The epidemiology of low back pain in radiographers working in the eThekwini Municipality

By

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DECLARATION OF ORIGINALITY

Except for quotations specifically indicated in the text and such help as I have acknowledged, this dissertation is wholly my own work and has not been submitted for any qualification at any other institution.

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Dedication

I dedicate this dissertation to
my fiancé
Erhard Koch and my mother Lynette Erasmus.
Thank you for being my pillars of strength,
for always believing that I could be anything and do anything
I put my mind to.

Thank you for being there throughout this life journey,
never giving up on me and for the unconditional love and support.
I am eternally grateful.

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ABSTRACT

Background

Low back pain (LBP) is one of the most common causes of occupational disability in healthcare professionals, including radiographers. Radiographers experience several difficulties at work, which include continuous radiation exposure, long working hours; shift work; high physical work load; inadequate staffing; heavy weight of the mobile x-ray machine; wearing a lead apron; bending and lifting patients. There is a paucity in the literature on the epidemiology of LBP in radiographers working in the public and private sectors of South Africa. To date no study has been performed which determines the risk factors for developing LBP in diagnostic radiographers within the eThekwini Municipality.

Aim

The aim of the study was to determine the epidemiology of LBP in diagnostic radiographers working in the public and private sectors of the eThekwini Municipality, and to identify the risk factors for LBP to which diagnostic radiographers are exposed.

Research methodology

The research conducted was a quantitative study with a descriptive design which targeted diagnostic radiographers working in both the public and private sectors of the eThekwini Municipality. The research tool was an online survey administered through 'SurveyMonkey' which included questions and statements relating to the epidemiology of LBP in order to meet the study objectives.

Results and discussion

One hundred and thirty-one radiographers (55,0%) participated in this study, of which 43 had to be excluded as per the exclusion criteria. The

final response rate was 37,0% (n=88), with 43,2% of the respondents from the public sector and 56,8% from the private sector. The point prevalence of LBP was found to be 42,1% and 36,0% in the private sector. The period prevalence rates of LBP in the public sector were i) 0-3 months 10,5%; ii) 3-6 months 2,6%; iii) 4-9 months 15,8%; and iv) 9-12 months 23,7%. The private sector LBP period prevalence rates were i) 0-3 months 6,0%; ii) 3-6 months 0%; iii) 4-9 months 4,0%; and iv) 9-12 months 34,0%. The cumulative annual LBP prevalence rate was 52,6% in the public sector and 44,0% in the private sector. Lifetime prevalence for LBP in the public sector and private sector radiographers was 89,5% and 90,0% respectively. The participants were characterised with bilateral, intermittent LBP that was moderate in nature, described as stiffness, a dull ache or sharp/shooting pain that was worse at work, reduced on days off work and affecting their daily and leisure activities.

Work-related LBP activities reported by radiographers included sitting for long periods; lifting heavy objects and patients; twisting; working at a computer; bending; continuous pulling; and working with forward positioned arms. Other activities included wearing a lead apron; transferring patients to a bed/chair; positioning of the overhead x-ray tube; sitting and standing for >3 hours; pushing hospital bed patients; carrying imaging cassettes; and working fast due to radiation exposure. Radiographers involved in these activities had an 80,0-100,0% risk of experiencing LBP. The were 45% of the participants who reported previously injuring their lower back at work. Female radiographers were more prone to LBP compared with male radiographers. High stress levels and smoking were associated with an increased incidence of LBP, and exercise was found to reduce the incidence of LBP.

Conclusion and recommendations

A clear association was found between the daily work activities of radiographers and LBP. Factors found to be causative to LBP in this

population included high physical demands, staff shortages and old equipment. As radiographers are often exposed to radiation, the focus of occupational health in radiographers has always been on reducing radiation exposure, to the neglect of occupational LBP risk factors. More emphasis should therefore be placed on LBP prevention in radiographers. This study can be repeated on a national scale to include all the radiographers currently practicing in South Africa. Education should be provided to radiographers regarding LBP prevention, as well as the occupational risk factors to which they are exposed. Ergonomic and chiropractic treatment intervention studies would be beneficial for the study population.

Keywords

Radiographers, occupational low back pain, epidemiology, chiropractic.

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SYMBOLS AND ABBREVIATIONS

%	**:** Percentage
<	**:** Refers to a value less than the value shown
=	**:** Sign implies equals to
>	**:** Refers to a value greater than the value shown
BMI	: Body mass index
CT	: Computed Tomography
DoH	: Department of Health
DUT	: Durban University of Technology
HPCSA	: Health Professions Council of South Africa
IREC	: Institutional Research and Ethics Committee
IVD	**:** Intervertebral disc
kg	: Kilogram
kg/m^2	: Kilogram divided by meter squared
km	: Kilometer
KZN	: KwaZulu-Natal
LBP	**:** Low back pain
MRI	: Magnetic Resonance Imaging
m	: Meter
n	**:** Population size
NM	: Nuclear Medicine
p	**:** Indicates the statistical significance of the data.
SA	: South Africa
Sig	**:** Significance
UK	: United Kingdom
USA	: United States of America
viz	: Adverb meaning namely
WRLBP	**:** Work-related low back pain

GLOSSARY OF TERMS

Body mass index (BMI):

Body mass index is a useful tool in measuring the weight category of individuals; it is calculated by the weight of a person in kilograms divided by their height in meters squared. The BMI of a normal individual occurs between 18,5- 24,9 kg/m^2, an underweight individual is classified as <18,5 kg/m^2 , an overweight individual as 25-29,9 kg/m^2 and an obese individual as above 30 kg/m^2 (Shiri *et al*. 2013).

Computed Tomography

A radiographic imaging modality that is involved in the production of sectional anatomical images of the human body in order to diagnose a clinical condition, using intricate computer and mechanical equipment (Bontrager and Lampignano 2005).

Cross-sectional design:

A research design where all data is collected at a single point in time (Bless Higson-Simth and Sithole 2004).

Diagnostic Radiography:

Stedman's (2012) defines the diagnostic radiography profession as the handling of x-ray equipment, the positioning of patients, the production of diagnostic radiographs and assisting the radiologist during special radiological procedures.

Epidemiology:

The World Health Organisation (2017) defines epidemiology as "the study of the distribution and determinants of health-related states or events and the application of this study in order to control disease and health problems".

Incidence:

A measurement of the amount of new cases of a condition or disease present within a given population over a particular period of time (Gerstman 2003).

Life-time Prevalence

The likelihood that an individual of a certain population has for experiencing a certain condition or disease in their lifespan, measured as a percentage (Gerstman 2003).

Low back (Lumbar spine):

The lumbar spine is made up of five lumbar vertebrae with their intervertebral discs, bordered by the thoracic spine superiorly and by the sacrum inferiorly (Standring 2008).

Low back pain:

Low back pain (LBP) is defined as pain, muscle tension, or stiffness located between the posterior costal margin and the inferior gluteal folds (Chou 2011).

Magnetic Resonance Imaging

A radiographic imaging modality that uses magnetic fields and radio waves to produce images of the anatomical structures of the human body in order to diagnose clinical conditions (Bontrager and Lampignano 2005).

Nuclear Medicine

A category of Radiography where small amounts of radioactive substances are administered intravenously in order to produce images of the various physiological processes present in the human body in order to diagnose clinical conditions (Bontrager and Lampignano 2005; Cain 2013).

Period prevalence:

The percentage of people with a particular condition over a specific period of time, eg. three months, six months or twelve months (Gerstman 2003).

Pilot study:

A small study conducted preceding a larger research study to establish whether the methodology, sampling, instruments and analysis are satisfactory and appropriate (Bless, Higson-Smith and Sithole 2004).

Point prevalence:

The proportion of a population with a particular disease or illness, at a specified point in time (Gerstman 2003).

Prevalence:

Defined as the proportion of people in a particular population who have a symptom or disease at a certain time (National Institute of Mental Health 2017)

Radiographer

Allied health professional who is responsible for medical imaging of patients, which involves the taking of radiographs/medical images of the human body by using x-rays produced by specialised equipment in order to diagnose clinical conditions (Radiological Society of South Africa 2016).

Radiotherapy

A Radiography modality that makes use of radiation to treat various types of cancers (Bontrager and Lampignano 2005).

Risk factors:

The World Health Organisation (2017) defines risk factors as any attribute, characteristic or exposure that leads to an increased likelihood of an individual to develop a disease or injury.

Stress:

Stress can be defined as home- or work-related factors that can have a negative effect on an individual in that environment, consequently resulting in physical and emotional overstrain (Stander 2014).

Ultrasound

A Radiography modality that makes use of high frequency sound waves to produce images of anatomical structures within the human body in order to diagnose clinical conditions (Bontrager and Lampignano 2005).

Validity:

The degree to which a study truly measures what it intends to measure (Bless, Higson-Smith and Sithole 2004).

Work related low back pain:

Work-related low back pain can be defined as low back pain that results from a work-related event (Sayyed *et al*. 2013).

CHAPTER 1
INTRODUCTION

1.1 Introduction

The background, rationale for the research study, assumptions and delimitations as well as the researcher's interest in the research study will be discussed in this chapter. The research aim and the objectives will also be stated, together with a summary of the chapters that constitute this research study.

1.2 Background

Low back pain (LBP) is defined as pain, muscle tension or stiffness located between the posterior costal margin and the inferior gluteal folds (Chou 2011). According to Casser, Seddigh and Rauschmann (2016), when the duration of LBP is less than six weeks it is referred to as acute LBP; when lasting more than six weeks but less than twelve weeks then it is referred to as sub-acute LBP. Low back pain lasting more than twelve weeks is referred to as chronic LBP (Chou 2011).

Harvin 2014 and Sayyed *et al*. 2013 explicated that work-related low back pain (WRLBP) risk factors include physical risk factors and personal risk factors. Physical risk factors include repetitive tasks, awkward joint positions, direct pressure and prolonged postures. Personal risk factors include age, gender, physical fitness, motor control and strength.

It has been found that occupations which require prolonged periods of sitting, lifting, stooping, twisting and standing result in an increased likelihood of WRLBP occurring (Alghadir, Zafar and Iqbal 2015). Work-related low back pain can also occur due to psychosocial causes such as depression, fatigue, anxiety and mental stress at work (Maher, Underwood and Buchbinder 2017).

Epidemiology is a branch of medicine that deals with the incidence, prevalence, distribution, and control of diseases (Britannia Academic 2017).

Radiographers experience a number of difficulties at work, including continuous radiation exposure. This compels them to work faster; long hours at work; shift work; a high physical work load; inadequate staffing; heavy weight of the mobile x-ray machine; and bending and lifting of heavy patients (Rajan 2014). The Australian study by Hoy *et al.* (2010) indicated that WRLBP may also result in activity limitation, thereby leading to a decrease in work responsibilities and an increase in work absenteeism.

A study done in Turkey by Karahan *et al*. (2009) on 1600 healthcare professionals with a LBP history included medical doctors, nursing staff, physiotherapists and technicians. The study found the twelve-month prevalence of LBP at the time of the survey to be 61,3%, with the nursing staff having the highest prevalence of LBP (77,1% over a twelve-month period). The work of Karahan *et al.* (2009) highlighted that a large percentage of healthcare professionals (78,3 %) indicated that their LBP started after they commenced working within the hospital environment. In Saudi Arabia, Alghadir, Zafar and Iqbal (2014) noted that the most common risk factor responsible for developing WRLBP is the high physical demand in the daily work routine of health care professionals.

Despite the vast growth in LBP research and numerous studies done on the epidemiology of LBP in health care workers, LBP remains the most prevalent musculoskeletal condition experienced by radiographers (Ledoux, Dubois and Descarreaux 2012; Lurusso, Bruno and L'Abbate 2007). The work of Lurusso, Bruno and L'Abbate (ibid) on musculoskeletal pain amongst Italian radiographers reported WRLBP as the most commonly reported musculoskeletal symptom. This study also suggested that high prevalence rates of musculoskeletal complaints may exist among radiographers.

