffet & Mclean, 2006). Furthermore, physiotherapists also help in the reduction of disability in patients with acute low back pain (Chavakula and Chi (2016).

Physiotherapists are important as they provide a patient-centred care in the management of LBP by reducing pain and improving function in the sufferers (Canadian Physiotherapy Association, 2012). Physiotherapists are able to closely monitor patients' physical functioning and performance, which includes educating patients on the optimal management of their daily tasks, as well as encouraging patients to adopt suitable regular lifestyle (Moseley, 2002). The programmes offered by physiotherapists are individualised, thus causing positive life long lifestyle changes and subsequently improve quality of life and lowering healthcare expenses incurred by LBP (Bello, Quartey & Lartey, 2015). Physiotherapists promote an individual wellness independent function by preventing disability, injury and disease. They are also involved in support programmes to prevent recurrence and re-injury, improving and maintaining optimal functional independence and physical performance. Physiotherapists are self-regulated and work interdisciplinary with other professionals to treat people with ailments such as musculoskeletal conditions including LBP (Fransen, 2004). Furthermore, physiotherapy has been reported to be the most cost effective solution in the tackling of musculoskeletal conditions (Canadian Physiotherapy Association, 2012). Physiotherapists have an extensive variety of non-pharmacological treatment modalities that are used in managing musculoskeletal conditions such as LBP. Modalities that involve direct hands on contact between patient and physiotherapist, for instance massage therapy and joint mobilisation and exercise (Fransen, 2004: Airaksinen et al, 2006). Exercise therapy is commonly used in conservative management of LBP because of its effectiveness in in reducing pain and function (Van Middelkoop, Rubinstein, Verhagen, Ostelo, Koes & van Tuderet, 2010).

2.6.3 HEALTH EDUCATION, PHYSICAL FITNESS AND EXERCISE

Research has highly recommended the development of educational programmes for the sufferers, as well as imparting knowledge in those affected with LBP. This reduces anxiety and pain as patients have more understanding about their LBP problem (Henrotin et al., 2006). Patient education provides sufferers with activities and information about their illness (Poland, Green & Rootman, 2000). Buckhardt (2005) emphasised the importance of healthcare workers to encourage self-management strategies to patients with LBP. This enables patients to have a wider scope of their LBP problem. Furthermore, it allows patients to know about the risk factors of their LBP (Buckhardt, 2005). Weiman, Yusuf, Berks, Rainer and Petrie (2009) also emphasised the importance of patient acquiring knowledge about their anatomy or body structure for it is an empowering health strategy that can help in managing LBP.

Sufferers of LBP should remain active throughout their life due to the health benefits of an active lifestyle, including early return to work, less disability, and improved recovery (Olaya-Contreras, Styf, Arvidsson, Frennered & Hansson. 2015). Several countries such as Germany, Canada, United States of America, Spain and the United Kingdom are using patient education programmes, namely the back-school programme (BS) (Mannion, Taimela, Muntener & Davorak, 2001). This programme has been developed to reduce the risk of back pain problems and increase knowledge on back care (Tavafian, Jamshidi, Mohammad & Montazeri, 2007). The programme involves educational skill factor together with exercises, while under supervision of a physiotherapist or medical specialist. Participants receive instructional hand-outs with information regarding anatomy and function of their backs, mechanical strain, posture, together with an exercise programme to increase back mobility, body mechanics, patient transfer techniques and advise on stretching techniques (Jaromy, Nemeth, Kranicz, Laczko & Bethlehem, 2012; Burton et al, 2006).

According to Kim, Hayden and Mior (2004), factors associated with LBP can be modified by intensive education and with exercises. Programmes such as the back-school programme have gained popularity because of its use of educational principles, simple technology and it being inexpensive. Furthermore, participants find enjoyment in attending the sessions (Hodselmans, Jaegers & Goeken, 2001). Soukup, Lonn and Glomsrod (2001) also reported that exercise and education are often common approaches used by physiotherapists in the prevention of LBP. Literature suggests that exercise poses no harm to patients with LBP and may only have a neutral effect or partially lessen the risk of future back injuries (Rainville, Hartgan, Martinez, Limke, Jouve & Finno, 2004). In addition, exercise has been found to improve and eliminate impairment in back flexibility. Evidence supports the use of exercise as a therapeutic tool that can work to reduce impairments, increase strength, back flexibility (Rainville et al., 2004) and also improves daily living, fear and avoidance beliefs (Krugar, Billson, Wood & Du Toit, 2015). It has also been reported that bed rest should not be recommended as it provides no benefit to patients with LBP. Patients are advised to stay active, as this will result in less time lost from work. Literature recommends that if bed rest is given it should not be for more than two to three days (Hagen, Hilde, Jamtvedt & Winnem, 2004).

Sufferers of LBP should avoid bending forward, twisting, prolonged, sitting lifting heavy objects and maintain an active lifestyle. Returning to work as early as possible and light duty rather than staying in bed, waiting for the pain to completely subside should be attempted (Kinkade, 2007). In order to avoid recurrence of episodes of LBP and sick leave, physical exercise is suggested as it is effective in LBP prevention (Burton, 2005). In a research study conducted by Maher (2000), exercise was concluded as the only workplace intervention that can be used to prevent LBP. LBP is a highly prevalent condition in the general population, it is therefore imperative that individuals suffering from LBP involve themselves in self-management strategies in managing LBP (May, 2010). Self-management strategies require sufferers to be involved in independent health promotion activities and independent self-management activities such as exercise and self-medication. It was further highlighted that exercise together with health education and advise should be the core of self-management strategies in the management of LBP due to its effectiveness (May, 2010). Smith and Grimmer-Sommers (2010) also reported that exercise programmes are effective in reducing pain in the sufferers of LBP.

Main and Williams (2002) stressed the need for sufferers to shift the attention on the illness to function and also use of active therapies rather than passive therapies. Encouraging patients to adopt copping strategies and self-care rather than focusing on just getting treatment for those suffering from LBP. It has been recommended that LBP patients should be encouraged to participate in low impact activities such as swimming, bicycling, and walking, in order to increase fitness levels among the patents (Arya, 2014).

If not managed, LBP can be very debilitating, thus keeping an active lifestyle regardless of LBP is healthy. In addition, guided self-care can be implemented as it has been shown to be effective in the reduction of LBP (Weiner & Nordin, 2010). Physical exercise has been recommended in preventing work absenteeism and further occurrences from LBP, as well as appropriate education approaches have showed more potential in in managing LBP. The above recommended strategies regarding exercise and LBP were echoed by Burton (2005) and Burton et al., (2006).

2.7 SUMMARY OF THE CHAPTER

Research has shown that low back pain injury rates have increased over the years, including in the mining industry. LBP and its management remain to be one of the leading costly and significant problems both in the mining industry and other professions. It is imperative that effective prevention efforts be put in place to reduce the prevalence of this debilitating condition. The next chapter presents and discusses the methodology used in the study.

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

This chapter provides an overview and rationale of the method used, and the process of data collection. The researcher provides a brief description of the research setting, research design, population and sampling method, and statistical analysis of the data collected. In addition, ethical considerations employed in the study are given.

3.1 RESEARCH SETTING

This study was conducted at Kansanshi Copper Mine in the Solwezi District, Zambia. Zambia is a landlocked country located in southern-central Africa with the area of 752.612 square kilometres and a population of approximately 13 million people. The country is demarcated into ten Provinces and 74 districts. Among the nine Provinces only two are mainly urban, including Lusaka, the capital city of Zambia and the Copperbelt Provinces. Solwezi District, which houses Kansanshi mine, is located in the North-Western Province of the country (Zambia Demographic and Health Survey, 2013; Zambia Demographic and Health Survey, 2007). From the time Zambia became independent, copper mining is the country's primary economic activity. Most of the country's export earnings are from copper and a large percentage of government revenue also comes from copper mining (Demographic and Health Survey, 2007; Garenne & Kakusi, 2006).

Solwezi is the provincial headquarters for the North-Western Province, also known as "the new Copperbelt". Kansanshi Copper Mine is one of the largest copper mines in Africa, located 15km north of Solwezi, and employs approximately 3,000 mine workers, excluding contract workers. The mine is an open pit mine which uses conventional open pit methods through the use of haul tracks and hydraulic excavators (Information Mine, 2012).

3.2 RESEARCH APPROACH

The study employed a quantitative research approach to address the first three (3) objectives through the collection and analysis of numerical data (Aliaga & Gunderson, 2000). A qualitative approach was employed to explore the mineworkers' knowledge of kinetic handling in their daily work environment, namely the last objective.

3.3 RESEARCH DESIGN

3.3.1 Quantitative component

Quantitative research can be defined as a research that explores phenomena through collecting of numerical data. The numerical data is then analysed through the use of mathematical methods, particularly statistics (Aliaga & Ganderson, 2006). The study employed a descriptive cross-sectional design. A descriptive study involves the observation of events occurring in a population without influencing or changing the environment (Levin, 2006), utilising a survey for data collection (Creswell, 2003). Cross-sectional designs are purposively done to find prevalence of outcome of interest for a given population. It may also be employed to establish the relationship between risk factors and outcome of interest. A cross-sectional research design was employed because of its appropriateness in measuring the prevalence of a phenomenon at one point in time. A limitation is that it does not give account of the sequence of events. The advantages of cross-sectional studies is that they are less costly, take up less time, and many outcomes and risk factors can be assessed at once and there is no loss to follow-up (Levin, 2006).

3.3.2 Qualitative component

An exploratory design was used for the qualitative part of the study, whereby focus group discussions were carried out in order to understand the mineworkers' knowledge and application of kinetic handling in their daily work environment with the aim of preserving and representing their voices (Harmell & Carpenter, 2004).

3.4 STUDY POPULATION AND SAMPLING

3.4.1 Quantitative component

The study population consisted of all the mineworkers currently employed at Kansanshi Mine, namely approximately 3,000 workers. To allow for generalisability of the results to the designated population (Babbie & Mouton, 2006), the Yamane formula (Israel, 1992) was used to calculate the sample size as follows:

$n = \frac{N}{1 + N(e)^2}$ where N = the total population, n = the sample size and e = the constant equal to 0.05.

A minimum of three hundred and fifty three (353) participants should participate in the study to be able to generalise the results to the population. Probability sampling, specifically simple random sampling was employed in the study. Simple random sampling is a technique where each member of the population will have an equal chance of being selected. The technique is bias free and the sample cannot be selected twice as a sample (Barreiro & Albandoz, 2001). Every third mineworker was selected to participate in the study from a list of names which was provided by the mining company.

<u>Inclusion criteria</u>

Mineworkers aged 18 years and older, working for at least one year at the mine, involved in physical mine work (haul track operators, hydraulic excavator operators, and rock breaker drivers, crush operators, skip man, artisan boiler makers, and pump chamber operators, artisan fitter, mechanic metal fabricators, plant fitters, truck layers and locomotive drivers).

Exclusion criteria

Mine workers with a history of LBP due to non-work-related reasons e.g. a fall at home or a motor vehicle accident as well as office bearers such as managers and supervisors employed by the mining company.

3.4.2 Qualitative component

Purposive sampling was employed as all the mineworkers who participated in the quantitative phase of the study were approached to participate in five (5) focus group discussions (FGD). A minimum of 25 participants was selected (five persons per FGD). Only four (4) FGD were done as saturation was reached by the fourth FDG.

3.5 DATA COLLECTION INSTRUMENT

3.5.1 Quantitative component

A self-administered questionnaire developed by Himolowa (2010) was used to collect data from the participants. The questionnaire was developed based on valid, reliable existing questionnaires, namely the Nordic Back Pain Questionnaire (Kuorinka, Jonson & Kilbom, 1987), the Profile Fitness Mapping Questionnaire (Bjorklund et al., 2007) and the Pain Disability Questionnaire (Anagnostis, Gatchel & Mayer 2004). The tool comprised of four sections with open and close-ended questions:

Section A: Social demographic-information and anthropometric measurements

Participants were required to provide information such as age, gender, level of education, job title, number of years' work experience, most commonly adopted posture on duty (i.e. bending, sitting, standing), duration of work per day and also if they are permanent or contract workers. **WEIGHT** and **HEIGHT** was measured by the researcher and research assistant. Each participant was taken to a room where anthropometric measurements were taken in private. An electronic digital scale was used to measure weight. The participants were asked to remove their shoes and socks as well as excess clothing. The weight reading was taken twice and the final recorded reading was the average of the two readings taken (in kg). For height, a tape measure was against the wall, 10cm above ground level. The participants were asked to remove their shoes, stand feet together and arms by the side. The heels, buttocks and upper back were against the wall. The measurements were taken from the floor to the highest point on the head in centimetres (cm). This was done to help calculate the respondents Body Mass Index (BMI), a screening tool which helps to categorise or indicate whether a person is overweight (obese) or underweight and also if they have a healthy weight for their height. Thereafter the participants were allowed to complete the questionnaires in the next door waiting room at Kasanshi Mine.

Section B: The Nordic Back Pain questionnaire

This section of the questionnaire consisted of 19 questions to determine the prevalence on LBP, perceived causes, and symptoms including history of LBP in the last 12 months (De Barros and Alexandre, 2003). The questionnaire was supported by a body chart which indicated specifically the area of interest in the present study. Close-ended dichotomised response alternatives of either ‘yes’ or ‘no’ was used. Participants were also asked if they could relate the initial onset of low back problem to a specific incident and if they had ever taken time off from work because of the low back problem.

Section C: Profile Fitness Mapping

The Profile Fitness Mapping questionnaire was used to test the functional limitation of the mineworkers (Bjorklund et al., 2007). The instrument assessed self-estimated symptoms and functional limitation as well as how LBP affects their ability of executing activities of daily living. The functional limitation scale consisted of 27 items with six (6) response alternatives, ranging from 1=very good, 2=good, 3=rather good, 4=rather bad, 5=bad, to 6=very bad. Higher index scores reflect better function and was presented as the percentage of the maximum score.

Section D: Pain Disability questionnaire

The final part of the questionnaire was used to test participation restriction, namely how LBP interfered with their daily routine activities at work and also everyday activities. Participants were instructed to make a cross (X) on one number ranging from (1) one to ten (10) on each scale that best describes how they felt (1 = almost nothing and 10 = very bad). The questions in this section asked whether their pain affected their normal work, their ability to participate in sports activities or any recreation activities and hobbies, their ability to stand, sit, walk or run. The tool has a functional status component (maximum score of 90) and a psycho-social component (maximum score of 60), yielding a total functional disability score ranging from 0 to 150 (Anagnostis et al., 2004).

Validity and Reliability of the instrument

Reliability is the stability of the measuring tool in yielding similar results from the same population at different times (Monette, Sullivan & De Jong, 2002). The Nordic Musculoskeletal Questionnaire has demonstrated reliability results with Kappa values ranging from 0.88 to 1, is internationally validated and respected having been used in the assessment of musculoskeletal symptoms worldwide (De Barros & Alexandre, 2003). The Profile Fitness Mapping Questionnaire has been reported to be highly reliable with Cronbach's alpha ranging from 0.90-0.95 (Bjorklund et al., 2007), while the Pain Disability Questionnaire has test-retest reliability coefficients ranging from 0.94 to 0.98 and a Cronbach's alpha coefficient of 0.96 (Anagnostics et al., 2004).

Validity refers to the extent to which an empirical measure accurately reflects the concept it is intended to measure (Babbie, 2004). Content validity of the developed instrument was assessed through peer review by a panel of experts while face validity was assessed by the implementation of the pilot study. All three instruments utilised in the questionnaire thus showed good reliability scores.

Pilot study

The aim of the pilot study was to help in identifying potential problems in the research process, as stated by Van Teijlinger and Hundley (2001). It was done to establish the questionnaire's face validity, the time it took to be completed and the clarity of the questions to the participants. The questionnaire was translated from English to Kaonde and back translated to English by two professional translators fluent in both English and Kaonde. Fifteen (15) mineworkers, who met the inclusion criteria of the study, were asked to complete the questionnaire after written informed consent was obtained from them. The participants in the pilot study were not included in the main study. The pilot study was successfully done and no comments arose from the study, thus no changes were made to the questionnaire.