A study conducted on health care professionals (including radiographers) in Malaysia by Ibrahim and Mohanadas (2012) revealed a LBP prevalence of 88,2% over a twelve-month period. This suggests that the prevalence of LBP in radiographers is very high when compared with the general population. A Bergeron, Wright and Killion (2006) study on radiographers working in the United States of America (USA), found that all participants who experienced chronic LBP chose chiropractic care or surgery as their primary treatment choice. Moore *et al*. (1992) outlined that WRLBP in radiologists may result from wearing lead aprons at work. Bergeron, Wright and Killion (2006) submitted that although most of the workforce in the USA experienced acute or chronic LBP, there seemed to be a significant increase in prevalence for WRLBP in allied health professionals such as radiographers. The study by Bergeron, Wright and Killion (2006) affirmed that 36,0% of all LBP symptoms experienced by radiographers occurred during patient handling, and that the radiographers who participated in the direct transfer of patients experienced LBP 37 times more frequently than those radiographers who did not. Furthermore, a Nigerian study found that a large number of practicing radiographers were suffering from LBP (Ugwu 2014). Acute LBP experienced by the radiographer can develop into chronic LBP if left untreated, which could lead to permanent disability (Bergeron, Wright and Killion, 2006).

The high prevalence of LBP in radiographers has resulted in a substantial economic burden in this economically productive work-group, and may lead to an increase in medical expenses, work absenteeism and disability (Ghilan *et al*. 2013). Low back pain affects a large proportion of the population and has a negative impact on work ability and on the general health of an individual (Manchikanti *et al*. 2014).

Kumalo (2014) stated that musculoskeletal pain in health care workers in the eThekwini municipality leads to work absenteeism, work restriction, a loss of income and also disability. As further asserted by Kumalo (ibid), the impact of WRLBP on absenteeism and health care cost needs investigation on a South

African platform. Ibrahim and Mohanadas (2012) reported that few epidemiological studies exist that have investigated occupation specific risk factors among radiographers. Interestingly, Mehrdad *et al.* (2016) evaluated 641 articles on LBP in numerous different professions and found LBP prevalence to be the highest amongst health care workers. The authors recommended that future research should be focused on the prevalence and risk factors of LBP specifically in different health care workers. The goal of this study therefore will be to establish the risk factors that radiographers working in the eThekwini municipality are exposed to, which may lead to the development of low back pain.

1.3 Aim and objectives of the study

The aim of this study was to determine the epidemiology of LBP in diagnostic radiographers working in the public and private sector of the eThekwini Municipality, and to identify risk factors for LBP to which diagnostic radiographers are exposed.

The following objectives were selected for the study:

Objective 1

To establish the point, period and lifetime prevalence of LBP amongst diagnostic radiographers employed in eThekwini Municipality.

Objective 2

To determine the nature, severity and clinical presentation of LBP in diagnostic radiographers in the eThekwini Municipality.

Objective 3

To identify possible socio-demographic, environmental, occupational and psychosocial risk factors that may contribute to LBP in diagnostic radiographers in the eThekwini Municipality.

Objective 4

To establish the association, if any, between work history and risk factors for LBP in diagnostic radiographers in the eThekwini Municipality.

1.4 Rationale for the study

There is a limited amount of research available indicating the epidemiology of LBP in diagnostic radiographers. To date, no study has been conducted to determine the risk factors for developing LBP in diagnostic radiographers within the eThekwini Municipality. There is a paucity in the literature regarding occupational demographics, risk factors, work history (Louw, Morris and Grimmer-Somers 2007) and the incidence and prevalence of LBP in diagnostic radiographers working in the public and private sectors of South Africa.

While numerous studies have been performed on LBP in other health care professionals abroad, the lack of South African demographics and the uniqueness of the scope of practice of the diagnostic radiographer warrants investigation on a South African population where the work environment is unique (Kumalo 2014; Louw, Morris and Grimmer-Somers 2007). This uniqueness includes long working hours; staff shortages; older equipment that requires more physical input; and different patient profiles that can lead to a significant increase in LBP, injury, work absenteeism and medical expenses.

The eThekwini Municipality was selected for its abundance of 273 diagnostic radiographers, which includes a varied distribution of the different modalities such as theatre radiography, computed tomography, mammography, magnetic resonance imaging as well as general diagnostic radiography. The different modalities have different risk factors for developing WRLBP, which may or may not have an effect on the incidence of WRLBP in diagnostic radiographers.

A questionnaire was used to gather data for this study. The questionnaire was constructed and adapted from the Dutch Musculoskeletal Questionnaire (Hildebrandt *et al*. 2001). The questionnaire was divided into four sections in order to obtain the desired data for this study. The sections included demographics (biographical information); social history; occupation (work environment, work experience, work history); and characteristics of pain. In addition, the questionnaire aimed to determine the risk factors for developing LBP found within radiographers in South Africa (SA), as there may be similarities to previous research, but also differences in the South African context.

1.5 Assumptions and delimitations

It has been assumed that all information generated from the study participants is of an honest nature and based upon their personal experience within the field of Radiography. The focus of the study included obtaining information from qualified diagnostic radiographers based amongst various radiographic modalities found within the public and private sectors in the eThekwini municipality.

1.6 Researcher's interest in the research study

The researcher has been employed in both the private and public sectors as a radiographer within South Africa, where he has personally witnessed radiographers experiencing LBP. In order to aid in the prevention of developing WRLBP, the need to identify occupation-specific risk factors exists within this population. As a chiropractic student, the researcher hopes to identify these occupation-specific risk factors within this study, in order to help decrease the incidence of LBP in radiographers. This would benefit the public and private health care sectors as well as the radiographers themselves.

1.7 Summary of the chapters

Chapter One explains the motivation and importance of the research study and how it relates to the research aim and objectives. Chapter Two discusses the relevant literature applicable to this study, followed by Chapter Three which illustrates the methodology used during this study. Chapter Four presents the study results obtained regarding LBP within the Diagnostic Radiography profession, while Chapter Five discusses the results and their context when comparing and contrasting them with the available literature. Chapter Six is the concluding chapter which highlights the pertinent findings of this research study and provides suggestions for future research within the field.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Chapter Two presents the current literature with regard to LBP, which includes the incidence, prevalence and risk factors in the development of LBP, particularly those pertinent to diagnostic radiographers. The anatomy and biomechanics of the lumbar spine will also be discussed within this chapter, and will include the bony anatomy, muscles, ligaments and innervation of the lumbar spine.

2.2. Anatomy of the low back

Anatomically, LBP is defined as pain, muscle tension, or stiffness located between the posterior costal margin and the inferior gluteal folds (Chou 2011).

2.2.1 Osseous structures of the low back

Figure 2.1 below illustrates the posterior view of the lumbar region, which is made up of five lumbar vertebrae with their intervertebral discs bordered by the thoracic spine superiorly and by the sacrum inferiorly (Standring 2008). There are nine vertebrae inferior to the lumbar region, which include five sacral vertebrae and four coccygeal vertebrae; together these form the sacrum and coccyx (Moore *et al*. 2010). Lastly, the ilium, ischium and pubic bones form the two os coxae bilaterally (Lewis *et al*. 2017; Moore *et al*. 2010).

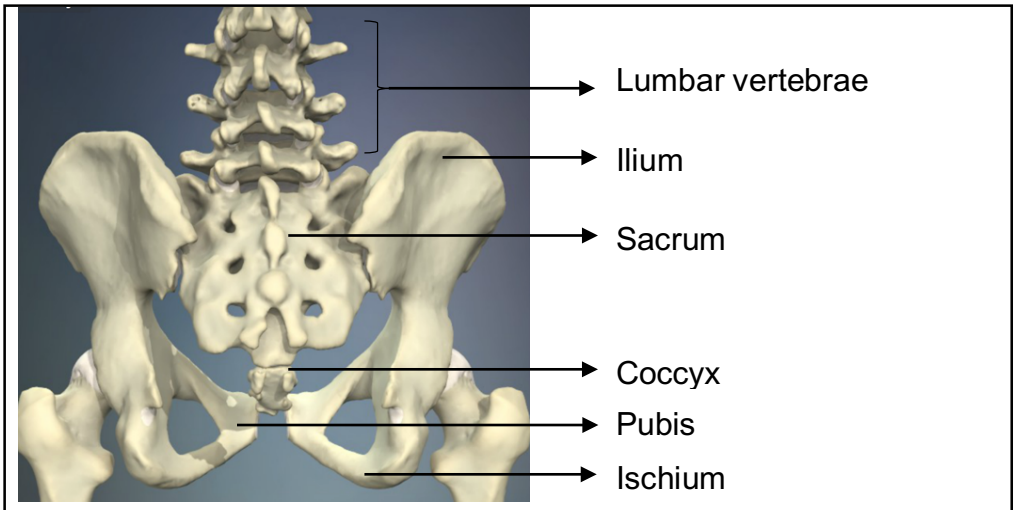

Figure 2.1: The osseus structures of the lumbo-pelvic region

2.2.1.1 Lumbar vertebrae

Figures 2.2 and **2.3** illustrate that each lumbar vertebrae comprises of a vertebral body, two pedicles, two laminae, one spinous process, two transverse processes and four articulating processes (Lewis *et al*. 2017; Moore *et al*. 2010; Standring 2008). According to Lewis *et al*. (2017) and Moore *et al*. (2010), the size of the vertebral bodies increases from L1 to L5, with L5 being the largest of the five lumbar vertebrae. This is necessary for the increase in weight-bearing that L5 undergoes by comparison with L1. The four articular processes (two superior and two inferior facets) form the superior and inferior zygopophyseal joints respectively (Moore *et al*. 2010). These form two joints between every two adjacent vertebrae, called zygopophyseal joints, which act along with the two transverse processes to allow certain movements between adjoining vertebrae (Lewis *et al*. 2017; Moore *et al*. 2010). The structures are illustrated in **Figure 2.2.**

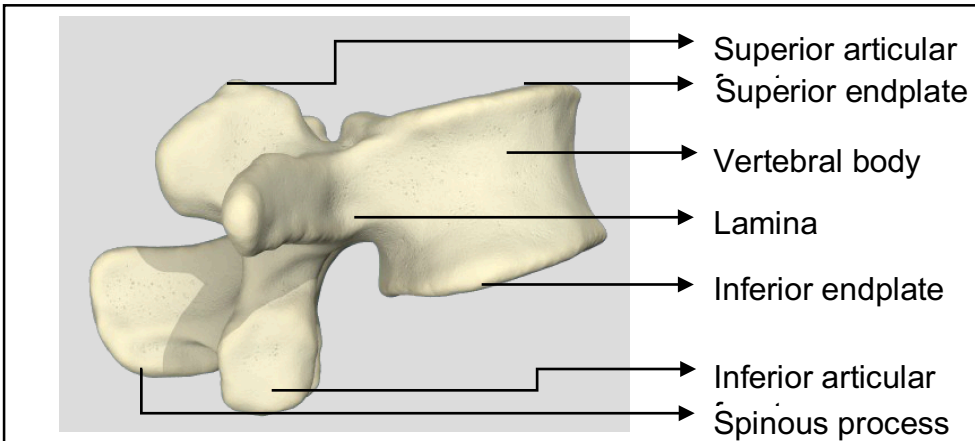

Figure 2.2: Lateral view of the lumbar vertebra

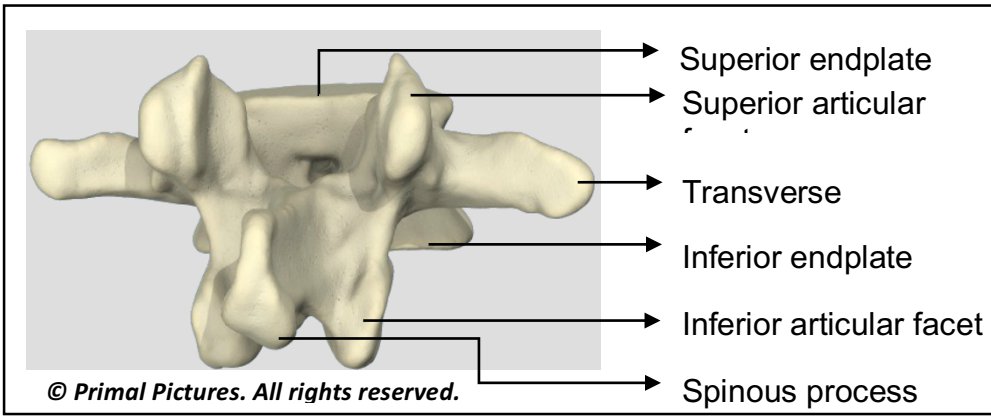

Figure 2.3: Posterior view of the lumbar vertebra

Movements of the lumbar spine include flexion and extension and to a lesser degree, lateral flexion (Moore *et al*. 2010). Limited rotation is possible due to the orientation of the facet joints, which are more laterally located at the lower lumbar spine as opposed to the upper lumbar levels (Moore *et al*. 2010; Standring 2008).

2.2.1.2 The Sacrum and Coccyx

Figure 2.4 below illustrates the sacrum, which consists of five sacral vertebrae fused together with no intervertebral discs between adjacent levels (Lewis *et al*. 2017; Moore *et al*. 2010) and the coccyx, which consists of four small fused coccygeal bones (Lewis *et al*. 2017; Moore *et al*. 2010). The sacrum is a large

triangular shaped bone situated inferior to the lumbar spine and between the two os coxae (Moore *et al*. 2010; Lee 2011), while the coccyx occurs inferior to the fifth sacral vertebrae.

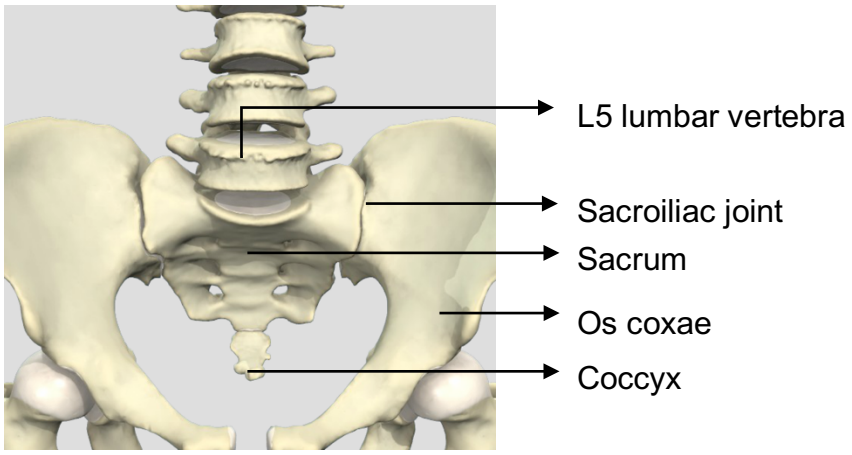

Figure 2.4: Anterior view of the sacrum

2.2.1.3 Os Coxae

Each os coxa (also known as the innominate bone) is formed by the fusion of three bones, viz. the ilium, ischium and pubis (Lewis *et al*. 2017; Moore *et al*. 2010; Standring 2008). The ilium, the largest and most superior part of the innominate bone, functions as a point for muscle attachment and is involved in the transfer of weight from the spine to the pelvis (Moore *et al*. 2010). The ischium lies inferior to the ilium and contains the acetabulum on its lateral aspect, which forms part of the hip joint (Lewis *et al*. 2017; Moore *et al*. 2010).

Bilaterally, at the inferior aspect of the ischial bones is a bony projection involved in weight-bearing while in the seated position, known as the ischial tuberosity (Moore *et al*. 2010). The ischial tuberosity is also a site for muscle attachment of the lower limb (Lewis *et al*. 2017; Moore *et al*. 2010; Lee 2011). As explained by Moore *et al*. (2010), the two pubic bones are found at the anterior and inferomedial aspect of the os coxae and are also responsible in forming part of the acetabular cavity. A secondary cartilaginous joint, viz. the pubic symphysis, unites the two pubic bones anteriorly (Standring 2008). A

number of abdominal muscles attach to the tubercles of the pubic bone (Standring 2008). These tubercles are relatively small bony projections, however they provide a strong site for muscle attachment (Lewis *et al*. 2017; Moore *et al*. 2010).

2.2.2 Articulations and Ligaments of the lumbar spine

2.2.2.1 The functional spinal unit

Figure 2.5 below illustrates the functional spinal unit, which consists of two successive vertebrae, the intervertebral disc (IVD) between them, and the associated muscular and ligamentous structures. The three-joint complex/motion segment consists of two facet joints (also known as zygopophyseal joints) and the IVD (Lewis *et al*. 2017; Moore *et al*. 2010).

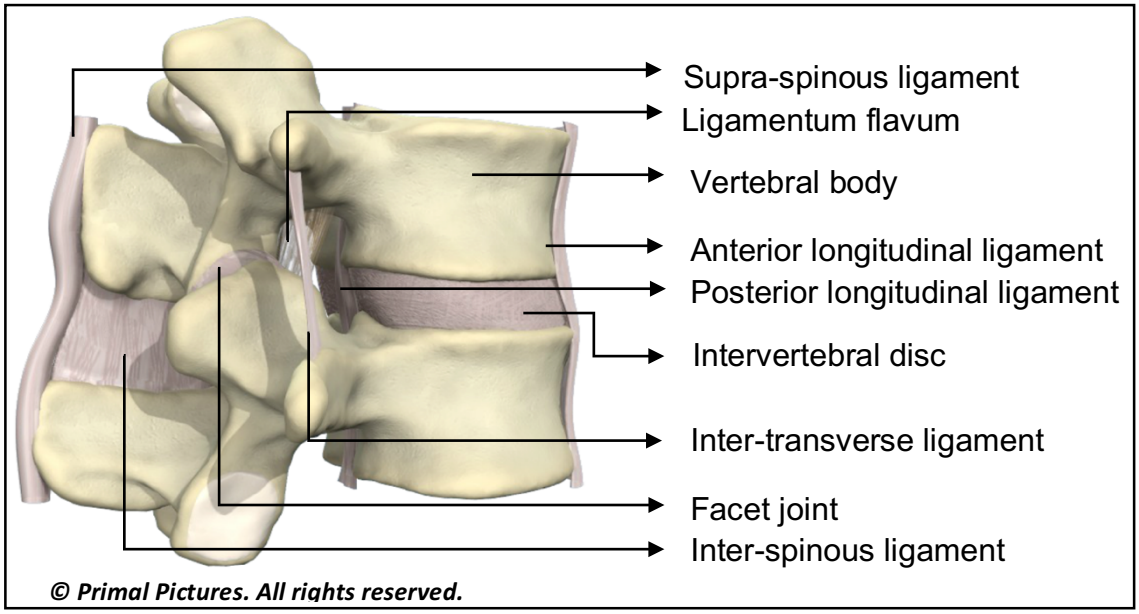

Figure 2.5: The functional spinal unit and ligaments

Various authors (Lewis *et al*. 2017; Moore *et al*. 2010; Standring 2008) purported that the spinal column is reinforced by the strength that the functional spinal unit provides by means of the IVD, and its attachment to the vertebral bodies it lies between. The continuous arrangement of the functional spinal units leads to a semi-rigid spinal column, which is ideal for strength and weight-bearing (Lewis *et al*. 2017; Moore *et al*. 2010).

The IVD is not the same thickness at each vertebral level (Moore *et al*. 2010), but rather increases in thickness from the first to the fifth lumbar vertebra in conjunction with its increasing weight-bearing responsibilities (Standring 2008). The IVD between L5 and the sacrum is therefore the thickest in height, whereas the IVD between L1 and L2 is the narrowest in height (Moore *et al*. 2010). The IVD is also thickest at the anterior aspect, which contributes to the lumbar lordosis (Standring 2008). Moore *et al*. (2010) clarified that the IVDs are said to contribute 25% of the entire height of the spinal column. The IVD is made up of two components: the inner nucleus pulposis and the outer annulus fibrosis (Standring 2008). The gelatinous nucleus pulposis provides a shock absorbing function to the IVD (Moore *et al*. 2010), whereas the cartilaginous annulus fibrosis provides strength and support to the IVD (Standring 2008).

The facet joints, which form part of the three joint complex along with the IVD, are synovial joints found on each side of consecutive vertebrae (Standring 2008). Moore *et al*. (2010) explained that the articulation that is formed within the facet joints is due to the interlocking mechanism of the opposing articular processes. The one process is curved and the opposing process is round, which affords a limited range of motion of the joint except for flexion and extension, which are not limited by the orientation of the articular processes (Moore *et al*. 2010).

Moore *et al*. (2010) and Standring (2008) further expressed that the articular processes are supported by ligaments passing between the vertebral bodies and neural arches. The most prominent ligament is ligamentum flavum, which is a thin ligament between adjacent vertebrae, passing from the anterior surface of the lamina above to the posterior surface of the lamina below (Standring 2008). The ligamentum flavum is responsible for limiting flexion and aiding in extension of the functional spinal unit (Moore *et al*. 2010).

Other ligaments that relate to the posterior neural arch include the supraspinous ligament; the interspinous ligament; intertransverse ligament; as

well as the mamillo-accessory ligament, which is classified as a false ligament (Standring 2008; Moore *et al*. 2010). Lastly, ligaments that relate to the anterior vertebral structures include the anterior longitudinal ligament (ALL), the posterior longitudinal ligament (PLL), and the true and false transforaminal ligaments (Moore *et al*. 2010).

2.2.2.2 Sacroiliac joint

Standring (2008) explained that the articulation between the iliac bone and the sacrum forms the sacroiliac joint. The function of the sacroiliac joint is to provide stability, although some degree of mobility is possible (Moore *et al*. 2010). The anterior sacroiliac, posterior sacroiliac, interosseous and iliolumbar ligaments are ligamentous attachments that reinforce the sacroiliac joint in terms of stability (Lewis *et al*. 2017; Moore *et al*. 2010).

The iliolumbar ligament connects the ilium to the fifth lumbar vertebra (Moore *et al*. 2010). Standring (2008) reported that the interosseous ligament is the largest and strongest of the supporting ligaments and is responsible for the transfer of weight from the upper body to the pelvis. Other ligaments that attach to the pelvis include the sacrotuberous and sacrospinous ligaments, which also aid in stabilisation (Lewis *et al*. 2017; Moore *et al*. 2010).

2.2.2.3 Pubic symphysis

The pelvic ring is enclosed anteriorly by the pubic symphysis (Standring 2008), a cartilaginous joint which unites the pubic bones anteriorly (Lewis *et al*. 2017; Lee 2011). The pubic symphysis also functions as a site for attachment of ligaments (Lee 2011) and as a shock absorber during walking (Moore *et al*. 2010).

2.2.3 Muscles commonly involved in low back pain

The various muscles involved in movement of the lumbar spine are described according to origin, insertion, innervation and action in **Table 2.1** below. The innervation of these muscles is a common cause of low back pain. The location of the various muscles can be seen in **Figures 2.6** and **2.7.**

Table 2.1: The muscles involved in movement of the lumbar spine

Muscle	Origin	Insertion	Innervation	Action
External oblique	Ext. surface & inferior borders of the inf. 8 ribs	Attaches to the ant. half of the iliac crest, linea alba & pubic tubercle	Thoraco-abdominal nerves T7-T11 & subcostal nerve	Bilaterally: Compresses the abdomen & flexion of the lumbar spine
Internal oblique	Thoracolumbar fascia, ant. two-thirds of iliac crest & inguinal ligament	Cartilage of the inf. 3-4 ribs & linea alba.	Thoraco-abdominal nerves T8-T12, iliohypogastric & ilioinguinal nerves	Bilaterally: Compresses the abdomen & flexion of vertebral column Unilaterally: Lat. flexion & rotation
Rectus abdominus	Pubic crest & pubic symphysis	5^{th}-7^{th} costal cartilages & xiphoid process	Thoraco-abdominal nerves	Flexion of the trunk, compression of abdominal viscera & controls pelvic tilt
Quadratus lumborum	Iliac crest & iliolumbar ligament	Inf. Border of the 12^{th} rib & L1-L4 vertebrae	Thoracic spinal nerve T12 & lumbar spinal nerves L1-L4	Bilaterally: Lumbar extension & inf. pull of 12^{th} rib during exhalation Unilaterally: Lat. flexion of vertebral column
Transversus abdominus	Int. surface of 7^{th}-12^{th} costal cartilages, iliac crest, lumbar fascia & lat. 3^{rd} of inguinal ligament	Linea alba with aponeurosis of int. oblique muscle, pubic crest & pubis	Thoraco-abdominal nerves & 1^{st} lumbar nerve	Compresses & supports abdominal viscera
Multifidus	Inf. tip of spinous process	Travels 2-4 vertebral levels to attach to transverse process	Post. rami of spinal nerves	Stabilizes vertebrae during local movements

Key: Ext = external Int = internal Sup = superior Inf = inferior
Ant = anterior Post = posterior Lat = lateral

Table compiled from Lewis *et al.*, 2017; Moore *et al.*, 2010; Standring, 2008.