3.5.2 Qualitative component

A semi-structured interview guide was developed based on literature (Kaplan, 2005) and was administered to mineworkers in order to explore their knowledge and application of kinetic handling in their daily work environment. Five FGDs (5 participants per group) were structured. Saturation was reached on the fourth (4) FGD and therefore no further FDGs were done.

Trustworthiness of the qualitative data

According to Guba (1981), trustworthiness refers to sequences of methods that are used in research to ensure consistency of qualitative designs. According to Shenton (2004) and Anney (2014), trustworthiness is measured through credibility, transferability, dependability and confirmability. These following steps were taken in the study to ensure trustworthiness.

a) Credibility

Credibility was enhanced through member checking and peer debriefing. Participants were given a summary of the FGD and time to comment on whether or not they feel the data was interpreted according to what they said. The transcribed verbatim draft was given to colleagues (peer debriefing) who were not involved in the study for their view. Matters raised by them were included in the field notes.

b) Dependability

A detailed and prolific description of the study was done to increase dependability and also to enable the readers relate the phenomenon described with their situations (Shenton, 2004) in order to increase consistence of the findings of the research a code recode method was done during data analysis. (Krefting, 1991). A code-recode method during data analysis was done to ensure dependability (Lincoln & Guba, 1985).

c) Transferability

Transferability was guaranteed by giving a detailed process of the qualitative data collection method procedure by the researcher, a detailed process of the analysis was similarly done to ensure repeatability of the study. This was also attained by giving description of participants' characteristics, texts and quotes.

d) Confirmability

Confirmability was achieved as the supervisor went through the data collection procedure and process notes including transcriptions, field notes as well as data synthesis products (thematic categories and interpretation). In addition, colleagues who were well-informed in qualitative methods discussed the research process and results.

3.6 DATA COLLECTION PROCEDURE

3.6.1 Quantitative component

After receiving written approval from all relevant authorities (see Section 3.8), the researcher approached the manager at Kansashi Mining and highlighted the aim, objective and significance for the study to be conducted. Following permission from the manager and obtaining the daily lists of the workers on duty, the researcher requested an appointment to meet the selected mineworkers in their weekly safety meeting to explain the purpose of the study and requested those who are willing, to participate in the study (Consent Form: Appendix F) Every third mineworker attending the meeting was invited to participate in the study. An Information Sheet (Appendix E) explaining the aims and objectives of the study as well as addressing issues of anonymity, confidentiality, and the right to withdraw were issued to those who were willing to participate in the study. Thereafter informed written consent (Appendix F) was obtained. Weight and height was measured by the researcher according to standard procedures (see 3.5.1) before the completion of the questionnaire (Appendix H) in the presence of the researcher and research assistant. The participants were assured of their right to withdraw from the study at any time without any consequences.

3.6.2 Qualitative component

The researcher approached and invited mineworkers that participated in the quantitative phase of the study to participate in the FGD. The aim and objectives of the FGD was explained to the mineworkers (Appendix E). A convenient time and place was organised for the FGD to take place. A FGD Confidentiality Binding Form (Appendix G) was obtained from each participant before the FGD commenced. The researcher explained that their participation was voluntary and they had the right to withdraw from the study at any time. A semi-structured interview guide was used during the FGD in Kaonde. A probing technique was used to ensure that no information was missed (Britten, 1995). The FGD was audio-taped and the research assistant took field notes. The FGD was continued until saturation was reached, namely when information was repeated and no new information was obtained (Polit & Beck, 2003). Each session lasted about 45 minutes.

3.7 DATA ANALYSIS

3.7.1 Quantitative component

Data was analysed using the Statistical Package for Social Sciences (SPSS) version 22.0. Descriptive statistics was employed to summarise demographic data. Continuous variables were expressed as means. Categorical variables were expressed as frequencies and percentages. Inferential statistics (cross tabulations) was used to determine the distributions of cases in the various groups. A significant difference was tested for using the Chi-square test (categorical variables) and student t-test (continuous variables). Statistical significance was set at an alpha level of 5%. The results were presented in tables and graphs (histogram, bar and/or pie charts). Significance was set at p-value of ≤ 0.05.

3.7.2 Qualitative component

The qualitative data was analysed by transcription verbatim of the audiotapes. Hammell and Carpenter (2004) stated that verbatim transcription of the data preserves the words of the participants. The transcription was done by an independent person with experience in transcription. The transcriptions were compared several times to audio-tape recordings and field notes to ensure accuracy. Thematic analysis was done on two levels: individual data and across all the participants, comparing themes and categories. Thematic analysis was begun whereby the transcriptions of all the interviews and process notes were read a number of times to familiarise the researcher with the content. The data was then coded into broad categories of emerging themes. Identification, organizing and naming of themes was followed (Joffe, 2012). Finally, interpretation of data was begun depending on the research objectives and research question.

3.8 ETHICS CONSIDERATIONS

Ethics clearance to conduct the study was obtained from the Senate Higher Degrees Committee of the University of the Western Cape (UWC) (Appendix A), the Zambia Ethics Committee (ERES) (Appendix B), the Ministry of Mines and Development (MMD) (Appendix C) as well as the Kansashi Mine management (Appendix D). An Information Sheet (Appendix E) regarding the purpose and procedure of the study was made available to the participants. Participation was voluntary and participants were given the opportunity to withdraw from the study at any time with no consequences. Written, informed consent (Appendix F) was obtained from each participant prior to completion of the questionnaires. A focus group Confidentiality Binding Form (Appendix G) was completed by those who participated in the FGDs. The information sheet, consent form and questionnaires (Appendix H) were available in English and Kaonde. Identification codes, using numbers was used on data forms to ensure anonymity. Information obtained from the participants was handled with confidentiality. The data collected was stored in a locker only accessible to the researcher. Pseudonyms were used to protect participants' identities when results were published. Tapes used were destroyed after they were transcribed and information documented according to themes. Questionnaires and any other data will be kept for a minimum of five years in a locked cabinet. Minimal perceived risks are expected in the study. However, sensitive issues or questions which arose from the study and could affect the participant was observed and referred to an expert for appropriate attention. Participants and the relevant institution will be informed of the outcome of the study when the final reports are available.

3.9 SUMMARY OF THE CHAPTER

This chapter focused on the research setting, the study design and sampling method as well as the methodology that was utilised in the study. The research setting was clearly described, the instrument defined as well as data collection procedure and data analyses have been clearly explained. Lastly the ethical considerations were clearly documented. The following chapter reports the quantitative results of the study.

CHAPTER FOUR

QUANTITATIVE RESULTS

4.0 INTRODUCTION

This chapter presents results of the quantitative data collected between October and December 2015. Of the 380 questionnaires distributed among mine workers, 222 were fully completed, yielding a 54.4% response rate based on the completed questionnaires. Incomplete questionnaires were not included in the analysis. Described in the chapter are the socio-demographic profile of the mineworkers (n = 222), the prevalence of low back pain amongst the mineworkers, the profiles of positions mostly adopted during the mineworkers' daily vocational activities and the functional limitations of the mineworkers due to low back pain. In addition, the influence of low back pain on the mineworkers' work as well as lifestyle activities is outlined. The results are summarised in tables where needed.

4.1 SOCIO-DEMOGRAPHIC CHARECTERISTICS OF THE PARTICIPANTS (n=222)

Table 4.1 presents the socio-demographic data of the study sample (n=222). The participants had a mean age of 35 years (SD = 9.6). Almost half of the mineworkers (n = 91; 41%) were in the age group 26 – 33 years old. The participants were mainly male (n=216, 97.3%) with a mere 2.8% (n=6) being female. More than half (n=129; 58.1%) of the participants were contract workers. Although 60.8% (n=135) have a normal BMI, almost a quarter (n=50; 22.5%) were classified as overweight. The mean years of employment in the mining industry was 6.7 years (SD=3.2), while the mean hours of work per day was 6 hours (SD=2.1).

Table 4.1 Socio-demographic characteristics of the mineworkers (n=222)

Characteristic	Frequency (n)	Percent (%)
Age categories (Mean = 35 yrs.; SD =9.6)		
18 to 25 years	24	10.8
26 to 33 years	91	41.0
34 to 41 years	54	24.3
42 to 49 years	26	11.7
Above 50 years	27	12.2
Gender		
Male	216	97.3
Female	6	2.7
Employment Status		
Permanent Worker	93	41.9
Contract Worker	129	58.1
BMI groups (kg/m^2)*		
≤ 18.4 (underweight)	17	7.7
18.5-24.9 (Normal weight)	135	60.8
25-29.9 (overweight)	50	22.5
≥ 30 (obese)	20	9
Years of Employment	**(Mean = 7.2; Years SD = 2.3)**	
Years of Employment in mining industry	**(Mean = 6.7 Years; SD = 3.2)**	
Hours of Work per Day	**(Mean 6 hours; SD = 2.1)**	

***according to the CDC (2011) BMI categories**

Of the 222 participants, most came from the age group 26 to 33 years old (n=91; 41.0%), followed by the age group 34 to 41 (n=54; 24.3%). Almost the same number of participants were from the age groups 42 to 49 years old and above 50 years old (n=26; 11.7% and n=27; 12.2% respectively). The least number of participants are in the age group 18 to 25 years old (n=24; 10.8%), as shown in Figure 4.1 below.

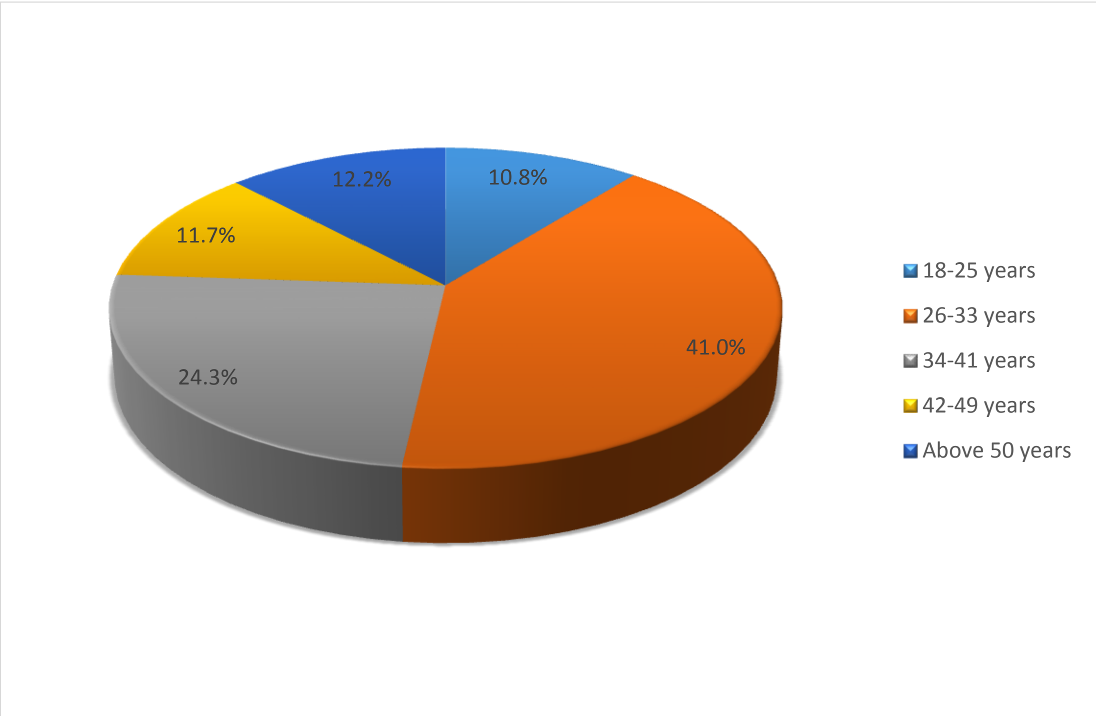

Figure 4.1 Age category of the mineworkers (n=222)

4.2 JOB TITLES OF THE PARTICIPANTS AND NATURE OF EMPLOYMENT (n=222)

With regard to the different job categories of the participants, the following job categories were mentioned: drivers, mechanical fitters, stores, laboratory technicians, excavators, plant fitters, fabricators, assistant surveyors, drillers, safety officer, welder, sampler/fitter, rigger, operators, plastician, instrument technician, planning assistants and crane operators. The five (5) most reported job categories were as follows: mechanical fitters (n=44; 19.8%); drivers (n=31; 13.9%); boilermakers (n=29; 13.1%); electricians (n=24; 10.8%) and instrument technicians (n=16; 7.2%). The data is presented in Table 4.2 below.

Table 4.2 Job title and employment status of participants (n=222)

Job Title	Contract Worker	Permanent Worker	Total
Driver	22(9.9)	9(4.1)	31(13.9)
Stores	1(0.5)	0(0)	1(0.5)
Lab. Technician	3(1.4)	2(0.9)	5 (2.3)
Excavator operator	0(0)	3(1.4)	3 (1.4)
Electrician	13(5.9)	11(4.9)	24 (10.8)
Civil Engineer	2(0.9)	2(0.9)	4 (1.8)
Fabricator	0(0)	2(0.9)	2 (.9)
Assistant Surveyor	0(0)	2(0.9)	2 (0.9)
Sampler/fitter	9(4.1)	2(0.9)	11(4.9)
Driller	1(0.5)	0(0)	1(0.5)
Plant Fitter	14(6.3)	7(3.2)	2 (0.9)
Safety Officer	1(0.5)	0(0)	1(0.5)
Welder	1(0.5)	1(0.5)	2 (0.5)
Mech. Fitter	24(10.8)	20(9)	44 (19.8)
Boiler Maker	13(5.9)	16(7.2)	29 (13.1)
Operator	4(1.8)	5 (2.3)	9 (4.1)
Rigger	4(1.8)	1(0.5)	5 (2.3)
Plastician	2 (0.9)	3(2.3)	5 (2.3)
Instrument Tech.	12(5.4)	4(1.8)	16 (7.2)
Planning Ass	1(0.5)	3(1.4)	4 (1.8)
Crane Operator	2(0.9)	0(0)	2 (0.9)
Total	**129 (58.1)**	**93(41.9)**	**222(100)**

The respondents' jobs were further categorised into four groups, namely handymen, masons, drivers and others. Each group had participants with the same work and same working conditions.

The masons (n=79; 35.6%) comprised workers engaging in work pertaining to construction and building work, including excavator operators, plant fitters, mechanical fitters, operators, and crane operators. The majority of the participants (n=95; 42.8%) were handymen which comprised electricians, fabricators, sampler offside, drillers, welders, boilermakers, riggers, plasticians and an instrument technologist. The drivers, whose daily work routine included running errands in the mine or transporting workers to their various working stations, were all clustered in one group (n= 31; 14.0%). Those whose jobs did not require strenuous activity were clustered in the "Others" category and comprised of the assistant surveyor, the safety officer, planning assistants, laboratory technologists and civil engineers (n=17; 7.6%).