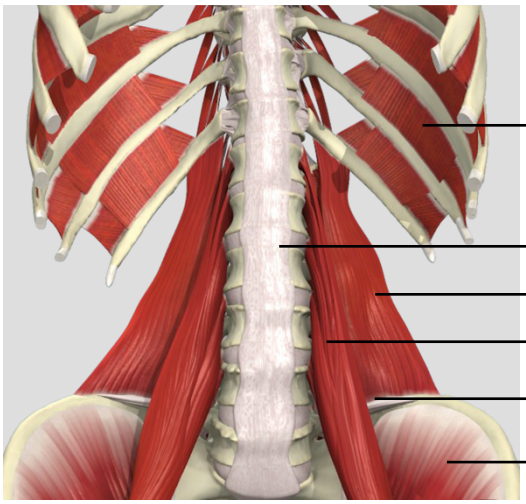

Figure 2.6: The musculature involved in lumbar spine

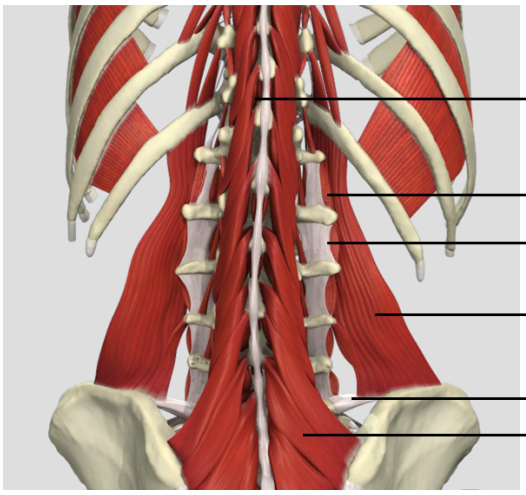

Figure 2.7: The musculature involved in lumbar spine

2.2.4 Innervations of the lumbar spine structures

The lumbosacral plexus originates from the lumbar enlargement of the spinal cord and extends from the level of T11 to S1 (Moore *et al*. 2010). This plexus gives rise to the various nerves responsible for the innervation of the lower limbs (Standring 2008). Moore *et al*. (2010) found that the lumbosacral plexus sends important information to the brain regarding proprioception and

movement of the lumbar spine joints, and detailed nociceptive information. Wyke receptors found in the lumbar region are responsible for monitoring and reporting information to the brain to enable the appropriate functioning of the lumbar spine (Lewis *et al*. 2017; Spandring 2008; Moore *et al*. 2010). Moore *et al*. (2010) also stated that the dorsal rami of spinal nerves are responsible for the innervation of posterior structures found in the lumbar and sacral region. The dorsal rami are divided into medial, median and lateral divisions (Spandring 2008). The sinuvertebral nerve originates from the spinal nerve root upon exiting the intervertebral foramina and innervates the internal vertebral canal structures (Moore *et al*. 2010).

2.2.4.1. Four types of intra-articular receptors

a. Type 1 receptors/ Ruffini bodies

These are free nerve endings, which react to small changes in ligament tension and capsule pressure (Musculino 2011; Lee 2011). They are the second most common receptor type and are usually found in small clusters within and around the joint capsules. The fibres are slow to adapt and therefore result in extended periods of joint effect changes (Lee 2011).

b. Type 2 receptors/ Paccini bodies

According to Lee (2011) these mechanoreceptors are commonly located within the deeper layers of the joint capsule, and are stimulated by small changes within the joint. They are sensitive to tension and rapid pressure changes. They also become active with acceleration and deceleration of the joint but are quick to adapt once stimulation due to joint movement ceases (Musculino 2011; Lee 2011).

c. Type 3 receptors/ Golgi tendon organs

These receptors are located at the musculotendinous junction and are responsible for providing information regarding joint position (Musculino 2011). They are stimulated by slow deep stretch close to muscle attachments (Lee 2011).

d. Type 4 receptors – (Free nerve endings)

These abundant, non-specialised and normally unmyelinated receptors, are involved in pain perception and information regarding initial joint movement (Musculino 2011). They are stimulated due to nociceptive changes such as fractures, chemical irritation or dislocations, and have a high threshold (Lee 2011).

2.2.4.2 Extra-articular receptors

The most common type of extra-articular receptor is the muscle spindle; this is found within skeletal muscle and consists of interfusal fibres in the centre and extrafusal fibers on the outside of the muscle spindle (Lee 2011). The intrafusal fibers stimulate motor neurons (Lee 2011) and promote agonist muscle contraction whilst inhibiting antagonist muscle contraction. As articulated by Musculino (2011) the muscle spindle is directly stimulated when the muscle is being stretched, resulting in a reflex contraction which in turn leads to the muscle tension returning to normal. The muscle spindle may be indirectly stimulated by the central nervous system or mechanoreceptors (Lee 2011). Normal functioning of the mechanoreceptors results in the nociceptors being overridden, although immobility or lack of mechanoreceptor activity and muscle inhibition can result in hyper-stimulated nociceptors which results in the experience of pain (Musculino 2011).

As a chiropractor, it is therefore important to understand the structure, function and innervation of the lumbar spine and sacroiliac joints, as LBP can be due to isolated or multiple changes within the confines of these low back structures. Low back pain due to injury, changes or damage within these structures have many etiologies. The epidemiology of low back pain will therefore be discussed in the following section.

2.3 Introduction to the epidemiology of low back pain

Low back pain is defined as pain, muscle tension, or stiffness located between the posterior costal margin and the inferior gluteal folds (Chou 2011). Low back pain can be categorised according to the duration it is experienced, i.e. i) LBP with a duration of less than six weeks is referred to as acute LBP; ii) LBP with a duration of six to twelve weeks is referred to as sub-acute LBP; and iii) LBP lasting more than twelve weeks is referred to as chronic LBP (Casser, Seddigh and Rauschmann 2016; Chou 2011).

The World Health Organisation (2017) defined epidemiology as "the study of the distribution and determinants of health-related states or events and the application of this study in order to control disease and health problems". The epidemiology of LBP will be discussed below as per the current literature.

2.3.1 Incidence, point and period prevalence of low back pain

Manchikanti (2000) reported that numerous studies have found the incidence of chronic LBP at three, six and twelve months ranges between 35,0% and 79,0%. A global review on the prevalence of LBP in the general adult population indicated a point prevalence of 12,0%, a one-month prevalence of 23,0% and a one-year prevalence of 38,0% (Manchikanti *et al*. 2014). Jin, Sorock and Courtenay (2004) claimed the annual prevalence of LBP to be 18,0% and further identified a lack of available literature on the extent and effect of LBP in developing countries.

The study by Manchikanti *et al.* (2014) also purported that the overall annual prevalence of chronic LBP was in the 15,0% to 40,0% range. The same study showed that the percentage of the work force affected with LBP ranged from 2,0% to 8,0%, with days absent from work per patient annually being nine days in the USA; ten days in Germany; 20 days in Canada and the UK; 25 days in the Netherlands; and 40 days in Sweden. A study conducted on occupational LBP in China reported the lifetime prevalence of LBP to be 50,0% (Jin, Sorock and Courtney 2004), while Manek and MacGregor (2005) noted that the

annual prevalence of LBP in the USA is 17,8%. A German population study by Schmidt *et al*. (2007) attested to a point-prevalence of 37,1%, a one-year prevalence of 76,0%, and a lifetime prevalence of 85,5% respectively.

Dyer's (2012) study on the epidemiology of LBP in White individuals in the eThekwini Metropolitan area found a period prevalence for: i) 0-3 months at 21,3%; ii) 6-12 months at 18,3%; and iii) longer than 12 months at 7,8%. A point prevalence of 34,0% was also expressed by Dyer (ibid). Docrat (1999) recorded the incidence and prevalence of LBP in the Coloured and Indian community in Greater KwaZulu-Natal to be at 76,6% and 78,2% respectively.

2.3.2 Lifetime prevalence of low back pain

Lower back pain is the most prevalent MSK condition and one of the most common causes of disability in developing countries (Louw, Morris and Grimmer-Somers 2007). Lower back pain is a massive public health problem with more than 80,0% of the worldwide population experiencing LBP at some stage during their lifetime. This high prevalence of LBP has resulted in a substantial economic burden, which leads to an increase in medical expenses, absenteeism and disability (Ghilan *et al*. 2013). Lifetime prevalence of LBP has been reported to range from 5,0% to 95,0% (Dagenais, Caro and Haldeman 2008; Bell and Burnett 2009). Jin, Sorock and Courtney (2004) affirmed a lifetime prevalence for LBP as 85,0% in the adult general population.

The Dyer (2012) study on the epidemiology of LBP in White individuals in the eThekwini Metropolitan area further reported a lifetime prevalence of 48,0%. Manchikanti *et al.* (2014) indicated that a global review of the lifetime prevalence of LBP was stated to be 40,0%, and that the highest lifetime prevalence for LBP was found among women within the age group of 40 to 80 years.

2.3.3 Radiographer-specific low back pain incidence and prevalence

A study conducted on health care professionals (including radiographers) in Malaysia by Ibrahim and Mohanadas (2012) revealed a LBP prevalence of 88,2% over a twelve-month period. This suggested that the prevalence of LBP in radiographers was very high compared with the general population. Bos *et al*. (2007) reported that the annual prevalence of LBP in radiographers in the Netherlands is 75,1%, of which 12,9% suffered from severe LBP. Kim and Roh (2014) also stated that there is an increase in prevalence for experiencing LBP among Korean radiographers. The Ghanian study on radiographers by Adesi, Kwadwo and Kab (2015) noted that 20,0% of the radiographers at the time were experiencing LBP.

2.4 Work-related low back pain

One of the most common causes of occupational disability in a variety of professions is MSK disorders (Alghadir, Zafar and Iqbal 2015). As posited by Roffey *et al*. (2010), LBP is a significant occupational health concern among working individuals. The authors further explained that harmful occupational activities include bending, standing, twisting, lifting, carrying and manual handling. Significantly, the most common risk factor responsible for developing low back pain (LBP) is the high physical aspect of these professions (Alghadir, Zafar and Iqbal 2015). Low back pain affects a large amount of the population and has a negative impact on work ability and on the general health of an individual (Manchikanti *et al*. 2014). Low back pain can also result in activity limitation, which can lead to a decrease in work responsibilities and an increase in absenteeism, as expressed by Hoy *et al*. (2010). Bergeron, Wright and Killion (2006) proffered that 40,0% of the current working population in the USA will experience LBP within any given year, and that an estimated 15,0% of these working professionals will experience chronic LBP for a period exceeding one year. Jin, Sorock and Courtney (2004) recorded a 74,0% annual prevalence for LBP in garment workers, while in a nationwide study on workers in Taiwan, Manek and MacGregor (2005) identified the annual prevalence to be 18,0% in male workers and 20,0% in female workers,

respectively. Manek and MacGregor (2005) further elaborated that workers in the 45-64 year age group had the highest prevalence of LBP.

2.4.1 Work-related low back pain in healthcare professionals

In reporting their study on 1600 healthcare professionals (including doctors, nursing staff, physiotherapists and technicians) with a history of LBP, Karahan *et al*. (2009) found the twelve-month prevalence of LBP at the time of the survey to be 61,3%. In that study, nurses recorded the highest prevalence of 77,1% over a twelve-month period. Karahan *et al*. (ibid) asserted that a large percentage of the healthcare professionals (78,3%) stated that their LBP started after they commenced working in a hospital.

A Taiwanese study on 3000 nurses found the lifetime prevalence of LBP to be 78,0% (Manchikanti 2000). A study by Bejia *et al*. (2005) reported the lifetime prevalence for experiencing LBP to be 57,7% in Tunisian healthcare professionals. The same study by Bejia *et al*. (2005) indicated the annual prevalence of LBP in healthcare professionals to be at 51,1%.

In a study conducted on 233 manual therapists (including physiotherapists, occupational therapists, biokineticists, chiropractors, reflexologists, aromatherapists and massage therapists) in South Africa, Pereira (2009) reported the point prevalence for LBP as 41,0%; one-year prevalence for LBP as 59,0%; and career prevalence for LBP as 79,0%. As expressed by Bergeron, Wright and Killion (2006), although most of the USA workforce experienced acute or chronic LBP there appeared to be a significant increase in the prevalence of LBP in allied health professionals. According to Kumalo (2014) MSK pain in health care workers leads to absenteeism, work restriction, loss of income and disability.

2.4.2 Work-related low back pain in radiographers

A study conducted by Bergeron, Wright and Killion (2006) on US radiographers found that all participants who experienced chronic LBP chose chiropractic

care or surgery as their primary treatment choice. Lurusso, Bruno and L'Abbate (2007) indicated that LBP was the most commonly reported MSK symptom in Italian radiographers, with 59,6% of the 203 radiographers indicating LBP as their most common MSK complaint. The study also suggested that high prevalence rates of MSK complaints may exist among radiographers.

Bos *et al*. (2007) and Bergeron, Wright and Killion (2006) found LBP to be a common complaint among radiographers and that the weight of a lead apron and the extensive time that it is worn on duty to be a radiography-specific risk factor for developing LBP. It was also reported by Bos *et al.* (2007) that LBP is a major concern among the radiography profession due to their exposure to LBP risk factors. When interviewed on the 03 September 2017 in the eThekwini Municipality, Mr Erhard Koch (diagnostic radiographer) stated that he has found the physical nature of a radiographer's job to be a possible causative factor for developing LBP. The duties of a radiographer include, but are not limited to, the lifting and manual positioning of heavy patients; pushing bed patients; pushing heavy equipment; carrying heavy items such as x-ray cassettes; wearing heavy lead aprons for prolonged hours; and standing for prolonged hours.

2.4.3 Work-related low back pain risk factors, injuries and their impact

Several authors have found that occupations which require prolonged periods of sitting, lifting, stooping, twisting or standing result in an increased likelihood of LBP (Bos *et al*. 2007; Alghadir, Zafar and Iqbal 2015; Adesi, Kwadwo and Kab 2015). As determined by Bergeron, Wright and Killion (2006), 36,0% of all LBP symptoms experienced by nurses occurred during patient handling. Furthermore, the professionals who participated in the direct transfer of patients experienced LBP 37 times more frequently than professionals whom had not. Bergeron, Wright and Killion (2006) declared that LBP is the most significant cause of chronic disability found in working professionals aged 45 years and younger in the USA, and that this resulted in more than 101.8 million

absenteeism days per year with an estimated 50 billion dollars spent on LBP treatment.

2.4.4 Radiographer-specific work-related low back pain risk factors and injuries

The work of South African diagnostic radiographers includes magnetic resonance imaging (MRI) and computerised tomography (CT) scans, in order to evaluate the anatomy and function within the body. In order to fulfil these responsibilities, radiographers are frequently required to participate in physical work which includes lifting immobile patients, pushing and pulling of heavy x-ray equipment and continuous computer work, in order to acquire and process images (Bos *et al*. 2005; Kim and Roh 2014; Alghadir, Zafar and Iqbal 2015). As expressed by Harvin (2014), some work-related causes of LBP include repetitive tasks, awkward joint positions, direct pressure and prolonged postures. Bos *et al*. (2007) further stated that radiographers are also required to perform tasks such as the repositioning of patients horizontally, as well as lifting patients from a wheelchair, which can cause increased compression loads in the lumbar and sacral region. While performing these tasks the radiographer is at risk for developing LBP as the actions of pushing, lifting and prolonged computer work have been well documented as risk factors for LBP (Lurusso, Bruno and L'Abbate 2007; Kim and Roh 2014; Alghadir, Zafar and Iqbal 2015).

It is to be noted that Kim and Roh (2014) emphasised that due to the increase of the imaging required concomitantly with the ever-growing patient population in today's society, the exposure to LBP risk factors in radiographers can be said to be increasing. As radiographers are often exposed to radiation, the focus of occupational health regarding radiographers has always been on reducing their radiation exposure to the neglect of their occupational LBP risk factors (Kim and Roh 2014). According to Adesi, Kwadwo and Kab (2015), radiographers experience several difficulties at work. These include continuous radiation exposure which requires working faster; long hours at

work; shift work; high physical work load; inadequate staffing; heavy weight of the mobile x-ray machine; and bending and lifting of heavy patients (Bos *et al*. 2005; Kim and Roh 2014; Rajan 2014; Adesi, Kwadwo and Kab 2015).

Ibrahim and Mohanadas (2012) explained that a few epidemiological studies exist which have investigated occupation-specific risk factors among radiographers. It has been found that LBP is the leading chronic health concern forcing older workers into premature retirement, and also forcing more people out of the workplace than heart disease, diabetes, hypertension, neoplasm, respiratory disease, and asthma combined (Maher, Underwood and Buchbinder 2017).

2.5 Socio-demographic low back pain risk factors

2.5.1 Age

Aging can be described as a dynamic process, which due to evolution leads to degenerative changes to the bones, ligaments and intervertebral discs. While degenerative changes in the spine that occur with aging are responsible for many disorders, impairment and disability, it has been indicated by Lardon *et al.* (2014) that LBP can be present from early life. According to Manchikanti *et al.* (2014) numerous conditions linked to degenerative changes in the spine and sacroiliac joint can be responsible for the individual experiencing LBP. These pathologies are due to 'wear and tear' and involve the intervertebral discs, facet joints, sacroiliac joints and surrounding soft tissue structures. Degeneration of the spine commonly occurs in three stages, viz. the dysfunction phase, unstable phase and stabilisation phase. When looking at degeneration in terms of the three joint complex, it is perceived that patients presenting with low back pain may experience increased symptomatology as the aging process progresses (Manchikanti *et al.* 2014).

Table 2.2 below indicates the increase in prevalence for experiencing LBP over the progression of time by looking at the point, period (annual) and lifetime prevalence rates from various national and international studies. One can

appreciate the increase in prevalence percentage seen over time, which indicates that as one ages there is a concomitant increase in the prevalence for experiencing LBP.

Table 2.2. International low back pain prevalence rates

Author	Date	Country	Industry	Point %	Period %	Lifetime %
Bierring-Sorenson	1982	Denmark	Public (adults)	14%	45%	62%
Hillman *et al.*	1996	United Kingdom	Public (adults)	19%	39%	59%
Igumbor, Useh and Madzivire	2003	Zimbabwe	Public (adults)	16%	40%	56%
Omokhodion, Umar and Ogunnowo	2000	Nigeria	Public (adults)	39%	44%	74%
Prista *et al.*	2004	Mozambique	Public (teenagers)	12%	14%	28%
Bejia *et al.*	2005	Tunisia	Public (adults)	3%	50%	57%
Jordaan *et al.*	2005	South Africa	Public (teenagers)	14%	51%	52%
Van Vuuren	2005	South Africa	Public	36%	56%	64%
Louw, Morris and Grimmer-Somers	2007	Africa	Public	32%	43%	49%
Schmidt *et al.*	2007	Germany	Public (adults)	37%	76%	85%
Dagenais and Haldeman	2012	Global	Public	25%	50%	85%
Manchikanti	2012	Global	Public (adults)	12%	38%	40%
Dyer	2012	Durban (SA)	Public (adults)	34%	18%	48%

Hoy *et al.* (2010) advised that a study found the incidence of LBP to be highest in the third decade of life, whereas Manek and MacGregor (2005) found that workers aged 45-64 years have the highest LBP prevalence rates.

The probability of an increase in the severity and the presence of complications exists to a larger extent with increasing age (DePalma, Ketchum and Saullo 2011). Lower back pain has been found to be a chief cause of disability and incapacity within individuals younger than 45 years with LBP risk factors

(Thomas 2007). It is therefore expected that if the sample population of this study represents a younger population, the degree and probability of LBP would be less. Alternatively, if the population includes an older age group then the likelihood of LBP would be increased. The above corresponds with the findings of Dagenais, Caro and Halderman (2008), who stated that a relationship exists between increased age and LBP prevalence.

2.5.2 Gender

Contrasting findings occur within the literature in relation to LBP gender prevalence. Some studies have reported LBP to be more prevalent in females, while others have either reported a higher prevalence in males or equal distribution between both genders (Hoffman *et al*. 2012). Bohman *et al*. (2014) reported that with regard to LBP females have a higher prevalence, are more severely affected and often have a poorer prognosis with than males. Ochsmann *et al.* (2009) indicated that gender had a significant role in LBP development, and further highlighted that overweight females were at greater risk for the development of LBP as opposed to overweight males. The points made by Ochsmann *et al*. (2009) were further elaborated on by Jin, Sorock and Courtney (2004), who suggested a greater prevalence of LBP in females (54,2%) as opposed to males (45,0%).

Lardon *et al.* (2014) proposed that the higher prevalence rates of LBP in younger females could be due to the onset of puberty and the resultant gynecological changes. The points made by Lardon *et al.* (ibid) were contradicted by Clays *et al.* (2007) as well as Ochsmann *et al.* (2009), who emphasised that overweight males had a higher prevalence for developing LBP as opposed to females who are of equal weight.

The findings of Mens, Huis in't Veld and Goudzwaard (2012) and Manchikanti *et al.* (2014) were that LBP was more prevalent in females, with 60,0% from a study on pregnant females (n=182) reporting pain in the lower back. It has also been stated that LBP is more common during pregnancy, often gets worse

during pregnancy, and can often remain post-partum (Manchikanti *et al.* 2014; Liddle and Pennick 2015). Liddle and Pennick (2015) also concluded that LBP has been experienced by two-thirds of pregnant women. Sinclair *et al.* (2014) found that for numerous women an increase in pain severity can interfere with regular daily activities, cause sleep disturbances, and result in work absenteeism.

Hoffman *et al.* (2012) stated that numerous studies have found no difference in LBP prevalence between men and women, although according to Manchikanti *et al.* (2014) some studies have found occupational LBP to be more prevalent in men. An explanation for the variances of the different gender prevalence rates found in the literature was proposed by Morris (2006), who expressed the view that these variances may be due to differences and characteristics of study populations of those previous studies.

Although the literature is at odds with respect to LBP gender prevalence (Manek and MacGregor 2005), it is recognised that LBP occurs more commonly in females than in males (Ochsmann *et al*. 2009). The authors argued that the higher LBP prevalence in females was as a result of the work environment, exercise involvement, and social habits and relations.

2.5.3 Body mass index and obesity

In the work of Shiri *et al.* (2013) Body Mass Index (BMI) is highlighted as a useful tool in measuring the weight category of individuals; BMI is calculated by the weight of a person in kilograms divided by their height in meters squared. The BMI of a normal individual is said to occur between 18,5-24,9 kg/m^2, while that of an underweight individual and an overweight individual is classified as <18,5 kg/m^2 and within the 25-29,9 kg/m^2 range respectively. When the BMI of an individual is above 30 kg/m^2, he/she is classified as obese (Shiri *et al*. 2013). Various authors (Jensen *et al.* 2012; Seaman 2013; Shiri *et al*. 2013) are in consensus that utilising BMI measurements as a marker of general adipose levels, and for that matter health, is accurate.

Shiri *et al.* (2013) and Hoy *et al.* (2010) expressed the view that obesity and not just excess weight is a significant contributing risk factor to the development of LBP. In addition, obesity is believed to have systemic metabolic effects on an individual that results in low level systemic inflammation, which can further increase the risk for developing LBP. Jensen *et al.* (2012) highlighted that female health care workers with excessive physical workloads had a 78,0% increased risk for developing LBP.

2.5.4 Ethnicity

A study by Portenoy *et al.* (2004) found that different ethnicities have various cultural influences that cause individuals from different ethnic groups to experience pain in a varied way, which can lead to over- and under-reporting of the LBP that is experienced. Portenoy *et al.* (2004) also found that Hispanic individuals (68,0%) were less likely than White individuals (82,0%) or African-American individuals (85,0%) to visit a doctor when they experience pain. African-American individuals more frequently used medication for pain than their White or Hispanic counterparts.

Population studies conducted by Van der Meulen (1997), Docrat (1999) and Dyer (2012) found the lifetime LBP prevalence of Coloured and Indian South Africans to be higher than Black and White individuals, with White individuals having the lowest prevalence rate for developing LBP. This would be in agreement with Portenoy *et al.* (2004), who indicated that ethnicity does indeed play a significant role in the experience and reporting of LBP.