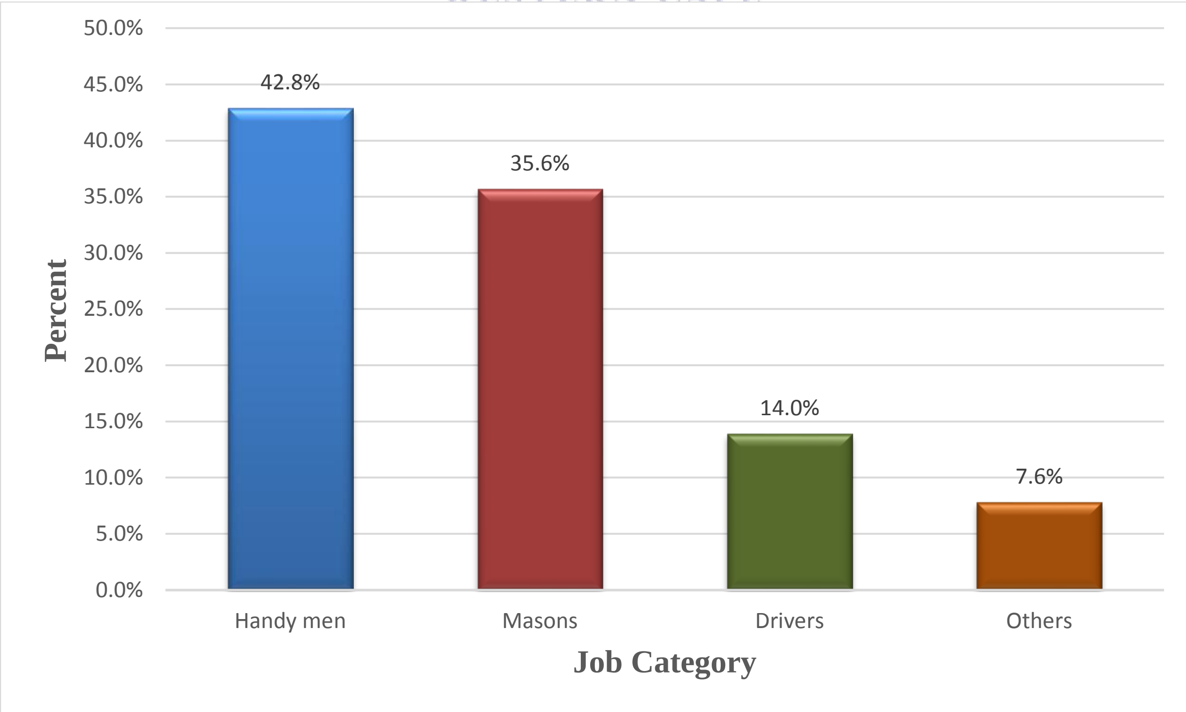

Figure 4.2 Job categories of the participants (n=222)

4.3 PREVALENCE OF LOW BACK PAIN AMONGST THE PARTICIPANTS (n=151)

Almost seventy percent (n=151; 68.0%) reported occupation-related LBP in the last 12 months. The prevalence of LBP in the last 12 months according to age categories is shown in Table 4.3 below. The highest prevalence of LBP was reported in the age group 26 to 33 years old (n=57; 37.7%); followed by the age group 34 to 41 years old (n=34; 22.5%), 50 years old and above (n=24; 15.9%) and the age group 18 to 25 years old (n=15; 9.9%).

Table 4.3 Age categories and gender of mine workers vs LBP prevalence during past 12 months

Age Categories	**Gender of Mineworkers with LBP**		
	Female	**Male**	**Total**
18 to 25 years	0 (0%)	15 (9.9%)	15 (9.9%)
26 to 33 years	4 (2.6%)	53 (35.1%)	57 (37.7%)
34 to 41 years	0 (0.0%)	34(22.5%)	34 (22.5%)
42 to 49 years	1 (0.7%)	20 (13.2%)	21 (13.9%)
Above 50 years	0 (0.0%)	24 (15.9%)	24 (15.9%)
Overall Total	**5 (3.3%)**	**146 (96.7%)**	**151 (100.0%)**

4.4 PREVALENCE OF LOW BACK PAIN ACCORDING TO JOB CATEGORIES (n=151)

Of the 68% (n=151) mineworkers that reported having LBP in the last 12 months, handymen accounted for the highest prevalence (n=107; 48.2%), followed by drivers (n=21; 9.5%), others (n=12; 5.3%) and masons (n=11; 5.0%).

Table 4.4 Prevalence of LBP according to major job categories (n=151)

JOB CATEGORY	NO n (%)	YES n (%)
Handy men	53 (23.8)	107 (48.2)
Drivers	10 (4.5)	21 (9.5)
Masons	3 (1.4)	11 (5.0)
Others	5 (2.3)	12 (5.3)
Total	**71 (32.0)**	**151 (68.0)**

While the prevalence of LBP for the past 12 months was 68.0% (n=151), the past one-month prevalence was 40.4% (n=61). Respondents were also asked if they had suffered LBP in the past week and results revealed that 33.1% (n=50) experienced LBP in the past seven days, as illustrated in Table 4.5 below.

Table 4.1 Low back pain per time period

	YES n (%)	NO n (%)	TOTAL n (%)
LBP in past 12 months	151 (68)	71 (32)	222 (100)
LBP in past one month	61 (40.4)	90 (59.6)	151 (100)
LBP in past 7 days	50 (33.1)	101(66.9)	151 (100)

The prevalence of LBP for all three time periods was statistically associated with variables such as BMI, gender, age and length of time worked. Body mass index (BMI) was significantly associated with all time periods, namely BMI and LBP past 12 months (p=0.002); BMI and LBP past one month (p=0.001); and BMI and LBP past week (p=0.003). Gender was also found to be significantly associated to all time periods. Significantly more male than female mineworkers had LBP the past 12 months (p<0.001); past one month (p=0.002) and past week (p=0.002). Furthermore, the mean age and mean length of time worked was computed for all three time periods (12-months, 1-month, 1-week). The mean age of participants who developed LBP over the past 12 months was 31 years old (SD 10.1) and it was found to be significantly associated with LBP (p= 0.040). The mean age of participants who developed LBP over the past one month was 46 years old (SD=10.1), and it was significantly associated with LBP (p=0.002). See Table 4.6 below.

Table 4.2 Distribution of LBP for the past 12 months, past one month and past week against characteristic variables

Variable		LBP past 12 months n (%) **(n=151; 68%)**	p-value	LBP past month n (%) **(n=61; 40.4%)**	p-value	LBP past week n (%) **(n= 50; 82%)**	p-value
BMI			0.002[a]				
Underweight		2(1.3)		1(1.60)		0(0)	
Normal weight		86(57)		26(42.6)		29(58)	
Overweight		48(31.8)		20(32.8)		10(20)	
Obese		15(10)		14(23.0)	0.001a	11(22)	0.003a
Gender	Male	146(96.7)		58 (95.1)		48(96)	
	Female	5(3.3)	<0.001	3 (4.9)	0.002	2(4)	0.002
Age (Years)	Mean	31	0.041[b]	46	0.002[b]	49	0.003[b]
Length of time (Years)	Mean	4	0.002[b]	10	0.005[b]	12	0.002[b]

[a] Fishers exact p-values; [b] p-values

4.5 AGE AND LOW BACK PAIN DURING THE PAST 12 MONTHS

Table 4.7 below shows that an increase in age is associated with LBP during the past 12 months. The data presented indicates that of the 151 mineworkers with LBP during the past 12 months, 62.5% (n=15) of the respondents in the age group 18 to 25 years old suffered with LBP, compared to 37.5% (n= 9) who did not have LBP. In the age group 26 to 33 years old, 62.6% (n=57) reported LBP while 37.4% (n=34) did not have LBP. More than sixty percent (n=34; 63.0%) of the participants in the age group 34 to 41 years old had LBP while in the age group 42 to 49 years old, 80.8% (n=21) reported LBP. Almost ninety percent (n=24; 88.9%) in the age group 50 years old and above had LBP during the past 12 months.

Table 4.3 LBP and age categories during the past 12 months

AGE CATEGORIES	NO n (%)	YES n (%)	TOTAL n (%)
18 to 25	9(37.5)	15(62.5)	24(100)
26 to 33	34(37.4)	57(62.6)	91(100)
34 to 41	20(37.0)	34(63.0)	54(100)
42 to 49	5(19.2)	21(80.8)	26(100)
Above 50	3(11.1)	24(88.9)	27(100)
TOTAL	**71(32.0)**	**151(68.0)**	**222(100)**

4.6 POSITIONS MOSTLY ADOPTED DURING THE MINE WORKERS DAILY VOCATIONAL ACTIVITIES

There were five (5) positions that were considered in the study namely standing, stooping, bending, kneeling and sitting. The position mostly adopted was bending (41%), followed by stooping (19%), and standing (17%). The least adopted position was kneeling (8%), as presented in Figure 4.3 below.

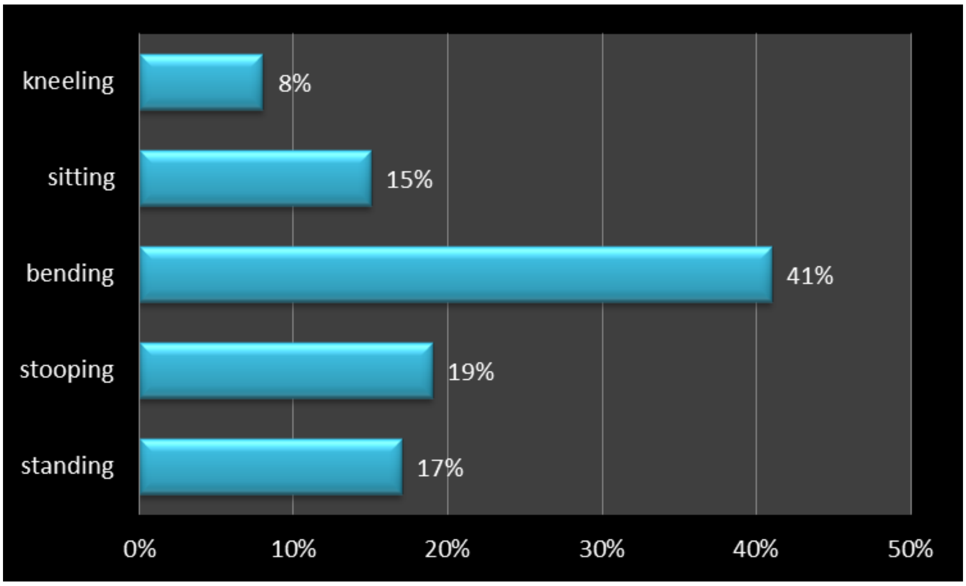

Figure 4.1 Adopted positions among mine workers during daily work

4.7 YEARS OF EMPLOYMENT AND LOW BACK PAIN DURING PAST 12 MONTHS (n= 151)

Table 4.8 below shows that length of employment of the 151 mineworkers who experienced LBP the past 12 months. Analysis indicated that of the 94 respondents that have worked five years or less, 62.8% (n=59) reported that they suffered from LBP, followed by 61.1% (n=33) of the 54 respondents that have worked between 6 and 10 years. Almost three quarters (n=23; 74.0%) of the 31 participants that worked for 11 to 15 years and, 71.4% (n=10) of the participants that worked for 16 to 20 years reported having had LBP. while 75.0% (n=9) had worked for a period of 21 to 25 years and 100.0% (n=17) were in the range of 26 to 30 years respectively.

Table 4.4 Length of employment and LBP during the last 12 months

LENGTH OF EMPLOYMENT	LBP DURING THE LAST 12 MONTHS		TOTAL n(%)
	NO n(%)	YES n(%)	
1-5 YEARS	35 (37.2)	59 (62.8)	94 (100)
6-10 YEARS	21 (38.9)	33 (61.1)	54 (100)
11-15 YEARS	8 (25.8)	23 (74.2)	31 (100)
16-20 YEARS	4 (28.6)	10 (71.4)	14 (100)
21-25 YEARS	3 (25.0)	9 (75.0)	12 (100)
26-30 YEARS	0 (0.0)	17 (100)	17 (100)
TOTAL	**71 (32.0)**	**151 (68.0)**	**222 (100)**

In order to determine if there was any significant relationship between the length of employment and prevalence of LBP in the past 12 months, chi square test was computed. A statistically significant relationship between length of employment and prevalence of LBP in the past 12 months were found (χ^2 = 11.257, p = .047). The Spearman correlation coefficient however suggests a weak, positive relationship between LBP during the past 12 months and length of employment (r_2 = 0.187, p = 0.005).

4.8 PREVALENCE OF LOW BACK PAIN ACCORDING TO ADOPTED POSTURE AT WORK (n=151)

The distribution of low back pain according to different adopted postures during work (standing, stooping, bending, kneeling and sitting) was assessed in the study. Bending posture contributed to 65% (n = 98) of LBP in mineworkers followed by standing 20% (n=30) and a mere 5% (n=2) of the participants reported LBP while sitting.

No significant association was found between LBP and working posture (p=0.07). However, there was a significant association between bending and low back pain (p=0.001).

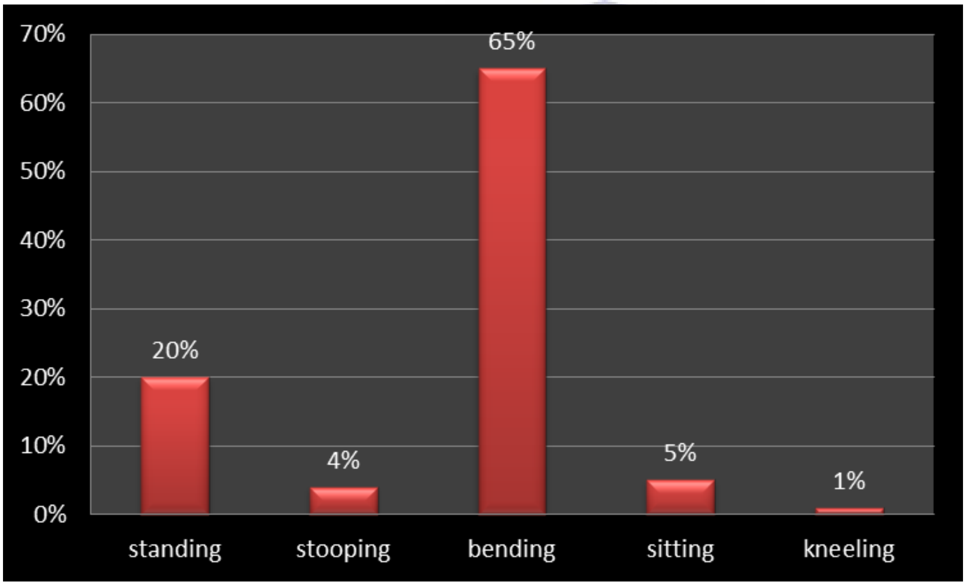

Figure 4.2 Prevalence of low back pain according to working posture

4.9 FUNCTIONAL LIMITATIONS OF THE MINE WORKERS DUE TO LOW BACK PAIN

Functional limitations are activity limitations that one experiences as a result of LBP problems. A 6-point Likert scale was used to express the participants' degree of limitation, namely: very good = 6, good = 5, rather good = 4, rather bad = 3, bad = 2, and very bad = 1.

Data is presented in the Table 4.9 below. The scale comprises of 24 items to determine the level of functional limitation due to LBP at a personal level. Table 4.9 below shows the collated scores for BAD and GOOD functional limitation. Scores of 1 to 3 and 4 -6 were clustered together as BAD and GOOD respectively.

Functional activities most affected with regard to percentage include: managing to lift (25.9%), managing to bend forward (23.8%), managing to squat (21.8%), managing to carry (20.8%), managing to bend backward (19.6%), managing to throw (19.6%) and managing to walk upstairs (18.2%) as presented in the table below.

Table 4.5 Functional limitation of the participants as a result of LBP

	GOOD		BAD		P-value
	n	**%**	**n**	**%**	
Managing Standing	116	(82.9)	24	(17.1)	0.002*
Managing Walking	133	(93.0)	10	(7.0)	<0.001*
Managing Sitting	127	(90.7)	13	(9.3)	0.002*
Managing to Lay Down	131	(91.6)	12	(8.4)	<0.001*
Managing to Run	122	(85.3)	21	(14.7)	0.002*
Managing to Carry	114	(79.2)	30	(20.8)	0.004*
Managing to Lift	106	(74.1)	37	(25.9)	0.451
Managing to Throw	115	(80.4)	28	(19.6)	0.003*
Managing to Put on and Take off a Sweater	124	(89.2)	15	(10.8)	0.034
Managing to Put on and Take off Socks	117	(83.0)	24	(17.0)	0.003*
Managing to Bend your Back Forward	109	(80.4)	34	(23.8)	0.056
Managing to Bend your Back Backward	115	(82.5)	28	(19.6)	0.004*

Managing Side Bend your Back to the Right	121	(84.5)	22	(15.4)	0.004*
Managing Side Bend your Back to the Left	118	(88.6)	25	(17.5)	0.004*
Managing to Turn your Back to the Right	118	(82.5)	25	(17.5)	0.004*
Managing to Turn your back to the Left	119	(3.2)	24	(16.8)	0.004*
Managing to Walk Upstairs	117	(81.8)	26	(18.2)	0.004*
Managing to Walk Down Stairs	120	(85.7)	20	(14.3)	0.003*
Managing to Squat Down	111	(78.2)	31	(21.8)	0.005
Managing to Jump with both Feet Together	118	(83.1)	24	(16.9)	0.004*
Managing to Lift your Right Leg when Lying Down	114	(85.6)	20	(14.4)	0.003*
Managing to Lift your Left Leg when Lying Down	124	(86.1)	20	(13.9)	0.002*
Managing to Lift Your Right Leg when Sitting	122	(86.5)	19	(13.5)	0.003*
Managing to Lift your Left Leg when Sitting	118	(85.5)	20	(14.5)	<0.001*

4.10 MEAN SCORES OF FUNCTIONAL LIMITATIONS OF THE MINE WORKERS DUE TO LOW BACK PAIN

The mean scores for functional limitations are presented in Table 4.9 below. In terms of mean scores the functional activities most affected were: managing to lift, which had a mean score of 1.25 (SD= 0.43) followed by managing to bend forward which recorded a mean score of 1.23 (SD= 0.42), managing to squat with a mean score 1.21 (SD= 0.41), managing to carry had a mean score of 1.20 (SD= 0.40), managing to bend backward revealed a mean score of 1.19 (SD= 0.39) and managing to throw with a mean score 1.19 (SD= 0.39), managing to walk upstairs mean score of 1.18 (SD= 0.38).

The chi square test for proportion was used to test the association between LBP and functional activities of the participants. The results revealed that there was a significant association between LBP of 20 of the 24 items ($p<0.05$).

Table 4.9 Mean scores for functional limitations

STATEMENT	mean (SD)	p-value
Managing Standing	1.17 (0.38)	0.002*
Managing Walking	1.07 (0.26)	<0.001*
Managing Sitting	1.09 (0.29)	0.002*
Managing to Lay Down	1.08 (0.27)	0.001*
Managing to Run	1.14 (0.35)	0.002*
Managing to Carry	1.20 (0.40)	0.004*
Managing to Lift	1.25 (0.43)	0.451*
Managing to Throw	1.19 (0.39)	0.003*
Managing to Put on and Take off a Sweater	1.10 (0.31)	0.034*
Managing to Put on and Take off Socks	1.17 (0.37)	0.003*
Managing to Bend your Back Forward	1.23 (0.42)	0.056*
Managing to Bend your Back Backward	1.19 (0.39)	0.004*
Managing to Side Bend your Back to the Right	1.15 (0.36)	0.004*
Managing to Side Bend your Back to the Left	1.17 (0.38)	0.004*
Managing to Turn your Back to the Right	1.17 (0.38)	0.004*
Managing to Turn your Back to the Left	1.16 (0.37)	0.004*
Managing to Walk Upstairs	1.18 (0.38)	0.004*
Managing to Walk Down Stairs	1.14 (0.35)	0.003*
Managing to Squat Down	1.21 (0.41)	0.005*
Managing to Jump with both feet Together	1.16 (0.37)	0.004*
Managing to Lift your Right leg when Lying Down	1.14 0.35)	0.003*
Managing to Lift your Left leg when Lying Down	1.13 (0.34)	0.002*
Managing to Lift your Right Leg when Sitting	1.13 (0.34)	0.003*
Managing to Lift your Left leg when Sitting	1.14 (0.35)	0.001*

4.11 TIME OFF DUE TO LOW BACK PAIN (n=151)

Figure 4.5 below shows that of the 151 mineworkers suffering with LBP, the majority (n=125; 82.8%) took time off work due to their LBP.

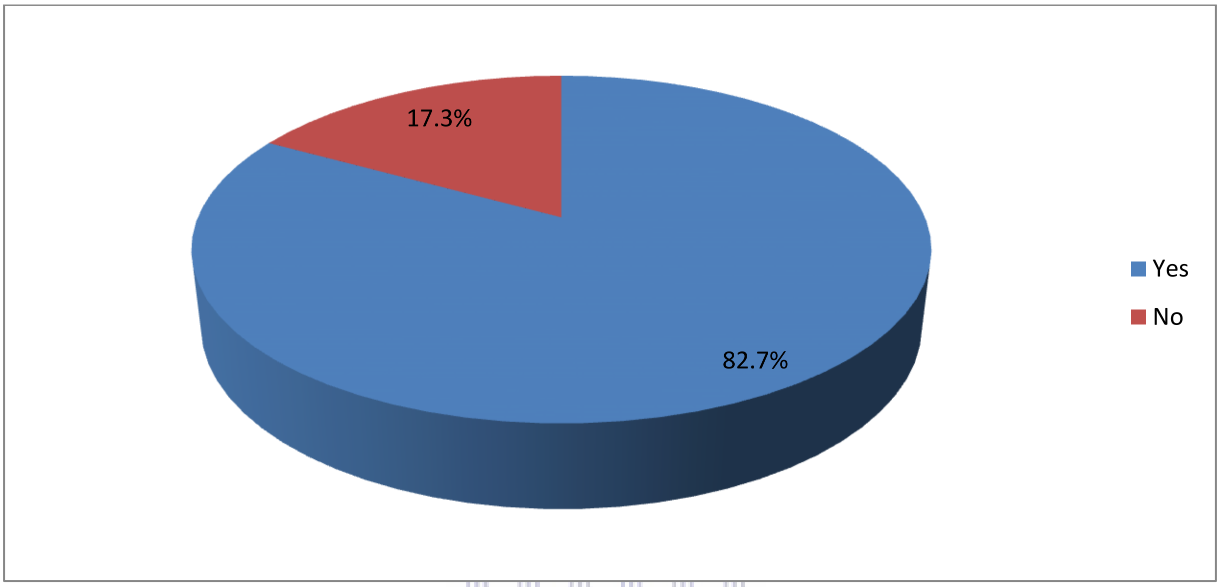

Figure 4.3 Time off due to low back pain

4.12 THE INFLUENCE OF LOW BACK PAIN ON THE MINE WORKERS'WORK ACTIVITIES

The levels of participation restriction as a result of low back pain were examined. A scale ranging from 0 to 10 was used to determine how severe LBP was in restricting participants to carry out certain activities; zero suggesting less restriction while ten denoting a high restriction. Activities recording a mode of equal of more than five (≥5) were regarded to have a high restriction. The following functional activities recorded a mode of ≥5: pain interfering with normal work (mode = 7), pain affecting ability to sit or stand (mode = 7), pain affecting ability to lift overhead, grasp objects, or reach for things, (mode = 5, 6 & 7 respectively), pain affecting ability to lift objects off the floor, bend, stoop, or squat (mode =

5, 8 & 9) as well as pain affecting your ability to walk or run (mode = 7). See Table 4.10 below.

Table 4.6 Participation restriction of mine workers due to LBP

LBP EFFECT	MODE
Pain interfering with normal work	7
Pain affecting ability to sit or stand	7
Pain affecting your ability to lift overhead, grasp objects, or reach for things	5,6,7
Pain affecting your ability to lift objects off the floor, bend, stoop, or squat	5,8,9
Pain affecting your ability to walk or run	7

4.13 THE INFLUENCE OF LOW BACK PAIN ON THE PARTICIPANTS' LIFESTYLE ACTIVITIES/ LEISURE TIME ACTIVITIES

Table 4.11 presents the effect of LBP on selected individual characteristics of the 151 participants who had LBP during the past 12 months. From the analysis, 37.4% (n=56) reported that LBP affect their lifestyle or leisure time activities negatively, while 46.4% (n= 70) and 36.4% (n=55) said it negatively affected their rest and sex life respectively. A significant association was found for LBP and its effect on sleep (p=0.01), mood (p=0.05) and during activity (p=0.02).

Table 4.11 Effect of LBP on lifestyle-related activities (n=151)

ACTIVITY	YES n (%)	NO n (%)	p-value
During Resting	70(46.4)	81 (53.7)	0.53
Affecting Sleep	39(25.9)	112 (74.2)	0.01*
Affecting Mood	35(23.2)	116 (76.8)	0.05*
Affecting Sex Life	55(36.4)	96 (63.6)	0.33
During Activity	83(55.0)	68 (45.0)	0.02*

***Significant p value**

4.14 RELATIVE RISK OF LOW BACK PAIN ON SOME INDIVIDUAL FACTORS

A risk is a chance or rather likelihood that a person will be injured or experience adverse health effects when exposed to a hazard. Analysis indicated that the overall relative risk for a participant to have LBP while at rest was 31.5%. The age group with the highest risk for LBP during rest was ≤35 years with a risk of 12.6%. Participants in the age group of >45 years had a risk of 9.9%, while those in the age group 36 to 45 years old had the lowest risk of 3.6%. The risk of LBP interfering with one's sex life had an overall risk of 25%; the highest risk (12.2%) occurring in participants ≤35 years. A risk of less than ten percent was reported for participants >45 years and between 35 and 45 years old with values of 7.7% and 5.9% respectively. The overall relative risks of LBP affecting one's sleep was 17.6%, with the age group ≤35 years having the highest relative risk of 8.1%, followed by the age group >45 years with a relative risk of 5.9%. The least relative risk was that of LBP during rest with an overall risk of 15.8%. The age group with a high risk was those ≤35 years (9.5%). Overall respondents with LBP that were in the age group ≤35 years old had the highest relative risk for all characteristics followed by the age group >45 years old.

Table 4.12 Relative risk of LBP on selected characteristics among age groups

CHARACTERISTICS	**≤35yrs. %**	**35 to 45 yrs. %**	**45 yrs. %**	**Total %**
Back problem affecting sex life	12.2	5.9	7.7	25.0
Back problem affecting moods	9.5	2.3	4.1	15.8
Back problem affecting sleep	8.1	3.6	5.9	17.6
Backache during rest	12.6	9.0	9.9	31.5

% estimate of the relative risk

4.15 SUMMARY OF RESULTS

The chapter presented results of the analysis of the qualitative data collected from mineworkers of Solwezi District, Zambia.

- Two hundred and twenty two (222) mineworkers with a mean age of 35 years old (SD=9.6) fully completed the questionnaire. The majority of the participants were male (n=216; 97.3%) and 60.8% had a normal BMI.

- Almost half of the participants (n=95; 42.8%) were handymen which comprised electricians, fabricators, sampler offside, drillers, welders, boiler makers, riggers, plasticians and an instrument technologist.
- Almost seventy percent (n=151; 68.0%) reported occupation-related LBP in the last 12 months with the highest prevalence reported in the age group 26 to 33 years (n=57; 37.7%).
- The past one-month and one-week LBP prevalence was 40.4% (n=61) and 33.11% (n=50) respectively.
- Handymen also had the highest prevalence of LBP during the past 12 months (48.2%). The majority of the participants (n=125; 82.8%) took time off work due to their LBP.
- A statistical significant association was found for LBP and BMI, gender, length of employment, bending during work activities, its effect on sleep, mood and during activities of daily living ($p<0.05$).
- The relative risk to have LBP during rest was 31.5%.

The following chapter will present the results of the focus group discussions that attempted to address Objective four, namely the qualitative perspective and exploration of the knowledge of mineworkers regarding kinetic handling.

CHAPTER FIVE

QUALITATIVE RESULTS: Exploring mine workers' knowledge of kinetic handling

5.1 INTRODUCTION

This chapter presents a qualitative perspective and it explores the knowledge of mineworkers regarding kinetic handling. It therefore provides an overview of the results of the thematic analysis of the focus group discussions (FGDs) which attempted to answer Objective Four, namely: to explore the knowledge of mineworkers from Solwezi District, Zambia regarding kinetic handling in their daily occupational activities. A brief description of the participants is shown below and it is followed by the presentation of the pre-determined themes and emerging themes derived from the thematic analysis. In the presentation of the findings, verbatim quotations are used to illustrate the themes and sub-themes. Cryptogram (secret code) G1 to G5 is used to present data and ensure anonymity and confidentiality of the participants. The quotations are in italics and three ellipsis (compression) points (…) are used to indicate unnecessary material that was omitted.

5.2 DESCRIPTION OF THE PARTICIPANTS

The researcher interviewed 20 mineworkers instead of 25 mineworkers who were clustered in groups of 5 per focus group discussion. These mineworkers were purposively selected as they are engaging in heavy manual work in their everyday working environment. By the end of the fourth focus group discussion, saturation was reached. Hence only four (4) focus groups were done. The participants voluntarily agreed to take part in the study which was conducted in english as all the participants were fluent in the english language. The ages of these participants ranged between 29 and 40 years old with mean age of 32 years old (SD=7.1).

Their work experience ranged between 6 and 15 years (mean=9 years; SD=3.4). All the participants had experienced work-related low back pain before.

Each quotation from the transcribed interview data starts with symbol P followed by a number i.e. P1. The symbol P represents a participant and the number for participant number in each of the four (4) focus groups made.

5.3 IDENTIFIED THEMES

The following themes were identified during the thematic analysis of the data obtained during the FGDs and will be outlined and discussed in the narrative below.

Table 5.1: Pre-determined and emerging themes

Pre-determined themes	Emerging themes
1. Awareness of lifting heavy objects	1. The use of equipment
2. Knowledge of carrying heavy objects	2. Assessment of the weight of an object before manual handling
3. Knowledge of pushing heavy objects	
4. Knowledge of pulling heavy objects	

5.3.1 Awareness of lifting heavy objects

According to the respondents, awareness played an exceedingly important role in reducing cases of LPB among mineworkers. One participant indicated that insufficient awareness on how to lift heavy loads could increase cases of LBP and in return affect production in the mining industry.

P3: *"Ja, I mean, lifting heavy objects is one area where we tend to get it wrong."*

The mineworkers whose comments revealed nuanced views, appeared knowledgeable about lifting of heavy loads as they worked. In their responses, they all indicated that lifting heavy objects requires bending the knees and not the back.

P3: *"The right way is we shouldn't use the back but use the leg muscles to lift the weight."*

P2: *"...For me, ja, I think that you need to kneel down, you straighten up your back, then you lift together with the load."*

Another respondent agreed that when lifting heavy objects, it is advisable not to bend forward. Instead, it is safer to kneel or squat down to the load while straigthening the knees and maintaining it close to one's body when lifting. See the excerpt below.

P8: *"... actually when lifting heavy objects you kneel down, one knee on the ground and the other in midair. Then when lifting you should not use the back to lift the load and* *make sure it is close your body. Otherwise "kuti chakufuna umusana"; literally translated as "it can break your back."*

It is evident from the responses that protecting one's back is a very important aspect in preventing LBP when lifting a heavy object.

P16: *"… you are supposed to always squat to protect the back."*

P13: *"Really, when lifting heavy objects, always guard against your back. Always use your legs to lift up from the ground because the back is not strong."*

P18: *"Yes, aah…the back has to be straight otherwise…"*

The explanations of the respondents prompted the researcher to find out whether there were guidelines as to the maximum kilogrammes (kgs) a mineworker should lift without injuring his/her back. In their responses, they all appeared ignorant about the stipulated weight by the mining company they work for. However, those who had a bit of knowledge about what weight is recommended for lifting objects for an individual, they said that one cannot lift a weight beyond his own, this means that one had know his own weight in order to safely lift any object. The stipulated weight seemingly recommended by the mining company is lifting an object equal to the weight of an individual. What is important is that some of the participants mentioned that one should first test the load to see whether they should ask for assistance or make use of a forklift or a crane. The excerpts below highlights their experiences.