2.5.5 Education and income

Hu *et al*. (2013) found no statistically significant difference amongst people with a different economic status with respect to LBP risk factors. Manchikanti *et al*. (2012) expressed the view that an association can, however, be drawn between social class, low level of education, low income and LBP. A Russian study on individuals with poor educational backgrounds found LBP to be prevalent in these individuals (Hoy *et al*. 2010). A global study by Williams *et*

al. (2015) indicated that there exists a link between LBP and socio-economic status, finding that lower economic and education status were at a greater risk for the development of LBP. This was attributed to the physical nature of lower income jobs and a lack of access to health care. Williams *et al.* (2015) concluded from a review of sub-Saharan prevalence studies that the prevalence of LBP in working-age adults is increasing. The study also found that people living in rural areas were at greater risk for developing LBP as opposed to those living in urban areas. This was attributed to the increase in self-performed strenuous household activities by the participants from rural areas. Lastly, the study by Williams *et al*. (2015) found that there were more individuals from rural areas employed within physical labour occupations than their urban counterparts. In contrast, Power *et al.* (2001) suggested that no clear link exists between education level and the incidence of LBP. Dagenais and Haldeman (2012) highlighted a paucity in the literature on the prevalence and incidence of LBP between individuals from different income and work class groups.

2.5.6 Marital status

Hammed and Agbonlahor (2016) indicated that a higher prevalence of LBP existed in single individuals as opposed to married individuals. Rana *et al*. (2016) further concluded that companionship resulted in a decreased chance of an individual experiencing LBP due to care and support from their partner. A study by Morris (2006) supported the argument that LBP was more prevalent in unmarried older females than males.

2.5.7 Medical insurance

Hoy *et al*. (2003) argued that individuals with the financial ability to more readily seek medical care may have a decreased LBP prevalence rate than individuals from low income populations who cannot afford medical care. The literature was lacking, however, with regard to financial position and LBP prevalence rates.

2.5.8 Previous surgery

Chronic LBP can commonly occur after spinal surgery (Ostelo *et al*. 2005). A study by O'Dowd and Hlavsova (2014) found that psychosocial factors can influence the outcome of surgical procedures and can lead to chronic LBP post-surgical intervention. The research of Ostelo *et al*. (2005) offered clarification on the matter, maintaining that the expectancy of treatment can have an impact on the outcome. For example, if there is hesitation or fearfulness regarding the outcome of surgery and a lack of confidence in surgical improvement, then this can affect the actual outcome and improvement of LBP. It has been argued that early cognitive interventions can significantly improve surgical outcomes if utilised early on prior to surgery (O'Dowd and Hlavsova 2014).

2.6 Psychosocial risk factors

Hoy *et al*. (2010) raised the point that psychosocial factors can influence the progression of acute LBP to chronic LBP. Psychosocial factors at work have been associated with an increased risk for developing LBP. These work factors, which include job dissatisfaction, work stress, monotonous and increased workloads, were also shown to lead to the progression of acute LBP to chronic LBP (Hoy *et al*. 2010). Karahan *et al*. (2009) found that smoking, a lack of exercise, and work stress can result in an increased likelihood for experiencing LBP.

2.6.1 Smoking

A strong association has been found between smoking and the prevalence of LBP (Manchikanti *et al*. 2012); an increase in frequency and duration of LBP has been associated with an increase in smoking. It has been propounded by Alkherayf and Agbi (2009) that daily smoking could significantly increase the risk of young adults experiencing LBP, and was directly linked to the dose smoked. Chronic LBP sufferers who smoke have also been found to experience increased levels of pain and symptoms compared with non-smoking chronic LBP sufferers (Manchikanti *et al*. 2012). Shiri *et al*. (2010)

further highlighted the point that smokers have been shown to have an increased incidence of LBP in comparison with individuals who have never smoked before. Furthermore, compared with non-smokers, smokers are more inclined to use pain medication and to suffer from severe LBP (Manchikanti *et al*. 2012).

Systematic reviews have found that 51,0%-77,0% of epidemiological investigations noted a causal link between smoking cigarettes and LBP (Wai *et al*. 2008). The pathophysiology attributed to an increased prevalence of LBP in smokers has been thought to include repeated micro trauma from a continuous chronic cough, which can result in disc herniation. Another possible cause included damage to the blood vessels which can lead to a decrease in blood supply to the IVD's and vertebral bodies, thereby resulting in early vertebral and disc degeneration (Wai *et al*. 2008).

2.6.2 Stress

Stress can be defined as home or work-related factors that can have a negative effect on an individual in that environment, consequently resulting in physical and emotional overstrain (Stander 2014). Rajan (2014) further explained that work-related stress involves the physical and emotional responses of an employee that occur when the employee's capabilities and resources cannot cope with the demands placed on them by their job.

Verrier and Harvey (2009) noted that psychological morbidity rates were greater amongst healthcare professionals compared with the general public. Work-related stress has led to an increase in work-related injuries and disease within both first- and third-world countries (Rajan 2014). Hartvigsen *et al.* (2004) recorded that no strong evidence existed to support that stress originating from work-related events can be associated with the development of LBP. This contradicts the findings of Heneweer *et al*. (2011) and Sterud and Tynes (2013), who reported that strong evidence exists for the association between psychosocial factors such as stress and the predisposition of an

individual to the development of LBP. The stress that the individual experiences is most likely due to apprehension from concern about a previous injury and experiencing similar pain to a previous event, or by association to social interaction with another individual suffering from similar pain (Morris 2006).

Work-related stress is a key contributing factor to LBP (Ibrahim and Mohanadas 2012), leading to an increase in absenteeism, low staff morale, greater risk of accidents and an increase in staff turnover rates. This results in an increase in expenditure for both employees and employers (Rajan 2014). Studies done on radiographers in Australia (Eslick and Raj 2002) and Nigeria (Ugwu 2011) found that major stressors for radiographers included workload; demanding patients; colleagues; equipment problems; staff shortages and support; being on-call; exposure to radiation; poor salaries; and being in a management position. Singh *et al.* (2017) found that burnout levels among radiographers were high.

A study by Gam (2015) on radiographers in the eThekwini municipality reported the main sources of stress as workload, defective equipment, strenuous shift work, bullying by other staff and staff shortages. Gam (ibid) further argued that physical exercise, counselling and wellness days were used to decrease stress; whilst the employment of more staff, the repair of faulty equipment, team building activities, reduced workloads, and improvement of working conditions were recommended as ways of reducing stress amongst radiographers. This was further supported by Kim and Roh (2014) and Gam (2015) who stated that stress related to the radiography profession may be high and could be further influenced by heavy workloads, traumatic experiences and low job satisfaction. Radiographers were stressed at work due to the high level of work demands and high physical labour. This includes standing for long hours of the day; repetitive movements; lifting; bending and twisting, which could lead to the muscles, blood vessels, and nerve tissues in their body becoming damaged or affected (Kim and Roh

2014). A study by Adesi, Kwadwo and Kab (2015) on radiographers in Ghana reported that 38,0% described the cause of their stress as being due to repetitive movements, poor posture, and working under physically demanding conditions.

It is therefore important, especially in the workplace, to identify psychosocial factors that may impact on the radiographers participating in this study, in order to decrease the impact of these factors on the development of LBP. This may reduce the influence of these factors on absenteeism and productivity.

2.6.3 Exercise

A consensus exists within the literature that exercise is beneficial and preventative to the development of LBP (Moreira *et al.* 2014). Harvin (2014) raised the point that workers who participated in regular exercise activities had a better prognosis and a stronger likelihood of recovering from spinal pain than colleagues who did not exercise. Exercise has been shown to have a preventative role with regard to spinal pain in office workers (Harvin 2014). Louw, Morris and Grimmer-Somers (2007) expressed the opinion that there is growing scientific evidence that illustrates the effectiveness of exercise in the reduction of disability and the recurrence of LBP.

A study performed on nurses in eThekwini (Kumalo 2014) found a significant relationship between work-related musculoskeletal pain and exercise. Staff involved in exercise were less likely to report musculoskeletal complaints. In contrast to the previous authors, Heneweer *et al*. (2011) revealed that women who perform high intensity exercises were at a greater risk of experiencing LBP. It is therefore important to state that the execution of exercise is equally important in relation to the frequency thereof (Heneweer *et al*. 2011).

2.7 Conclusion

Several studies have presented the complex nature of LBP, which may have multiple contributing factors and etiologies. The literature is clear on the extent of LBP in populations globally, and how it can impact on an individual's quality of life. Numerous occupation-specific risk factor studies have been conducted on a variety of professions. There is, however, a paucity in the literature regarding occupational demographics, risk factors, work history and the incidence and prevalence of LBP in radiographers in South Africa. The lack of South African demographics and the uniqueness of the scope of practice of the radiographer warrants investigation on a South African population where the work environment is unique. This uniqueness includes long working hours, staff shortages, older equipment that needs more physical input and different patient profiles that can lead to a significant increase in LBP, injury and absenteeism. Chiropractors can play a vital role in reducing the low back pain experienced by radiographers by use of manual therapy and educating them on proper work ergonomics. This study will therefore attempt to identify the occupational risk factors common in radiographers in both the private and government sectors of the eThekwini municipality, and to determine how they relate to previous studies when compared with a South African viewpoint.

CHAPTER 3
METHODOLOGY

3.1 Introduction

This chapter describes the methods used to conduct the research study. Areas of interest discussed within this chapter include the research type and design; research procedures followed; the research tool; the sampling process; ethical considerations; and the methods of statistical analysis.

3.2 Research type and design

The research study was a quantitative study with a descriptive design. According to Kothari (2004) a descriptive study can make use of questionnaires to collect data. Kothari (2004) also stated that the main purpose of descriptive research is to describe a state of affairs as it currently exists. A quantitative data approach is used when the researcher wants objective answers to a specific research question (University of Southern California 2014), and is employed when a phenomenon is studied in terms of numbers (Kothari 2004). This was the best design to evaluate precise answers to specific questions, which in this context included the demographics, nature and severity and clinical presentation of LBP in diagnostic radiographers working within the eThekwini Municipality.

3.3 Study setting and target population

The research study was conducted on diagnostic radiographers from both the public and private sectors throughout various hospitals within the eThekwini Municipality. A letter of permission (Appendix A) was obtained from the KwaZulu-Natal Department of Health (KZNDOH) after requesting permission by letter (Appendix B). The target population included all qualified diagnostic radiographers registered with the Health Professionals Council of South Africa (HPCSA) and working in the eThekwini Municipality in the public and private

sectors. Both public and private sector diagnostic radiographers were selected, to observe the possible differences that may or may not exist regarding risk factors, nature and severity of LBP within these two sectors. Occupational risk factors that include long working hours, old heavy machinery, frequency of lifting of heavy patients and staff shortages, may or may not be applicable to either or both these sectors (Rajan 2014).

Diagnostic radiographers were preferentially selected over radiographers in other disciplines such as Nuclear Medicine, Radiotherapy and Ultrasound, due to the nature of their occupation. Diagnostic radiography is a physically demanding job (Gam 2015), and commonly involves the handling of larger numbers of patients and procedures per day than the other radiography disciplines (Verrier and Harvey 2009). Diagnostic radiographers are also the only radiographers who work night shifts and extended working hours (Gam 2015). They are also seated less during the day than the other disciplines, as most equipment requires the diagnostic radiographer to be in the upright position and to be mobile (Verrier and Harvey 2009). The diagnostic radiographer can often be expected to wear a heavy lead apron for prolonged periods of time, to carry heavy imaging cassettes and to push a mobile x-ray unit, unlike the other disciplines. Additionally, more qualified diagnostic radiographers occur in practice in the eThekwini Municipality than the other disciplines, which provided a larger sample population group.

3.4 Sample selection

The total number of diagnostic radiographers in the eThekwini municipality with active HPCSA registration was 273 at the time of data collection. The research participants were identified by utilising the HPCSA online register, which can be publicly accessed. As permission was denied by one of the larger public hospitals to include their 35 radiographers in the study, the remaining 238 registered diagnostic radiographers in the eThekwini municipality were approached to obtain data from a minimum of 120 diagnostic radiographers who met the inclusion criteria. A total of 131 diagnostic radiographers

completed the questionnaire, resulting in a 55,0% response rate. To avoid participant bias, the two radiographers who participated in the expert group and pilot study were excluded during data collection for the main study. The participants required less than twenty minutes to complete the questionnaire.