P2: *"Hmm, ja the weight can be compared to a 50kg bag of mealie meal. But we don't lift more than 60kg alone [laughter…hmmmm] you can't."*

P11: *"… You need to asses if you are able to lift the load. Then if you are able … you kneel down with your back straight, then you lift it ja…If you are unable to then call for help if there is any other people who can help you. If there is nothing (nobody) and the five of you can't lift it, we use a forklift or a crane."*

P4: *"If it is out of our range we call for a machine to come and lift ja…"*

P5: *"You have to assess whether the object has to be lifted manually. If it can be lifted manually you have to use the kinetic methods and this is a method whereby you have to kneel down and avoid straining your back."*

P10: "*We do assess and assessing you have to ask how much if we are four of us we ask how much the four of us are weighing then we look at the kgs marked on the object to be lifted and if the load is much heavier than the four of us then we ask for help or a crane because we are not supposed to lift objects much heavier than ourselves."*

5.3.2 Knowledge of carrying heavy objects

Looking after their back and hands were very important for the participants when carrying heavy loads as they take cognisance of safety measures when executing their tasks to avert injuries. Respondents indicated that heavier objects are lifted and carried by forklift or crane while objects with weight within their capacity were lifted and carried manually. The weight of the object is firstly assessed.

P5: *"You have to assess whether the object can be lifted manually."*

Regarding carrying heavy objects manually, respondents explained that specific rules must be followed to prevent LBP and other potential injuries. A proper grip is off utmost importance. Their earlier responses on awareness of heavy object lifting were echoed. See the excerpts below.

P19: "*...how we carry heavy objects is that we use kinetic methods. You have to make sure that your body is straight up with the heavy object close to your chest."*

P13: *"...you should carry the load near your chest or near your body."*

P20: *"...you have to make sure that it is closer to your body so that you are able to firmly hold the object which you are transporting."*

P18: *"...and you have to hold the object firmly."*

P12: *"...actually when carrying you use both hands and make sure you have a nice grip."*

P17: *"... when you are carrying an object you use both hands. Make sure you check for the firm position whereby you grip it nicely..."*

The participants acknowledged that caution should be taken when carrying heavy objects, for instance, that the environment around should be safe and hazard free.

P3: *" … before you start moving, it's important to first see your walkway to make sure that there are no hazards on the path you are supposed to take. It is also important to take short steps and not long steps like this." [participant demonstrate the kind of walk]*

P5: "In fact, madam, you should also avoid carrying loads on top of your head... will strain your neck and that can lead to injuries in the neck."

From the above verbatim quotes, it is evident that the participants have good knowledge regarding lifting and carrying of heavy objects. However, whether they apply their knowledge in their daily work environment is debatable.

5.3.3 Knowledge of pushing heavy objects

Concerning the participants' knowledge of the pushing of heavy objects, most indicated that the proper position during pushing is to bend forward at the hips to secure one's balance and make use of one's own body weight to push the heavy object. The specific stance the participants referred to was with one leg in front of the other. This sort of stance enables the body to have a supportive ground on which to exert the forward thrust; thereby pushing the heavy object with manageably less effort.

P14: *"... You have to position your legs in such a way that when you exert power using your feet or your legs, you will be able to push that thing nicely so that you are not going to strain your back…"*

P15: *"Ja, in fact, when pushing objects you have to bend slightly forward so that you can push nicely."*

P1: "*I am not sure whether what I am going to say is correct but I think on the posture you have to also bend a bit so that you don't over-power your back because your back is very cardinal when pushing an object."*

P11: *"You have to bend a bit and make sure one leg is in front of the other to provide maximum force."*

One participant expressed ignorance on pushing awareness.

P16: *"Well on that one I am not very sure i think on that one u have to position yourself accordingly to the height of the thing u are pushing if the object is above you I believe you just have to get closer to it when pushing. Ja… that's my contribution."*

When it is not possible to move a heavy object by pushing it, the participants have to make use of equipment to assist them with the task.

P6: *"Another way we push heavy objects which are humanly impossible to push is by chain blocks or rollers."*

P12: *"Sometimes if we can't manage we have to use machinery. If it is something you can manage you can use your hands to push that object."*

5.3.4 Knowledge of pulling heavy objects

Like pushing, participants explained that facing the object gave you an advantage when you prepare to pull it. This position enables one to see any potential huddle that might prevent a smooth movement when pulling a heavy object. Incorrect stance, tripping hazards as well as slippery grounds were some of the possible safety hazards mentioned by the participants. See the verbatim quotes below.

P1: *"…You have to be facing the object that you are pulling… have to make a stance and face the object that you are pulling so that you see the stability of the object…"*

P9: "*Yes, I think that when pulling heavy objects, first you have to consider the ground level and then the distance."*

P7: *"Sometimes we use ropes when pulling objects."*

P2: *"I think that it depends on the item to be pushed. If the item is big then you may use a rope or if you are able to grip with your hands you can just use the hands. It should be held firmly so that the grip is covenant with the weight… the position of the back should be straight so that you use the legs and hands to push; one leg in front, the other behind."*

One participant mentioned that although there are similarities between pushing and pulling a heavy object, it is more difficult to pull when there is nothing to hold on to, e.g. handles.

P4: *"…If the load has got no tags where you can hold and pull… which means you need to attach some attachment like you tie a rope so that you are able to pull it nicely. …without tags it can be difficult…"*

Although most of the participants knew how to pull a heavy object to prevent an injury to their backs, some admitted not knowing exactly what to do.

P14: "*I am not sure, but you have to make sure that the ground is safe and not slippery and your foot wear should also be appropriate."*

P4: *"Yes, you have to follow the safety rule which states that whatever you are doing, make sure that your back is straight…"*

P15: *"There should be no tripping hazards on your walk way as this may cause you to fall and injure yourself."*

P20: *"…And you have to make sure that the floor is not slippery…"*

P7: *"You make sure that there are no spillages like oil which can cause you to fall."*

5.4 SUMMARY OF THE CHAPTER

The knowledge of mineworkers regarding the application of kinetic handling principles in their daily occupational activities were explored and reported on. The following chapter will be the discussion of the quantitative (Chapter Four) and qualitative (Chapter Five) results.

CHAPTER SIX

DISCUSSION

6.0 INTRODUCTION

The aim of this study was to determine the role of occupation related low back pain (LBP) on the functional activities of mineworkers from Solwezi District Zambia. This chapter discusses the prevalence (12 months, one month, and one week) and common risk factors related to LBP. Prevalence of LBP is also discussed in association with age categories, job categories, anthropometric measures, working posture and work experience. In this study disability due to LBP is also discussed under activity limitations and participation restriction experienced by mineworkers suffering with LBP. Finally, discussion on mineworkers' knowledge on kinetic handling in their daily occupational lives is presented.

6.1 DEMOGRAPHIC CHARACTERISTICS OF THE MINEWORKERS

The response rate in this study was low (54.4%) compared to response rates in similar studies (Xu et al., 2012; Murtezani et al., 2011). A high level of difficulty was encountered when comparing the demographic characteristics of this study with previous studies, especially the age and mean age. There seems to be a lot of disparity in the recruitment age of the participants among different studies, depending on the country where the study was done and the remarkable difference the participants' age distribution; hence comparisons were difficult to make. In the present study, the mean age of the mine workers was 35 years old (SD=9.6). The majority of the mineworkers in the present study were in the age group 26-33 years old (41.0%; n=91). This result is different when compared to demographic data from similar studies. Kunda & Frantz (2013), Bio et al. (2007) and Bandyopadhay et al. (2012) reported mean ages of 40.31 years old (SD=8.6), 40 years old (SD=5.6) and 43.83 years old (SD =9.3) respectively.

Most of the respondents in the present study were male (97.3%) with a mere 2.7% female participants. This finding is in line with a study conducted by Tawiah, Oppong-Yeboh and Bello (2015), who reported a prevalence of 96.1% for male and 3.9% female respondents in their study. Ghaffarri, Alipour, Jesen, Farshad and Vingard (2006) reported 78% male participants in their study, while Pari and Dhara (2015) only had male participants. Mine work is highly hazardous and a very demanding occupation which requires high levels of physical strength to perform daily occupational duties. Therefore, it is usually an occupation done by men.

6.2 PREVALENCE OF LOW BACK PAIN

The current study reported that 68% of respondents suffered from low back pain in the past 12 months, indicating a high prevalence compared to other studies (Bio et al., 2007; Ghaffari et al., 2006; Murtezani et al., 2011; Kunda & Frantz 2013; Tawiah, Oppong-Yeboah & Bello 2015). Although the prevalence of LBP in the present study was higher than in most other studies conducted globally, Mandal and Srivastava (2010) reported more than eighty percent (85%) prevalence amongst dumper operator mineworkers in India. Pari and Dhara (2015) reported that 75% of clay mineworkers suffered LBP. Methodological variance as well as different population and sampling strategies could contribute to the dissimilarity in results. Sarikaya, Özdolap, Gümüştasş and Koç (2007) reported a prevalence of 78% and 34% among underground and surface mineworkers respectively. The latter study was conducted over a period of five years which could be the reason for the variance in the prevalence. The high one-month (40.4%), and one-week (33.1%) prevalence reported in the present study is of great concern as a study by Ghaffarri et al. (2006) reported a very low one-week prevalence of LBP of 8.5%.

6.3 INDIVIDUAL RISK FACTORS FOR LOW BACK PAIN IN MINEWORKERS

Personal risk factors that contribute to the prevalence of low back pain include age, level of individual fitness and conditioning, prior injury and pain intolerance (Snook, 2006; NRC, 2001, 2006). Other reported factors include BMI, height and weight (Gallagher, 2008; Woolf & Pfleger, 2003). The present study found a statistical significant association for LBP and BMI, gender, and length of employment ($p<0.05$). The findings of this study are in line with Bio, Sadhra, Jackson and Burges (2007) and Guo, Chang, Yeh, Chen and Guo (2004) who reported a significant association between age and LBP. Biglarian et al., (2012) also observed that an increase in age is strongly associated with low back pain. This finding is justified by the fact that as people grow older, degeneration of tissue sets in which may subject an individual to be more vulnerable to low back pain.

The current study reported a highest prevalence of LBP in the younger age group 26 to 33 years old (n=57; 37.7%). The results of the present study concur with research which reported that LBP incidence is mostly reported among people in their thirties, while the overall prevalence increased with age, especially in the age group 60 to 65 years old (Hoy, Brooks, Blyth & Buchbinder, 2010; Mazloum, Nozad & Kumashiro, 2006). LBP may be common among young people because they habitually tend to do physically demanding activities in haste, making them more susceptible to LBP (Mazloum, Nozad & Kumashiro, 2006). The foregoing can as well be related to why an increase in prevalence of LBP in the younger age group was observed. To the contrary, Kunda (2008) made an observation that younger workers were more vulnerable to injury than older workers as the latter are likely to be more acquainted and experienced with their work, thus negating the probability of injury in older employees.

As the present study supports the statement that the likelihood of suffering from LBP increases significantly with age, Waxman, Tennant and Heliwell (2000) also observed that LBP is a problem that may begin with acute episodes, which may later become chronic and thereafter may result in disability as times go by. Once this occurs, it may likely continue with less chance of recovery; hence the increase of prevalence with age (Bio, et al., 2007). The finding in the present study is consistent with the findings of Kopec, Sayre and Esdaile (2004) who revealed that age and height were significant predictors of LBP in men, although the participants were from a general populace study rather than being limited to some set of workers. The researchers also found an association between LBP and BMI, which is in consonance with what the present study established. Obesity is greatly associated with LBP, and it is said that individuals with increased weight bear more physiological stress on their bodies thus they experience more exhaustion and cardiovascular problems which increases their risk to LBP compared to those with low BMI (Mazloum, Nozad & Kumashiro, 2006). In contrast to the findings of the study, Himalowa (2010) and Murtezani (2010) found no association between LBP and individual risk factors for LBP.

In the present study, significantly more male than female mineworkers had suffered from LBP in the past 12 months ($p<0.001$); past one month ($p=0.002$) and past one week ($p=0.002$). This could be due to the notion that mine work is an occupation predominantly done by men as it requires high level of physical strength and endurance to perform the daily vocational tasks. In general, males are proportionally over-represented in professional work fields such as machine operative, skilled trades and elementary jobs while only few women are employed in machine operated and skilled job (Okunribido & Wynn, 2010).

Regarding mineworkers' length of employment or work experience, a statistically significant relationship was found between length of employment and prevalence of LBP in the past 12 months (χ^2 = 11.257, p = .047). However, the correlation coefficient suggests a weak, positive relationship between LBP during the past 12 months and length of employment (r_2 = 0.187, P = 0.005). In the present study, more than sixty percent (62.8%of the respondents had worked for equal to or less than five years, indicating that the onset of LBP occurred during the first five years of employment as a mineworker. This observation is also evident in the research conducted by Fabiano, Curro, Reverberi and Pastorino (2008), Kunda (2008) as well as Himalowa (2010). This could be owed to inexperience among the mineworkers affected by LBP.

In the present study, LBP prevalence was high among the workers who had served the longest years in the mine (26 to 30 years work experience). Musculoskeletal disorders have been reported to be common among the older age group (Okunribido & Wynn, 2010), hence the workers with the longest service could as well be the older workers. This result could be attributed to the gradual decrease in capacity of human function with age, hence the older mineworkers are more prone to work-related musculoskeletal disorders compared to the younger mineworkers (Okunribido & Wynn, 2010). Although mineworkers in the older age category may have good work experience, depending on their job description, it may have a wearing effect on their physical capacity, making them vulnerable to LBP (Buchman, Boyle, Wilson, Bienias & Bennet, 2007; Kenny, Yardley, Martineau & Jay, 2008). This assertion may explain why there were a high percentage of long serving employees suffering from LBP in the present study. On the contrary some researchers found a high rate of musculoskeletal disorders and injury in workers with less experienced workers than experienced workers. The researchers concluded that being unfamiliar to the work environment and circumstances, inadequate knowledge regarding the specific field of work as well as lack of skill or practice are all factors that could contribute to increase musculoskeletal disorders in mineworkers (Hakkanen, Viikari-Juntura & Martikainen, 2001; Fabiano, Curro, Reverberi & Pastorino, 2008; Himalowa, 2010).

6.4 JOB CATEGORIES OF MINE WORKERS AND LOW BACK PAIN

When LBP was examined individually as per job category in the present study, of the 68% mineworkers that reported having LBP in the last 12 months, handymen accounted for the highest prevalence (n=107; 48.2%). This aligns with the findings of Bio et al (2007) who found that mineworkers from the engineering department which consisted of drilling, blasting and mining were the groups mostly plagued with LBP. They are the mineworkers that do the hard physical work, making them more vulnerable to LBP. On the contrary, Himalowa (2010) observed that the highest prevalence of LBP was recorded among masons, which could have been so because most construction workers are masons and the study being based entirely on construction workers. The present study also recorded drivers as the second highest job category affected by LBP (n=21; 9.5%). This may be due to the fact that drivers are exposed to long periods of sitting (up to 12 hours). In particular, drivers experience monotonous driving conditions, often on uneven road surfaces or rough terrains especially in the mining environment, and this increases their exposure to a lot of vibration and trunk accelerations, well-known risk factors for LBP (Waters, Genaidy, Virue & Makola, 2008; Eger, Steveson, Grenier, Boileau & Smets, 2011; Kilpatrick, Sanderson, Blizzard, Teale & Venn, 2013). The prevalence of LBP among the drivers in the present study could be associated with long hours of monotonous driving on rough roads. In the present study, a clear discrepancy in the prevalence of LBP was recorded between various job categories.

6.5 OCCUPATION-RELATED RISK FACTORS FOR LOW BACK PAIN IN MINE WORKERS

Mining is an occupation that is very hazardous and it represents a significant source of musculoskeletal injuries and stress (Esterhuizen & Gurtunca, 2006; Burges-Limerick, 2007; Banddyopadhay et al., 2012). Several researchers have reported on various occupation-related risk factors for the development of LBP. These risk factors include exposure to repetitive movements, manual lifting and handling of materials, exposure to awkward postures such as kneeling, squatting, bending as well as physical activity such as whole body vibrations (Mandal & Srivastava, 2010; Murtezani et al., 2011; Bandyopadhay et al., 2012). Respondents in the present study reported on five (5) working positions, namely standing, stooping, bending, kneeling and sitting and the distribution of low back pain according to different adopted postures during work. No significant association was found between LBP and working posture. However, there was a significant association between bending and LBP (p=0.001). This result is consistent with Xu et al. (2012) who stated that bending posture showed a positive association with LBP among the coal mineworkers in China. Similarly, Tawiah, Oppong,Yeboh & Bello (2015) owed the high incidence rates of LBP to the nature of the job of the gold mineworkers which included awkward bending and twisting of the back at work as well as manual handling activities.