Of the 131 participants, 43 had to be excluded as they did not meet a 70,0% questionnaire completion rate as suggested by the statistician to be acceptable. The final sample used for data analysis was therefore 88, which was accepted by the statistician as statistically viable. The sample of radiographers were grouped to include 38 public sector diagnostic radiographers and 50 private sector diagnostic radiographers. This grouping enabled the identification of similarities and differences which may exist between diagnostic radiographers employed within the two sectors. The target population received a letter of information (Appendix B) at the start of the survey which provided all relevant information in terms of the research study. The study participants were also required to indicate their consent (Appendix C) in order to proceed with the online questionnaire.

3.4.1 Inclusion criteria

The research participants for this study had to be:

- Qualified and registered with the HPCSA under the category of Diagnostic Radiography.
- Currently employed within the private and/or public sector of the eThekwini Municipality as a Diagnostic Radiographer.

3.4.2 Exclusion criteria

The exclusion criteria for this study were:

- Student Radiographers.
- Nuclear Medicine Radiographers, Ultrasonographers and Radiotherapists.

3.5 Questionnaire development

The research tool for this study was an online questionnaire (Appendix D) that was amended after a focus group and pilot study to the final version (Appendix E), used to collect data from the study population through 'SurveyMonkey'. The questionnaire was constructed and adapted from the Dutch Musculoskeletal Questionnaire (Hildebrandt *et al*. 2001) and was critiqued by both a focus and a pilot group. Different styles of questioning were used in the questionnaire to increase the likelihood of participants accurately answering the questions.

The types of questions employed included open-ended questions, multiple choice questions, dichotomous (yes/no options) and scaled response questions. This allowed for both structured and unstructured questions so as to enhance validity and reliability of the questionnaire (Struwig and Stead 2001). The questionnaire was divided into four sections in order to obtain the required data for this study. The sections included demographics (biographical information); social history; occupation (work environment, work experience, work history); and characteristics of pain.

3.6 Research procedure

A request to permission letter to conduct the research study was send to all the public and private hospitals with radiography facilities in the eThekwini Municipality (Appendix F). Permission to conduct the study was obtained from the KZNDOH (Appendix A); the practice managers at the participating private hospitals (Appendix G-I) and the various medical superintendents/managers at the participating public hospitals (Appendix J-R). The e-mail addresses of participants were obtained from the managers or head of department of the various participating hospitals, and in a private capacity via word-of-mouth and snowballing. The questionnaire was made available via an online link e-mailed to each participant. A record was kept of all completed questionnaires to ensure that no study participant completed the questionnaire more than once. The researcher did a weekly tally of the completed questionnaires, and once

the sample size of 120 was achieved the link for accessing the questionnaire was deactivated. The settings on 'SurveyMonkey' were also adjusted to allow only a single use for each link sent to a participant's e-mail address, as the software detected the IP address and only allowed participation once per IP address used. The implemented privacy policy of 'SurveyMonkey' (2016) stated that all the data collected from the survey was received only by the individual who designed the survey, and that all the data and e-mail addresses of participants were kept secure.

3.7 Focus group discussion

The inclusion of an expert group ensured reliability of the research tool and aided in content validity; this assisted the researcher in identifying important areas that were addressed regarding the study population (Morgan 1997). During the expert group meeting all members were encouraged to make suggestions and discuss and provide ideas around the topic, to ensure that the questionnaire (Appendix D) was critically assessed. This further ensured that a uniform and thorough format was reached, corresponding with the aims and objectives of the study.

The expert group included:

- Two radiographers who met the inclusion and exclusion criteria.
- A statistician.
- The research supervisors.
- A qualified chiropractor.
- The researcher.

Inclusion criterion for the expert group:

- Participants had to be eighteen years of age and older.

Exclusion criterion for the expert group:

- Anyone who was not willing to sign the letter of information and informed consent (Appendices B and C) for the expert group.

3.8 Pilot study

During the pilot study the questionnaire was completed by two radiographers to ensure validity of the different sections and questions of the research tool; this was conducted once ethical clearance was received. The pilot study allowed the questionnaire to be tested for feasibility and to identify any flaws before the study commenced. Feedback from the expert group and pilot study was used to improve the questionnaire (Leon, Davis and Kraemer 2011).

For the pilot study the participants had to be two radiographers who were:

- Qualified and registered with the HPCSA under the category of Diagnostic Radiography.
- Currently employed within the private and/or public sector of the eThekwini Municipality as a Diagnostic Radiographer.

3.9 Data analysis

The data obtained from the study was presented in the form of graphs and tables with the assistance of the statistician, according to the study objectives. The SPSS version 24.0 statistical software was used. Descriptive methods were utilised to further describe the data collected and to compare and contrast it with other documented data. Inferential statistics were used to establish possible associations between variables. Contingency tables were used where applicable to evaluate the data and to demonstrate the observations from two different related categorical variables. Point, period and lifetime prevalence were described using relative frequency and percentage tables. The Pearson's Chi Square Test was used for ordinal and nominal data. A p value of <0,05 was considered as statistically significant. Where the frequency counts were less than five, the Fisher's Exact Test was used to analyse the significance of the different relationships. This was in accordance to communication with Mr Deepak Singh (statistician) at the Durban University of Technology on 13 June 2016, who offered to render his services as the statistician (Appendix S).

3.10 Challenges experienced

During the data collection process, the following challenges were identified:

- A large number of respondents did not complete all sections of the questionnaire. The questionnaires that were less than 70,0% completed were consequently excluded from the data analysis.
- There was poorer participation from the public sector radiographers, which may be due to limited access to internet facilities.
- One public hospital did not provide the researcher permission and access to include their ± 35 radiographers in the research study.

3.11 Verification of data input

The necessary data for this research study was acquired using 'SurveyMonkey'. The raw data was downloaded and coded using a Microsoft Excel spreadsheet. Prior to statistical analysis, the raw data was verified for consistency and accuracy.

3.12 Ethical considerations

Permission and copy right was received from Primal Pictures (Appendix T) in order to use the anatomy images as illustrations within Chapter 2. Ethical approval in order to conduct this study (Appendix U) was obtained from the Institutional Research and Ethics Committee (IREC) (REC 142/16) at the Durban University of Technology (DUT). Permission was obtained from the KZNDOH; the medical superintendents at the participating public hospitals; and practice managers at the participating private hospitals. Participation in the study was voluntary and participants could withdraw at any point without fear of consequences, which ensured non-maleficence. No participants were coerced into participating in the study and participation in the questionnaire was done without the researcher present to ensure participant autonomy. Participants did not receive remuneration. Study information and consent letters were included at the start of the questionnaire and participants indicated consent at the start of the questionnaire in order to participate in the online

questionnaire. Participants' names were not included in the questionnaire to ensure their anonymity and confidentiality. Anonymity was further ensured by the 'SurveyMonkey' online software by not providing the researcher with the IPL address of research participants. Only the researcher, statistician and supervisors had access to the data obtained from the questionnaire. The results were referred to as the 'public sector' and 'private sector', which ensured the privacy of participants. The researcher objectively coded and reported on the data at all times. Possible benevolence of the study included presenting the results of the research study at radiography seminars to educate radiographers in methods to decrease risk factors and to help prevent WRLBP. Participants were treated equally and with respect, which ensured justice. When the study was administered to the expert group the members were requested to orally agree their confidentiality regarding the research study content/questionnaire.

3.13 Summary

A quantitative, descriptive study was conducted, involving the sampling of qualified diagnostic radiographers residing and practicing in public and private hospitals within the eThekwini Municipality. Ethics approval in order to perform the research study was obtained from the DUT's IREC. All the participants were contacted via online methods. The study made use of an online survey as a research tool that included various questions related to the epidemiology of LBP in diagnostic radiographers, as per the study objectives. The research tool content was assessed, critiqued and modified by a focus group and a pilot study performed prior to distribution to ensure reliability and validity. The data attained during the research study was kept confidential and stored under password protection by the researcher.

CHAPTER 4
RESULTS

4.1 Introduction

This chapter presents the results obtained from the questionnaire (Appendix F) in this study. The questionnaire was the primary tool used to collect data and was distributed to 238 radiographers in both the private and public sector. The data collected from the responses was analysed with SPSS version 24.0. The results will present the descriptive statistics in the form of graphs, cross tabulations and other figures for the quantitative data collected. Inferential techniques include the use of correlations and chi square test values, which are interpreted using the p-values.

4.2 Abbreviations

%	Percentage.
<	Refers to a value or figure less than the value or figure shown.
=	Equal to.
>	Refers to a value or figure greater than the value or figure shown.
kg/m^2	Kilogram divided by meter squared.
p	Indicates the statistical significance of the data. A *p* value of <0,05 indicates a significant relationship between variables (Singh 2017).
kg	Kilogram.
BMI	Body Mass Index.
km	Kilometer.

4.3 Response rate

In total 238 radiographers were targeted and 131 questionnaires were returned, resulting in a 55,0% initial response rate. Of these 131 respondents, 43 were excluded from the statistical analysis due to being incomplete surveys, leaving 88 valid questionnaires of which 38 were public sector radiographers and 50 were private sector radiographers. The response rate therefore was 37,0%.

4.4 Descriptive and interferential statistics

This section includes both descriptive and interferential statistics, which have been discussed concurrently based on the study objectives. The results were presented as mean percentages per variable. Where applicable, the significant relationships between the variables were accentuated.

4.5 The Research Instrument

The research instrument consisted of 250 items, with a level of measurement at a nominal or an ordinal level. The questionnaire was divided into five sections which measured various themes as illustrated in **Table 4.1** below:

Table 4.1: Themes of the research study

1	Biographical data
2	Social history
3	Occupation
4	Characteristics of past and current LBP
5	Impact of LBP

4.6 Section A: Biographical Data

This section summarises the biographical characteristics of the respondents in terms of gender; ethnicity; age; height; weight; marital status; number of dependents; education; and sector of employment.

4.6.1 Gender

Figure 4.1 below illustrates the overall gender distribution per sector.

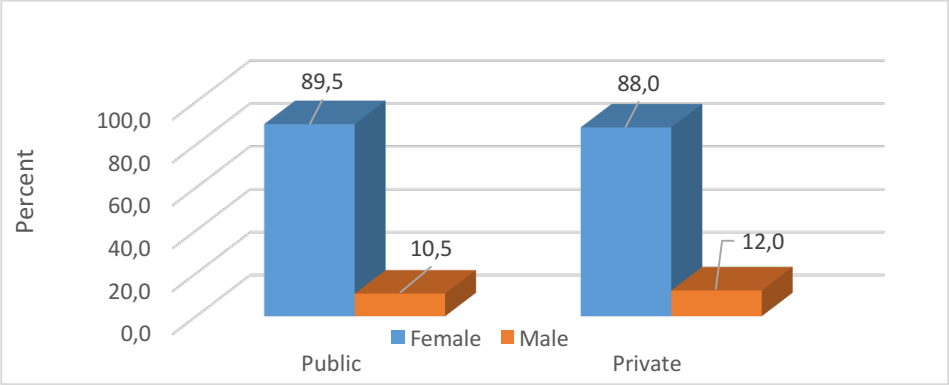

Figure 4.1: Gender distribution per sector

The majority of participants were female (88,6%) in this study. The demographic profile of participants showed the ratio of females to male at approximately 9:1 for both sectors. The percentage distributions were also similar in the two sectors ($p > 0,05$).

4.6.2 Ethnicity

Figure 4.2 indicates the racial composition of the sample per sector.

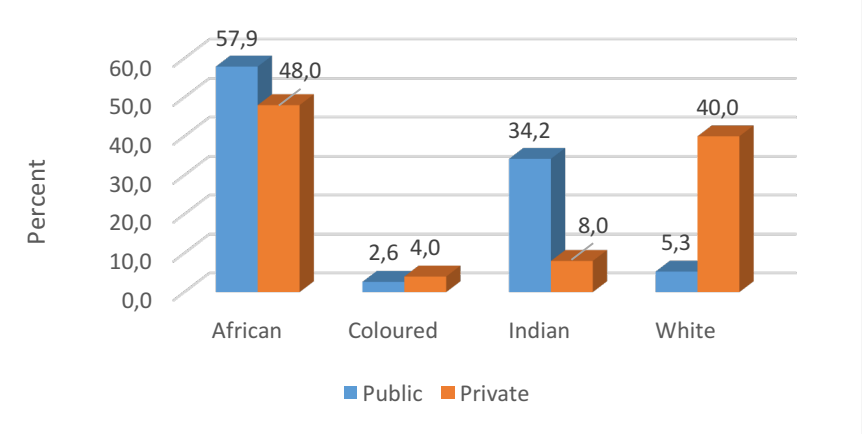

Figure 4.2: Racial composition of the different sectors

There were significantly more African respondents in both sectors with many more Indians in public service, and significantly more Whites in private practice ($p < 0,001$).