The National Research Council (NRC) (2001) also reported that regular bending was an occupation-related risk factors reported to have showed a positive correlation with the occurrence of LBP. Heavy physical work is a prominent feature in the mining industry.

Contrary to what was observed in the present study, Bio et al., (2007) reported that 77% of the mineworkers' LBP was attributed to heavy physical work. In another study on construction workers, an occupation closely related to mining, Himalowa (2012) reported lifting and bending as the activities associated with the development of LBP. A study conducted at a brick manufacturing factory, an occupation equally physically demanding as mining, Ndivhudzannyi (2003) reported frequent twisting and bending of the trunk to cause a lot of LBP. Pari and Dhara (2015) also concluded that the bending and twisting posture that was adopted by the clay mineworkers contributed to the risk of LBP and other musculoskeletal disorders.

The present study reported that a (n = 98; 65%) high number of workers suffered from LBP due to working in bending posture. This may be so as postural stress has been reported as the most common cause of LBP which also includes frequently bending forward. The frequent flexion and extension involved in forward bending puts a considerable amount of stress on the back structures (ligaments and discs), causing muscles strain. This finding concur with a study conducted by Waonqennqarm, Rajaratnam and Janwantanakul, (2015) who confirmed that a forward leaning posture is associated with the development of LBP.

6.6 MINEWORKERS' TIME OFF WORK DUE TO LOW BACK PAIN

LBP is a major contributor to the high absenteeism rates observed in the mining industry (Dias, 2014) and ranked among the most common and difficult occupational health problems. The direct costs as a result of LBP is insignificant compared to the production losses related to it (Maniadakis & Gray, 2000). The economic impact of LBP is enormous and affects all sectors in the society which starts with an individual family, community, industries, and trickles down to the government (Duthey, 2013). Some of the consequences of LBP at work include poor performance, inactivity and un-productiveness, which results in worker redundancy. This strains the employers' budget causing them to spend more on employee's health care systems (Heifenstein, Goldenfum & Siena, 2010).

In the United States of America (USA) Stewart, Ricci, Chee, Morganstein and Lipton (2003) reported that LBP ranked among the leading cause of work absenteeism and lost productive time while in the United Kingdom (UK) more than 100 million work days are lost per year amongst young adults due to LBP (Duthey, 2013). In the present study, 83% of the mine workers took time off work due to their LBP, a figure slightly higher compared to the study conducted by Bio (2007) who reported that 76% of the mineworkers lost time from work due to LBP. Furthermore, a mean duration sick leave of 6 days (sickness absence record of 2 to 7 days) was also found in Bio's study. In Ghaffari's (2006) study proportion of workers who were absent from work due to LBP was 5% per year. It has been observed that the more pain a worker experiences, the more physical limitation they have and the more time they take off work (Carlisle & Parker, 2014). Furthermore, the researchers also observed that LBP greatly interfered with the mineworkers' normal work activity, a tendency that was significantly linked to distress. The high percentage of workers who took time off work in the present study clearly shows the disabling effect LBP has on mineworkers. It may also be very difficult for employees with recurring LBP to return to work after an episode of LBP because they experience many problems in returning to work due to disability (Bell & Burnett, 2009).

6.7 THE EFFECT OF LOW BACK PAIN ON FUNCTIONAL ACTIVITES OF MINEWORKERS

Low back pain can cause great levels of physical inactivity among those affected, thus lessening their capacity to perform activities of daily living as well as leisure time activities.

Furthermore, they tend to develop a de-conditioning syndrome which is characterised by reduced activities of their daily living (Spenkelink, Hutten, Hermens & Greitmann, 2002). The findings of the present study concluded that participants had difficulty in performing most of the functional activities, including lifting of objects, bending forward or backwards, squatting, carrying objects, and walking upstairs. This concurs with findings from a study conducted by Himalowa (2012) who mentioned that construction workers faced a lot of limitation when carrying and/or lifting objects at work as well as while running due to fear of pain and movement. This is understandable as LBP sufferers have a tendency to stay away from activities that require much physical effort (Picavet, Vlaeyen & Schouten, 2002) as they fear worsening of their low back problem (Al Obaidi, Zoabi, Shuwaie, Zaabie & Nelson, 2003).

Participants in the present study found it difficult to engage in various activities of daily living because the pain prevented them from doing so. LBP causes activity restriction and can be very debilitating, resulting in reduced mobility and functioning (Reld, Williams & Gill, 2005). The reduced mobility of the lower limbs can have a negative influence on walking upstairs, squatting and bending forward and backward as these activities pose extra strain on the back in those already suffering with LBP. Similar results were echoed by Spenklink et al. (2002) who reported that patients with LBP tend to walk slower because of fear of movement.

6.8 PARTICIPATION RESTRICTION OF MINE WORKERS DUE TO LOW BACK PAIN

Workers involved in highly physical load jobs like mining face a number of health problems, including LBP. This results in poor work performance and reduced productivity as workers fail to perform their duties as they should because of the back problem (Meerding, Ijzelenberg, Koopmanschap, Severens & Burdof, 2005). The current study discovered that mineworkers had challenges in participating in certain activities because the pain interfered with their ability to perform the specific activity. The results indicated that pain interfered with their normal work and their ability to sit or stand, and in addition, the mineworkers found it difficult to lift objects, grasp objects or reach for things. The workers may have been avoiding these activities because of fear of aggravating their pain (Kose & Hatipoglu, 2012). LBP affects a patient's lifestyle through walking, standing, sleeping and travelling, as well as their social life. Overall their daily living is greatly affected by LBP. In addition, Main and Williams (2002) highlights that there are two types of sufferers of LBP; the avoider and the coper. The avoider tends to avoid activity because they have a belief that staying away from activity will help recovery. The avoider spends his or her days worrying about the pain that may follow in the future. On the other hand, the coper learns to cope with the pain, and tries to live his or her life as normally as possible by staying positive and keeping an active lifestyle.

6.9 THE EFFECT OF LOW BACK PAIN ON LIFE STYLE ACTIVITIES OF MINEWORKERS

Persons with LBP experience mental, social, anxiety and physical disruptions which result in loss of sleep, deterioration in health and poor physical performance (Nurul-Izzah, Abdullah, Moin, Shamsul-Bahri & Hashim, 2010). It has been reported that problems that come with LBP include psychological distress and sleep disturbance which are also associated with LBP (Alsaadi, McAuley, Hush & Maher, 2011). In the present study, a significant association was found for LBP and its effect on sleep (p=0.01), mood (p=0.05) and during activity (p=0.02). This is in consonance with Himalowa (2010) who observed that the construction workers had emotional problems because of their LBP problem. Amongst the reported problems, anxiety and moodiness were mentioned. Tang, Salkovskis, Hodges, Wright, Hana and Hester (2008) stated that the emotional misery that the patients with LBP go through may lead to poor work performance and may create a feeling of irritability and helplessness. Although pain and depression are often associated with each other, not many studies have been conducted to establish this fact (Tang et al., 2008). However, in the present study the researchers found a direct relationship between pain and depression. In addition, the effect of LBP on a worker's mood could also be attributed to psycho-social factors such as monotonous work, time pressure, poor work content, high demands from work, low support from colleagues and supervisors (Ijzelenberg & Burdorf, 2005).

Low back pain is common amongst workers experiencing low social support at work (Wahlstedt, Norbäck, Wieslander, Skoglund & Runeson, 2010). These authors also reported a direct relationship between psycho-social factors at work and LBP. Furthermore, failure of an individual to cope with such factors may increase work-related stress and later lead to development of musculoskeletal symptoms. The present study also reported that the mineworkers experienced LBP during activity, which is contrary to what was reported by Hendrick Milosavilevic, Hale, McDonouqh, Ryan and Baxter (2011). The researchers found no evidence to support the hypothesis that engaging in difficult physical activity was detrimental to patients with LBP. However, caution should be taken when comparing the two studies because of the difference in LBP definition and methodology applied. To conclude, mineworkers' lifestyle activities were greatly limited as LBP negatively influenced it. The result also brings to light how the mineworkers are greatly impacted by LBP.

6.10 RELATIVE RISK FOR LOW BACK PAIN IN MINE WORKERS

The current study reported an overall relative risk of 31.5% for a participant to have LBP at rest. The age group reported with the highest risk for LBP while at rest was ≤ 35 years. Not only does LBP affect the physical aspect of a mineworker's life, it also affects other areas of their daily life (Carlisle & Parker, 2014). It should also be noted that this study reported the highest prevalence of LBP in the age group less than ≤ 35 years old (26 to 33 years old); hence the highest relative risk being reported among this age group. This is consistent with Carlisle and Parker (2014) who reported more distress among the young age group of coal mineworkers during their rest hours. From this observation, it can be concluded that mineworkers are unable to have adequate rest due to their LBP. In addition, the pain affects their quality of sleep and rest, and this lack of rest can increase the risk of injury at work, especially in the age group 35 years old and less.

6.11 KINETIC HANDLING PRINCIPLES OF MINEWORKERS

a) Awareness when lifting heavy objects

One of the most interesting findings in the present study relates to how important it is for mineworkers to be aware of the safety precautions when employing kinetic handling principles in their daily work environment. It can be argued that the absence of such awareness can have adverse effects on a mineworker's physical well-being as well as the production of the mines. When participants were asked if they are aware of the proper techniques when lifting heavy objects and how it could help in preventing LBP, they indicated that being aware of these principles played an extremely important role in minimising cases of LBP among mineworkers. As Gallagher (2008) aptly notes, minimising LBP increases production in any organisation. Thus, while the stress is not on increasing production, it can be inferred that the safety and health of mineworkers is a critical factor in the success of mining production. Moreover, it is vital to note that the mining industry has long been associated with high incidences of low back disorders and low back injuries which account for a large proportion of lost workdays and the cause of debility in mine workers (Burgess-Limerick, Straker, Pollock, Dennis, Leveritt & Johnson, 2006).

As observed in the present study, one of the risk factors for low back injuries was notably manual lifting activities. Several researchers have shed light on possible mechanisms that may contribute to low back injuries. The results can be used to improve the model designs of lifting tasks to decrease injury risk (Mayton, Amirouche & Jobes, 2005; Helfnstein, Goldenfum & Siena, 2010; Sterud & Tynes, 2013). The knowledge of low back injury mechanisms and lifting model design highlights the leverage that can be maximised to reduce the risk of low back pain. In the present study, mineworkers agreed that there is need to be aware of proper lifting techniques to avoid LBP.

Shiel's (2008) suggestion that it is not ideal for people to lift or carry objects weighing more than their own weight is noteworthy at this juncture. According to the researcher, some strategies of weight lifting should be bear in mind to prevent the onset of LBP. For example, one should keep ones back straight when bending forward and backwards, and lift with the knees while supporting the weight of the object. Preferably, an object should be kept close to the body. Accordingly, Arya (2014) explains that the core or stabilising abdominal muscles should be strengthened to support the spine. Similar findings from various studies equally points to the fact that forward trunk bending when lifting objects is a risk (Xu, 2012; Tawiah et al., 2015; Waonqenngarm, Rajaratnam & Janwantanakul, 2015). From this perspective, it can be concluded that bending forward creates an additional moment (weight or load) to the low back due to the weight of the trunk, which must be counteracted by the back muscles through increased contraction. This 'shock' to the low back strains the spinal tissues resulting in a sudden spinal tissue failure when this additional load is imposed on them (Gallagher et al., 2005).

Forward trunk bending is usually inevitable in mineworkers. This may be so because they usually work in constrained spaces in order to access the minerals in the ground by making tunnels, especially in underground mines. The nature of their working environment often limits what can be done to reduce forward trunk bending in mineworkers. On the other hand, there are several possible easier changes that can be done in working areas or facilities to reduce manual handling activities, especially for those working in heavy industries such as the mining industry. A possible change includes less manual handling activities by replacing them with mechanical object lifting. Apart from replacing these activities with mechanical ones, sensitisation among mineworkers on proper lifting knowledge techniques, for example limiting the weight of objects lifted, is yet another way out. Ideally, items should be kept "about waist height, not lower than knee height and not higher than shoulder height". (Manual Handling Policy, 2015 pg,4; Jager, Griefahn, Liebers, Steinberg & Fur, 2003 pg. 17).

When injury mechanisms are examined, it is proposed that most attention in the industry needs to be focused on the effects of sustained and repetitive bending, and low back trauma due to lifting and lowering. However, an investigation must be conducted on how much the workers themselves know when it comes to such techniques. Research shows that standard advice and instruction on lifting and handling techniques are often insufficient to bring upon change in bad habits (Haslam, Clemes, McDermott, Shaw, Williams & Haslam, 2007). The common recommendation on lifting heavy objects is that "bend the knees and not the back".

In the present research study, improper posture while bending is associated with LBP and affects up to 65% of mineworkers. This is an alarming percentage that requires drastic measures to ameliorate cases of LBP. When lifting objects, repeated trunk bending causes the muscles of the spine to lose their strength and increased susceptibility to muscle spasms (sudden contractions of muscles) (Solomon et al., 2003).

In the present study, mineworkers were not fully aware, and some appeared unsure of the prescribed maximum weight in kilograms that they could lift as an individual. Others highlighted that it was not required of them to lift objects that exceeded their own weight. Considering the complex and varied nature of lifting activities, actual static load quantities for lifting are no longer specified. Past guidelines suggested 20 to 23kg for the recommended maximum weight (Occupational Health Department, 2007; Albers & Estill, 2007). However, amongst numerous other factors, this recommendation did not take into consideration the effects of fatigue, which can intensely decrease the recommended weight that can be lifted safely by an individual. According to the Occupational Health Department (2007) the lack of a specified weight lift is as a result of numerous individual variable capabilities, although their guidelines state that an individual should not lift loads exceeding 25 kg. However, this load limit can only be applicable in persons whose individual capabilities present no risk factors. For instance, in properly trained individuals in lifting techniques, the ability to lift may be high and low for those with ill health.

In the current study mine workers were well aware of the laid down guidelines on lifting techniques although it was evident that the knowledge perception on lifting among the mineworkers varied, but most importantly the workers had a clear understanding on the importance of safeguarding their back by maintaining an upright posture of the back when lifting as well as carrying objects. A better awareness of the lifting techniques among mineworkers is very much required if the frequency of LBP is to be adequately addressed.

b) Awareness when carrying heavy objects

The mineworkers' awareness when carrying heavy objects was above average. Good knowledge of the precautions was demonstrated by the participants. This is in contrast to their knowledge regarding the application of kinetic handling principles when pushing and pulling (see the following Section C). Knowledge of the correct way to carry heavy objects enable a person to safeguard his/her back. This is because any deviation from the recommended techniques may lead to a strain and consequently cause low back pain (Davis & Marras, 2000). The pain in turn may limit someone to function properly at work. Although the study did not focus on determining the extent of LBP, this supposed setback was not the case among three quarters of the mineworkers involved in this study. The quantitative results report that 79.2% of the participants still managed to carry heavy objects after sustaining LBP. This is also consistent with the qualitative data results, which indicated that three quarters of those interviewed having better knowledge of handling heavy objects after the LBP experience. Of the total number of respondents, 20.8% experienced limitations in the carrying of heavy objects.

During the interview, mineworkers were able to clearly describe on proper ways to carry heavy loads, including keeping it close to their bodies. Guidelines regarding carrying suggest that the load should be kept as close to the body as possible to prevent lumbar strains (Manual Handling Policy, 2015). Objects should not obstruct the individual's sight and walkway, carrying distances and repetitive tasks should be reduced to avoid exhaustion (Manual Handling Policy, 2015). Furthermore, a person should always ask for assistance when carrying awkward or heavy loads. The present study finding thus concludes that LBP experiences made the mineworkers aware of how they can safeguard themselves against further LBP while doing their everyday activities such as carrying a heavy object at work.

c) Awareness on pushing and pulling heavy objects

One of the interesting findings in pushing and pulling heavy objects in the present study is the correlation between the lack of awareness on safety measures and the number of mineworkers affected by LBP. Although the participants' general knowledge on safety measures in general seem to be adequate, the mineworkers' awareness on applying these measures while doing pushing and pulling activities appeared to be inadequate. For example, some mineworkers showed insufficient knowledge on the general posture as well as how and where to hold the heavy object.

Pushing and pulling should never be done with one hand or twisting and turning of the trunk (Jager, Griefahn, Liebers, Steinberg & Fur, 2003, Pg19). Literature recommends that when pushing heavy objects the body's own weight should be *applied* and the person should lean forward when pushing and backwards when pulling (Department of Occupation Health, 2007). In addition, it is also advised that one lean toward the object to be pushed and then use their legs and the force of their body's weight to move the object forward. In both instances, it is imperative to "maintain an upright back with arms close to the centreline of the body, avoiding twisting and turning" (Department of Occupational Health, 2007, pg5). However, the Manual Handling Policy (2015) states that items should rather be pushed instead of pulled. The person could lean with his/her back against the fixed object to be pushed and use their body weight to push it.

In addition, it is believed that the body uses more energy in pulling than pushing (Knapik & Marras, 2009) because high force exertion is usually found in pulling of heavy objects. This exertion force is harmful to the body because it requires the use of high muscle forces which may lead to muscle overloading and exhaustion. The exertion force possesses a high risk of damage to the back muscle especially when performing tasks with long-lasting repeated high forces. However, this can be avoided by doing it in a way that the force acts close to the body. Thus, it can be argued that adequate awareness on safety rules and measures for pushing and pulling as is the case with other kinetic handling techniques has a positive effect on reducing the cases of LBP, thus increasing organisational production.

d) The use of equipment

Concerning the use of equipment, the study concludes that automated machinery is the most viable replacement for lifting any heavy objects while manual lifting can be employed when lifting light objects. According to the Department of Occupation Health (2007) the specifications that have been suggested in manual handling regulations include doing away with manual handling activities and replacing it with the use of control measures such as machine-driven aids or mechanical aids. In the mining occupation, manual handling of materials is usually unavoidable and poses a great danger to the worker. As simple solution to ease and lessen problems linked to such problems, research recommends the use of wheelbarrows, carts and trucks in replacement of manual tasks (Jung, Haight & Frevalds, 2004).

Participants in the present study were able to elaborate and emphasise on how important it was for them to use powered assistance in an event where they were unable to perform a task, especially in instances where the object was too heavy to lift or carry. Several mechanical aids were mentioned which included the use of winches, forklifts, and cranes. The Manual Handling Policy (2015) suggests that organisations should ensure to replace operations involving manual handling of materials to reduce the occurrence of hazardous manual handling activities. This could only be achieved by providing automated mechanical aids such as trolleys, carts and hoists. Concerning the use of carts in pushing and pulling, Hoozemans et al (2004) observed that the cart weight as well as the handle height affects the mechanical loading of the low back as well as the shoulder. The researcher concluded that low carts should be used and designed in such a way that the push and pull be done at shoulder height to reduce mechanical loading both at the shoulder and lower back.

e) Assessment of the weight of an object before manual handling

Assessment of heavy objects is an important preliminary safety precaution. It enables a worker to determine whether the object can be lifted manually or with the help of machines. The present study reveals that workers applied this knowledge appropriately. However, the study noted that workers were at risk of the development of LBP when they attempt to determine if the object is in the range of their lifting capacity, especially in the absence of other assistive weight determining equipment. According to the Policy on Manual Handling (2015), skilled individuals should conduct risks assessment regarding manual handling activities. Among the listed factors that should be considered during an assessment are that a worker should have sufficient knowledge coupled with a clear understanding of the work involved. Other guidelines recommend that it is always important to plan and assess both lifting and carrying jobs and to test the weight of an object by gently rocking it.

6.12 SUMMARY OF THE CHAPTER

The results of this study provide an elucidation on how occupation-related LBP impacts a mineworker's life (physically, psychologically, and emotionally), as well as their functional and lifestyle activities. The results of the present study provide robust evidence of a high percentage disability and loss of quality of life because of LBP among the mineworkers of Solwezi. No known study has been conducted among mineworkers on the exploration of knowledge regarding kinetic handling on their daily occupational activities.

CHAPTER SEVEN

SUMMARY, CONCLUSION, RECOMMENDATIONS AND LIMITATIONS

7.0 INTRODUCTION

This chapter serves as the concluding part of the study and provides an outline of the main issues emanating in the study. Conclusions derived from the main findings of the study are explicitly stated, and this is followed by proposed recommendations. Lastly, limitations encountered in the study are stated.

7.1 SUMMARY OF THE STUDY FINDINGS

The aim of the study was to determine the role of occupation-related low back pain on the functional activities of mineworkers from Solwezi District, Zambia. The prevalence of occupation-related low back pain and the common risk factors related to low back pain were investigated. The association between occupation-related LBP and functional activities as well as an account of mineworkers' knowledge regarding kinetic handling in their daily occupation activities were assessed.

The following results were obtained after 222 mineworkers with a mean age of 35 years (SD=9.6) successfully completed the questionnaire. It was revealed that 97.3% (n=216) of the respondents were male with 2.6% being female. 60.8% of the participants had a normal BMI, while 22.5% were obese. Also, 42.8% (n=95) of the participants were handymen which consisted of fabricators, electricians, drillers, riggers, welders, boiler makers, instrument technologist sampler offside and plasticians. The study indicated that 68% of the respondents suffered LBP in the past year. A one-month prevalence was reported by 40.4% of the respondents and a one-week prevalence by 33.1% of the respondents. The highest occurrence of LBP was reported in the age group 26 to 33 years old, revealing a frequency of 37.7 %, with the lowest occurrence in the age group 18 to 25 years old (9.9%). Regarding job categories, handymen recorded the highest prevalence (48.2%) of LBP among the respondents. The onset of LBP was mostly related to bending, reported by 65% of respondents. Chi-square test with a 95% confidence interval showed an association between LBP and socio-demographic characteristics which included age, gender, BMI, bending during work activities and length of employment. A statistical significance result was also obtained on the effects of LBP on mood ($p<0.05$), sleep ($p=0.01$), and during activities of daily living ($p=0.02$) of the participants. Most participants (n=125; 82.8%) reported that they had taken time off due to their LBP. Furthermore, challenges mineworkers faced relating to functional limitations due to LBP were identified. The results revealed that the functional activities mostly affected as a result of LBP included managing to lift with (mean 1.25, SD= 0.43) managing to bend forward (mean 1.23, SD= 0.42) managing to squat (mean 1.21, SD= 0.41), managing to carry (mean 1.20, SD= 0.40), managing to bend backward (mean 1.19, SD= 0.39) managing to throw (mean 1.19, SD= 0.39), managing to walk upstairs (mean 1.18, SD= 0.38). Also, chi-square test for proportion revealed an association between LBP and participants' participation restriction. The following activities recorded a mode equals to or more than five (≥5) and were considered to have a high restriction on the participants; pain interfering with normal work (mode = 7), pain affecting ability to sit or stand (mode = 7), pain affecting ability to lift overhead, grasp objects or reach for things, (mode = 5, 6 and 7), pain affecting ability to lift objects off the floor, bend, stoop, or squat (mode = 5, 8 and 9) and pain affecting your ability to walk or run (mode = 7). The relative risk for a mineworker to have LBP during rest was 31.5%. The knowledge and perception of kinetic handling among mineworkers showed general good knowledge regarding lifting and carrying. The participants described clearly how they manually lift or carry objects by maintaining an upright back when lifting or carrying objects. General knowledge of safety measures was shown. The knowledge of pushing and pulling among the participants appeared to be a little insufficient compared to the knowledge on lifting and carrying which was adequate. Two themes emerged from the focus group discussion which included assessment of an object before manual handling as a preliminary safety precaution before handling the loads. The participants understood the importance of safeguarding their backs when manually handling loads by checking if the load was in their lifting range or can be pushed or pulled manually. The second theme was the use of equipment, a desirable means of moving objects when manual handling was impractical. It was agreed that automated machinery was the only practical means of transporting loads where manual handling was not practical. A number of assistive devices were also mentioned which assisted mineworkers in moving objects from one point to the other. These assistive devices included winches, chain blocks, and rollers cranes and forklifts.

7.2 CONCLUSION

The current study revealed that LBP is a serious vocational health hazard in trades such as the mining industry. Results indicated a high LBP prevalence owed to occupation-related activities mineworkers engage with in their day to day work environment and activities, particularly monotonous bending which has shown to be a major cause of LBP in this study. The impact of occupation-related LBP in the mining industry is huge and has shown a high rate of absence from work among the mineworkers. Furthermore, LBP caused a significant amount of vocational as well as every day activity limitation and participation restriction amongst the mineworkers. The need for physiotherapists to collaborate with stakeholders from the mining industry is evident from the results. This could assist with the development of prevention strategies to curb the initial onset and recurrence of LBP in the mining population by increasing the mineworkers' knowledge regarding the application of kinetic handling principles while at work which could assist with the reduction in the prevalence of LBP.

7.3 RECOMMENDATIONS

1. To educate all stakeholders in the mining industry regarding the optimal back care prevention strategies and ergonomics in work premises. This would help eradicate or lessen poor back care ergonomics among mineworkers while doing a very physically demanding work.

2. Employers should, where possible, do away with manual handling of materials among mineworkers and replace it with the use of innovative assistive devices for load transportation. This could assist in the lowering of injury rates resulting from manual material handling of loads.

3. Another way of lowering back injury rates in the mining industry is to avoid or lessen load handling in restricted spaces by providing mechanisms in which mineworkers' bodies would be properly supported while working in awkward postures.

4. Physiotherapists should focus on interventions that prevent or lessen further occurrences of LBP and maintain optimal physical function among the sufferers of LBP. An early return to work programme should be formulated to teach those that are affected by LBP. Physiotherapists should also educate them on coping strategies when suffering with LBP and assist them to return to work as soon as possible. A

multi-faceted approach involving physiotherapists, mineworkers as well as other relevant stakeholders should be employed. Physiotherapists should also enhance and promote exercise and physical fitness amongst the mineworkers affected by LBP as well as those without LBP.

5. Effective prevention of occupation-related LBP requires combined efforts involving persons at all level of organisations including employers and employees. Employers should provide their workers with necessary training regarding back care ergonomics and encourage work place interventions to reduce injury.

6. The results of this study can be used by employers and policy makers to assist them in the development and planning of prevention measures to be implemented in the mining industry to curb this hazardous problem.

7. More studies should be conducted on occupation-related low back pain and on knowledge of kinetic handling among mine workers.

7.4 LIMITATIONS OF THE STUDY

1. The response rate was low as not all the anticipated mineworkers managed to complete the questionnaire. Therefore, the results of the study cannot be generalised to the entire mining industry in Zambia and Africa at large.

2. It was difficult to arrange time to meet the mineworkers due to the nature of their work as they were only given little time in their safety meeting to complete the

questionnaire. It made it difficult for the researcher to follow up on them when they took the questionnaire with them.

3. The information obtained was self-reported therefore, information may not be precise.

7.5 SUMMARY OF THE CHAPTER

The final chapter summarised the findings of the study. In addition, limitations and recommendations of the study were also given.

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APPENDIX

Appendix A

OFFICE OF THE DEAN
DEPARTMENT OF RESEARCH DEVELOPMENT

UNIVERSITY of the WESTERN CAPE

08 June 2015

To Whom It May Concern

I hereby certify that the Senate Research Committee of the University of the Western Cape approved the methodology and ethics of the following research project by: Ms S Chisenge (Physiotherapy)

Research Project:	Occupation related low back pain and functional activities of mine workers from Solwezi District, Zambia.
Registration no:	15/4/47

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

Private Bag X17, Bellville 7535, South Africa
T: +27 21 959 2988/2948 . F: +27 21 959 3170
E: pjosias@uwc.ac.za
www.uwc.ac.za

A place of quality,
a place to grow, from hope
to action through knowledge

Appendix B

ERES CONVERGE

33 Joseph Mwilwa Road
Rhodes Park, Lusaka
Tel: +260 955 155 633
+260 955 155 634
Cell: +260 966 765 503
Email: eresconverge@yahoo.co.uk

I.R.B. No. 00005948
F.W.A. No. 00011697

7th August, 2015

Ref. No. 2015-June-027

The Principal Investigator
Ms. Suwilanji Chisenge
Riverside Extension Plot 5955
KITWE.

Dear Ms. Chisenge,

RE: OCCUPATION RELATED LOW BACK PAIN AND FUNCTIONAL ACTIVITIES OF MINE WORKERS FROM SOLWEZI DISTRICT, ZAMBIA.

Reference is made to your corrections dated 5th August, 2015. The IRB resolved to approve this study and your participation as principal investigator for a period of one year.

Review Type	**Ordinary**	Approval No. **2015-June-027**
Approval and Expiry Date	Approval Date: 7th August, 2015	Expiry Date: 6th August, 2016
Protocol Version and Date	Version-Nil	6th August, 2016
Information Sheet, Consent Forms and Dates	• English.	6th August, 2016
Consent form ID and Date	Version-Nil	6th August, 2016
Recruitment Materials	Nil	6th August, 2016
Other Study Documents	Questionnaire, Focus Group Discussion Guide.	6th August, 2016
Number of participants approved for study	353	6th August, 2016

Where Research Ethics and Science Converge

Specific conditions will apply to this approval. As Principal Investigator it is your responsibility to ensure that the contents of this letter are adhered to. If these are not adhered to, the approval may be suspended. Should the study be suspended, study sponsors and other regulatory authorities will be informed.

Conditions of Approval

- No participant may be involved in any study procedure prior to the study approval or after the expiration date.
- All unanticipated or Serious Adverse Events (SAEs) must be reported to the IRB within 5 days.
- All protocol modifications must be IRB approved prior to implementation unless they are intended to reduce risk (but must still be reported for approval). Modifications will include any change of investigator/s or site address.
- All protocol deviations must be reported to the IRB within 5 working days.
- All recruitment materials must be approved by the IRB prior to being used.
- Principal investigators are responsible for initiating Continuing Review proceedings. Documents must be received by the IRB at least 30 days before the expiry date. This is for the purpose of facilitating the review process. Any documents received less than 30 days before expiry will be labelled "late submissions" and will incur a penalty.
- Every 6 (six) months a progress report form supplied by ERES IRB must be filled in and submitted to us.
- ERES Converge IRB does not "stamp" approval letters, consent forms or study documents unless requested for in writing. This is because the approval letter clearly indicates the documents approved by the IRB as well as other elements and conditions of approval.

Should you have any questions regarding anything indicated in this letter, please do not hesitate to get in touch with us at the above indicated address.

On behalf of ERES Converge IRB, we would like to wish you all the success as you carry out your study.

Yours faithfully,
ERES CONVERGE IRB

Dr. E. Munalula-Nkandu
BSc (Hons), MSc, MA Bioethics, PgD R/Ethics, PhD
CHAIRPERSON

Appendix C

All correspondence should be addressed to the Director of Mines
Telephone: +260-1-237306 / 235324 / 5 / 6
Telefax: +260-1-237307/235363
New Government Complex, Nasser Road
E-mail:

In reply please quote:

No: MMEWD/101/9/10

REPUBLIC OF ZAMBIA

MINES DEVELOPMENT DEPARTMENT

P. O. BOX 31969
LUSAKA
18th August, 2015

The Chief Executive Officer
Kansanshi Mining Limited
PO Box
SOLWEZI

Dear Sir,

REF: RECOMMENDATION FOR SUWILANJI CHISENGE TO CONDUCT A RESEARCH AT KANSANSHI MINING LIMITED

Reference is made to the above subject.

The Ministry of Mines, Energy and Water Development is in receipt of application of the above mentioned Zambian National who is a student pursuing a Master's Degree in Physiotherapy at the University of Western Cape in South Africa. As a requirement of the Master's degree thesis, she is seeking to carry out a research on occupational related low back pain and functional activities of the mine workers. She wishes to undertake this research at your company as she is a local resident of Solwezi District. The duration of the research is approximately one (1) month and targeting about 350 participants among the Kansanshi mine workers.

The Ministry of Mines, Energy and Water Development has no objection with the above named student conducting her research at Kansanshi Mining Limited and would appreciate any assistance that would be rendered.

Yours faithfully,

F. Banda

Fred Banda
Chief Mining Engineer
For/ Director of Mines
MINES DEVELOPMENT DEPARTMENT

Appendix D

KANSANSHI MINING PLC

A COMPANY OWNED BY

FIRST QUANTUM

ZCCM

P.O. Box 110385 Solwezi Zambia · Solwezi – DR Congo Road · Telephone 260 2 658 [illegible]
Facsimile 260 8 821 889 [illegible]

To Whom It May Concern

The bearer of this Letter of Approval, Suwilanji Chisenge is a bonafide student of the University of the Western Cape. She is studying for her Masters' degree in Physiotherapy. As part of the requirement for the award of this degree, she is required to do a research; her area of interest is Lower Back Pain.

She has been allowed to do this research at the turnstile entrance to the mine. She has been given permission to interview workers exiting the mine and get workers to complete questionnaires.

Kind regards,

Bruce Lewis

(Corporate Social Responsibility Manager)

Appendix E

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa
Tel: +27 21-959 2542, Fax: +27 21-959 1217
e-mail: tsteyl@uwc.ac.za

INFORMATION SHEET

Project Title: Occupation related low back pain and functional activities of mine workers from Solwezi district, Zambia.

What is this study about?

This is a research project being conducted by SUWILANJI CHISENGE at the University of the Western Cape. We are inviting you to participate in this research project because you are a mine worker at Kasanshi copper mine, Solwezi district Zambia. The purpose of this research project is to determine the prevalence of occupation related low back pain among mine workers, to identify the common risk factors influencing occupation related low back pain and to explore mine workers' knowledge of kinetic handling in their daily work activities. The outcome of the study could help physiotherapists, medical professionals, government and mine industries in planning specific measures on how to reduce the magnitude of the problem of low back pain through the development of specific preventive education and policy implementation.

What will I be asked to do if I agree to participate?

You will be asked to:

- Complete a **self-administered questionnaire** that will take approximately 15-20 minutes to complete. The study will take place at the mine, during one of the safety meetings. Before completion of the questionnaire, you will be asked to sign a consent form to indicate your willingness to participate in the study. The questionnaire include questions on your demographic information such as age, gender, height and weight (will be measured by the researcher and/or research assistant), a section on whether you have experienced symptoms of low back pain in the last 12 months, a section to determine any functional limitations (activities you struggle with due to your low back pain) and questions on how the low back pain affects your daily work activities.

- Participate in a **focus group discussion** at a time that is convenient for you to explore your knowledge of kinetic handling in your daily work environment. The focus group discussion will be tape recorded after informed consent were obtained and should not take longer than 30 – 45 minutes. All the tapes will be destroyed once they have been transcribed and documented according to themes.

Would my participation in this study be kept confidential?

We would do our best to keep your personal information confidential. To help protect your confidentiality the following steps will be taken:

- **Questionnaires:** will not contain information that may personally identify you. Your name will not be included on the surveys. A code will be placed on the survey. Through

- the use of an identification key, the researcher will be able to link your survey to your identity. Only the researcher will have access to the identification key. To help protect your confidentiality all information gathered will be stored in a locked filing cabinet. No unauthorised party will be able to access the information.

- **Focus group discussions:** This study will use focus groups and the extent to which your identity will remain confidential is dependent on participants' in the Focus Group maintaining confidentiality. The focus group discussion will be tape recorded after informed consent was obtained. A code will be attached to all audio-taped data that will be linked to an identification key only known to the researcher. All tapes will be destroyed once they have been transcribed and documented according to themes. Transcribed data will be stored in a locked filing cabinet. No unauthorised party will be able to access the information. Password-protected computer files will be used for the electronic version of the transcribed data.

If we write a report or article about this research project, your identity will be protected to the maximum extend possible.

What are the risks of this research?
There may be some risks from participating in this research study. All human interactions and talking about self or others carry some amount of risks. We will nevertheless minimise such risks and act promptly to assist you if you experience any discomfort, psychological or otherwise during the process of your participation in this study. Where necessary, an appropriate referral will be made to a suitable professional for further assistance or intervention.

What are the benefits of this research?
This research is not designed to help you personally, but the results may help the investigator learn more about the factors influencing the increase of low back pain among the mine workers. We hope that in the future, other people might benefit from this study through improved understanding of health promotion and education strategies implemented at mines to decrease the prevalence of low back pain among mine workers.

Do I have to be in this research and may I stop participating at any time?
Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.

APPROVED

07 AUG 2015

ERES CONVERGE
P/BAG 125, LUSAKA.

What if I have questions?

This research is being conducted by SUWILANJI CHISENGE from the Department of Physiotherapy at the University of the Western Cape. If you have any questions about the research study itself, please contact SUWILANJI CHISENGE at +26 0977581377 (w) or via email at suwilanjichisenge@yahoo.com

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Head of Physiotherapy Department:
Dr Nondwe Mlenzana
University of the Western Cape
Private Bag X17
Bellville 7535
nmlenzana@uwc.ac.za

Dean of the Faculty of Community and Health Sciences:
Prof José Frantz
University of the Western Cape
Private Bag X17
Bellville 7535
chs-deansoffice@uwc.ac.za

The Chairperson ERES Converge IRB
Dr. E. Munalula-Nkand
33 Joseph Mwilwa Road
Rhodes Park Lusaka.
Email- eresconverge@yahoo.co.uk

This research has been approved by the University of the Western Cape's Senate Research Committee and Ethics Committee as well as the Zambia ethical committee ERES.

Participant's name.............................

Participant's signature.....................................

Date..........................

Witness .... **Date**....................

Researcher...................... **Date**.....................

Appendix F

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa
Tel: Tel: +27 21-959 2542, Fax: 27 21-959 1217

e-mail: tsteyl@uwc.ac.za

CONSENT FORM

Title of Research Project: Occupation related low back pain and functional activities of mine workers from solwezi district Zambia.

The study has been described to me in language that I understand. My questions about the study have been answered. I understand what my participation will involve and I agree to participate of my own choice and free will. I understand that my identity will not be disclosed to anyone. I understand that I may withdraw from the study at any time without giving a reason and without fear of negative consequences or loss of benefits.

I .... **Agree to participate in the study.**

Participant's name.............................

Participant's signature.....................................

Date..........................

Witness .... **Date....................**

Researcher...................... **Date.....................**

Consent Form Version Date: 15 September 2014

APPROVED

Appendix G

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa
Tel: +27 21-959 2542, Fax: 27 21-959 1217

e-mail: tsteyl@uwc.ac.za

FOCUS GROUP CONFIDENTIALITY BINDING FORM

Title of Research Project: OCCUPATION-RELATED LOW BACK PAIN AND FUNCTIONAL ACTIVITIES OF MINE WORKERS FROM SOLWEZI DISTRICT, ZAMBIA.

The study has been described to me in language that I understand. My questions about the study have been answered. I understand what my participation will involve and I agree to participate of my own choice and free will. I understand that my identity will not be disclosed to anyone. I understand that I may withdraw from the study at any time without giving a reason and without fear of negative consequences or loss of benefits. I understand that confidentiality is dependent on participants' in the Focus Group maintaining confidentiality. I hereby agree to the following:

__ I agree to uphold the confidentiality of the discussions in the focus group by not disclosing the identity of other participants or any aspects of their contributions to members outside of the group.

Should you have any questions regarding this study or wish to report any problems you have experienced related to the study, please contact the study coordinator:

Participant's name... **Participant's signature**...........................

Date...........................

Witness .... **Date**.....................

Researcher........................ **Date**......................

Focus Group Confidentiality Binding Form — Version Date: 15 September 2014

Appendix H

DATE .... Appendix ...

Questionnaire Number....

OCCUPATION RELATED LOW BACK PAIN AND FUNCTIONAL ACTIVITIES OF MINE WORKERS FROM SOLWEZI DISTRICT, ZAMBIA.

This questionnaire must be completed by the participant after signed and written consent to participate in the study is granted. It is not required of you to put down your name, as the questionnaire is anonymous. The information obtained from this questionnaire is solely for the purpose of research.

Instructions

- **Please fill in the spaces provided.**
- **Select one response by putting an X in the appropriate box.**
- **Please explain in short words where you are required to.**
- **Don't write your name on the questionnaire as it is supposed to be anonymous.**

Thank you for your co-operation.

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DEMOGRAPHIC INFORMATION

As a participant, kindly answer the following questions by writing in the space or by putting a cross (X) in the appropriate box.

1. Gender a. Male ☐ b. Female ☐

2. Age............................ **3. Height**................................ **4. Weight**............

5. Job title (e.g. haul track operators, hydraulic excavator operators etc.).....................................

6. Are you a

i. Contract worker? a. YES ☐ b. NO ☐

ii. Permanent worker? a. YES ☐ b. NO ☐

7. How long have you been working?..

8. How long have you been working in the mining industry?......................................

9. How many hours do you work per day?..

10. Which position do you mostly adopt while working?

i. Standing a. YES ☐ b. NO ☐

ii. Stooping a. YES ☐ b. NO ☐

iii. Bending a. YES ☐ b. NO ☐

iv. Kneeling a. YES ☐ b. NO ☐

v. Sitting a. YES ☐ b. NO ☐

11. Other (please specify)...

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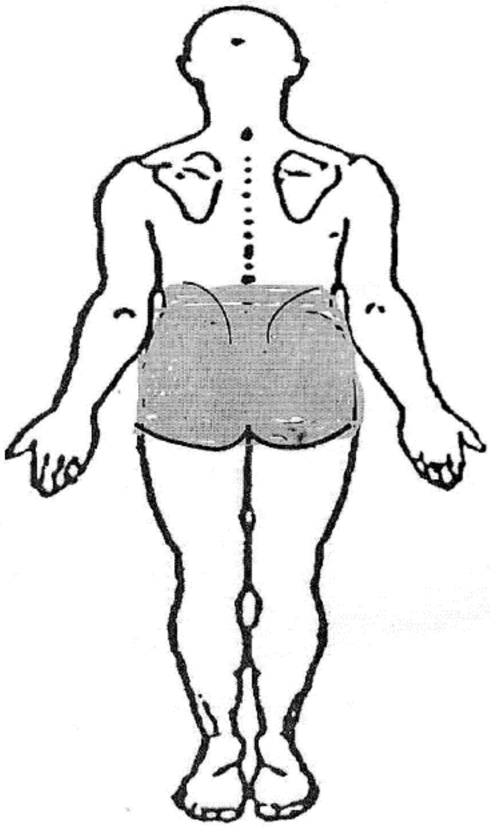
P/BAG 125, LUSAKA.

THE FOLLOWING INFORMATION IS USED TO DETERMINE YOUR LOW BACK PAIN SYMPTOMS

The shaded part on the picture below shows the lower back of the human body from behind. Answer the following questions by writing in the space or by putting a cross (X) in the appropriate box.



1. Have you at any time during the last 12 months experienced:

Pain, stiffness, soreness, ache, discomfort in your lower back (shaded area) whether or not it extends to one or both legs?

a. YES ☐ b. NO ☐

If NO, you can end here and thank you very much for your participation.

2. Can you relate the initial onset of low back problem to a specific incident?

a. YES ☐ b. NO ☐ (specify) ....

3. During the last 12 months have you been prevented from carrying out activities at work because of the problem in the back?

a. YES ☐ b. NO ☐

4. Have you ever taken time off work because of the low back problem?

a. YES ☐ b. NO ☐

If YES, how long? ....

5. Have you had a low back problem any time during the last month?

a. YES ☐ b. NO ☐

6. Have you had a low back problem during the last 7 days?

a. YES ☐ b. NO ☐

7. Do you think your back problem is as a result of your job?

a. YES ☐ b. NO ☐

Do you experience:

8. Problems with urination?	a. YES ☐	b. NO ☐
9. Problems emptying the bowels?	a. YES ☐	b. NO ☐
10. Problems with your stomach?	a. YES ☐	b. NO ☐
11. Limping during walking?	a. YES ☐	b. NO ☐
12. Disturbance of balance?	a. YES ☐	b. NO ☐
13. Irritability, short tempered?	a. YES ☐	b. NO ☐
14. Anxiety?	a. YES ☐	b. NO ☐
15. Backache during activity?	a. YES ☐	b. NO ☐
16. Backache during resting?	a. YES ☐	b. NO ☐

Does your back problem affect?

17. Your sleep? a. YES ☐ b. NO ☐

18. Your mood? a. YES ☐ b. NO ☐

19. Your sex life? a. YES ☐ b. NO ☐

THE FOLLOWING SCALE TESTS YOUR FUNCTIONAL LIMITATION

Answer the following question by underlining one answer from 1- 6

Because of your low back problems, how do you manage to:

1) Stand?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

2) Walk?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

3) Sit?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

4) Lay down?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

5) Run?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

6) Carry?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

7) Lift?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

8) Throw?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

9) Put on and take off a sweater?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

10) Put on and take off socks?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

11)Bend your back forward?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

12)Bend your back backward?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

13) Side-bend your back to the right?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

14) Side-bend your back to the left?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

15) Turn your back to the right?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

16) Turn your back to left?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

17)Walk upstairs?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

18)Walk downstairs?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

19) Squat down?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

20) Jump with both feet together?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

21) Lift your right leg when lying down?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

22) Lift your left leg, when lying down?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

23) Lift your right leg, when sitting?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

24) Lift your left leg, when sitting?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

WHAT CAN YOU SAY ABOUT:

25) The condition of your work?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

26) Your general health?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

27) Return to work?

1. Very good. 2. Good. 3. Rather good. 4. Rather bad. 5. Bad. 6. Very bad

THE FOLLOWING SCALE TESTS YOUR PARTICIPATION RESTRICTION

Instructions: These questions ask your views about how your pain now affects how you function in everyday activities. Please answer every question and cross (X) the ONE number on EACH scale that best describes how you feel.

1. Does your pain interfere with your normal work?

Work normally — Unable to work at all

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

2. Does your pain interfere with your traveling to work?

Travel anywhere I like — Only travel to see doctors

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

3. Does your pain affect your ability to sit or stand?

No problems Cannot sit/stand at all

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

4. Does your pain affect your ability to lift overhead, grasp objects, or reach for things?

No problems Cannot do at all

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

5. Does your pain affect your ability to lift objects off the floor, bend, stoop, or squat?

No problems Cannot do at all

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

6. Does your pain affect your ability to walk or run?

No problems Cannot walk/run at all

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

7. Has your income declined since your pain began?

No decline Lost all income

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

8. Do you have to take pain medication every day to control your pain at work?

No medication needed On pain medication throughout the day

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

9. Does your pain force you to see doctors much more often than before your pain began?

Never see doctors | See doctors weekly

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

10. Does your pain interfere with your ability to see the people who are important to you as much as you would like?

No problem | Never see them

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

11. Does your pain interfere with recreational activities and hobbies that are important to you?

No interference | Total interference

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

12. Do you need the help of your family and friends to complete everyday tasks because of your pain?

Never need help | Need help all the time

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

13. Do you now feel more depressed, tense, or anxious than before your pain began?

No depression/tension | Severe depression/tension

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

14. Are there emotional problems caused by your pain that interfere with your family, social and or work activities?

No problems | Severe problems

0 -------- 1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9 --------10

Thank you for your time and for your participation in this study.