4.6.3 Numerical data for age, height, weight and number of dependents

Table 4.2 is a summary of the descriptive statistics for the numerical data for the biographical data.

Table 4.2: Numerical biographical data of participants

Sector of employment		Age in years	Height in meters	Weight in kg	Number of dependents
Public	N	38	37	38	38
	Mean	31.50	1.6076	66.37	1.00
	Median	28.00	1.6000	61.00	1.00
	Std. Deviation	8.695	0.11434	19.206	0.930
	Minimum	22	1.20	42	0
	Maximum	59	1.86	124	3
	Range	37	0.66	82	3
Private	N	50	50	50	50
	Mean	34.14	1.6440	66.70	1.08
	Median	32.00	1.6300	65.00	1.00
	Std. Deviation	9.245	0.08836	14.849	1.209
	Minimum	23	1.50	46	0
	Maximum	62	1.98	103	4
	Range	39	0.48	57	4
Total	N	88	87	88	88
	Mean	33.00	1.6285	66.56	1.05
	Median	31.00	1.6300	63.00	1.00
	Std. Deviation	9.057	0.10124	16.766	1.092
	Minimum	22	1.20	42	0
	Maximum	62	1.98	124	4
	Range	40	0.78	82	4

The average age of radiographers within this population was 31 years, with an average height of 1,62 meters and average weight of 66,5kg. On average, however, the radiographers in the private sector were slightly older (34,1 years) than the radiographers in the public sector (31,5 years). The average weight of radiographers in both sectors were similar at 66,4kg and 66,7kg respectively. The average height of radiographers in the public sector was 1,61m while the radiographers in the private sector were slightly taller at 1,64m. The average BMI value of radiographers in the private sector can therefore be calculated to be 24,8kg/m^2 which puts them in the normal range of 18,5 -24,9 kg/m^2. The radiographers in the public sector, however, had a

BMI value of 25,6 kg/m^2 which puts them in the overweight range of 25,0-29,9 kg/m^2. The average number of dependents was one for both groups.

Table 4.3 below represents the p-values of the comparisons between the public and private sectors. None of the p-values were significant (p > 0,05). This implies that the central values between the sectors for the variables were not that different.

Table 4.3: Significance of selected demographics of the public and private sectors

	Age in years	Height in meters	Weight in kg	Number of dependents
Mann-Whitney U	738.000	790.000	871.000	940.000
Wilcoxon W	1479.000	1493.000	1612.000	2215.000
Z	-1.789	-1.161	-0.666	-0.089
Asymp. Sig. (2-tailed)	0.074	0.246	0.506	0.929

4.6.4 Marital status

Figure 4.3 illustrates the percentages of married, single and divorced/separated radiographers in this study. There were more single radiographers in the public sector (55,5%) than in the private sector (36,0%), and more married radiographers in the private sector (62,0%) as opposed to the public sector (42,1%). Less than 3,0% of participants in both sectors were divorced or separated.

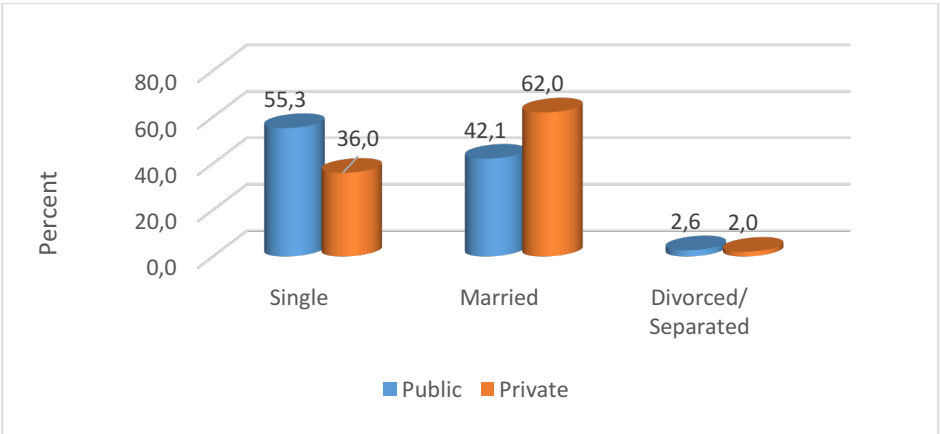

Figure 4.3: Marital status of radiographers in the different sectors

4.6.5 Level of education

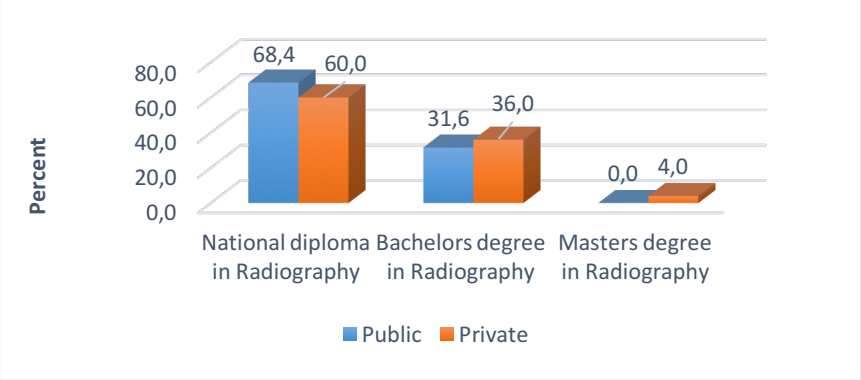

Figure 4.4: Level of education of radiographers in the different sectors

Figure 4.4 illustrates that the majority of radiographers in both sectors had a National Diploma in radiography only. The percentage distributions were also similar in the two sectors ($p > 0,05$). A larger percentage of radiographers in the private sector were in possession of postgraduate qualifications, viz. Bachelor's degree (36,0%) and Master's degree (4,0%). This was in contrast to the public sector where the highest postgraduate qualification recorded was a Bachelor's degree (31,0%).

4.7 Section B: Social and medical history

This section deals with the social history of participants and includes questions on past medical history and current health status. It also includes questions on sleep, exercise and stress.

4.7.1 Current health status

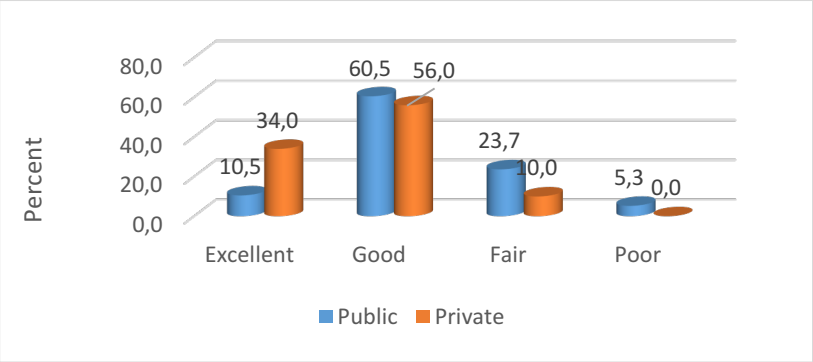

Figure 4.5: Current health status of radiographers in the different sectors

Figure 4.5 illustrates that the majority of both sectors rated their current health status as good. There was a marked difference between public and private in terms of excellent health, as only 10,5 % of radiographers in the public sector rated their health as excellent as opposed to 34,0% of radiographers in the private sector. None of the radiographers in the private sector rated their health as poor, however 5,3% of radiographers in the public sector reported poor health currently.

Table 4.4: Current health status of radiographers in the different sectors

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	10.235[a]	3	0,017	0,011		
Fisher's Exact Test	9,883			0,012		
Linear-by-Linear Association	9.956[b]	1	0,002	0,002	0,001	0,001
N of Valid Cases	88					

As seen in **Table 4.4**, there was a significant relationship between the current health status of radiographers working in the different sectors (p = 0,012).

4.7.2 Medical health insurance

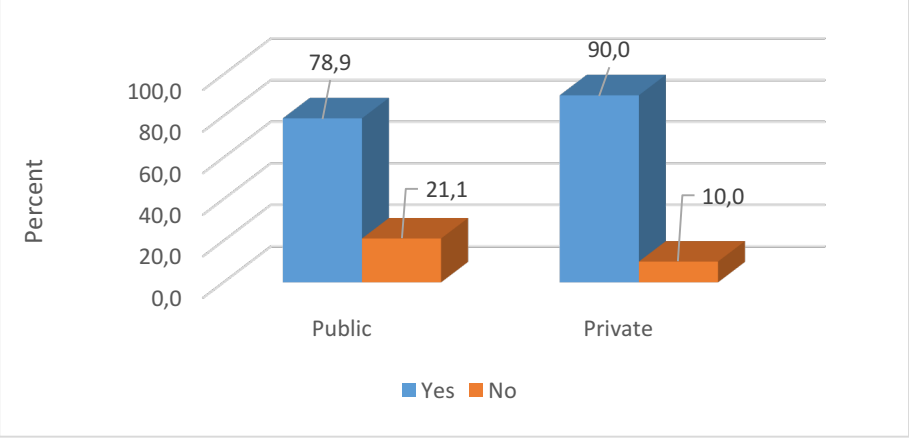

Figure 4.6: Medical health insurance

There was no significant difference between the two sectors with regards to radiographers with or without medical health insurance (p = 0,225), as seen in **Figure 4.6**. Only 10,0% of private sector radiographers reported not having any medical health care insurance, as opposed to 21,0% of radiographers in the public sector.

4.7.3 Back support

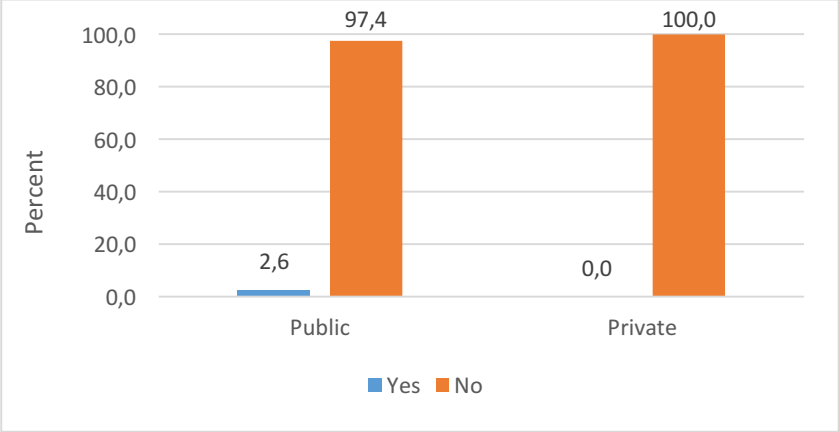

Figure 4.7: Back support

As can be seen in **Figure 4.7**, none of the radiographers in the private sector reported currently wearing a back support, as opposed to 2,6% of the radiographers in the public sector. This may indicate that radiographers in the public sector experienced a greater need for back support.

4.7.4 Back surgery

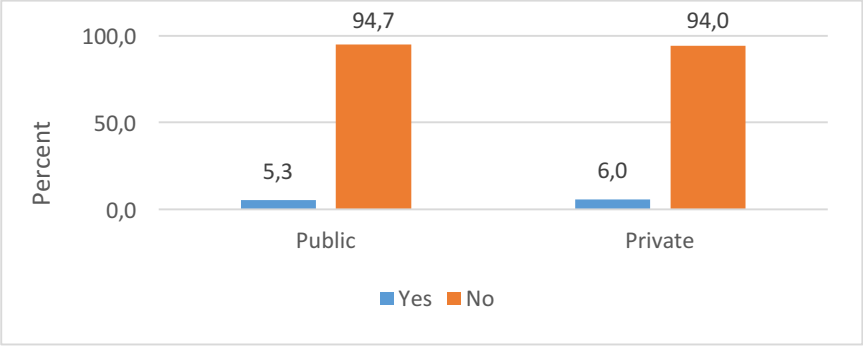

Figure 4.8: Back surgery in radiographers

No significant difference was noted between the two sectors with regard to previous back surgery (p = 1,000). **Figure 4.8** illustrates a similar distribution between radiographers from both sectors, with more than 94,0% of radiographers from both sectors reporting no previous back surgery.

4.7.5 Lower limb surgery

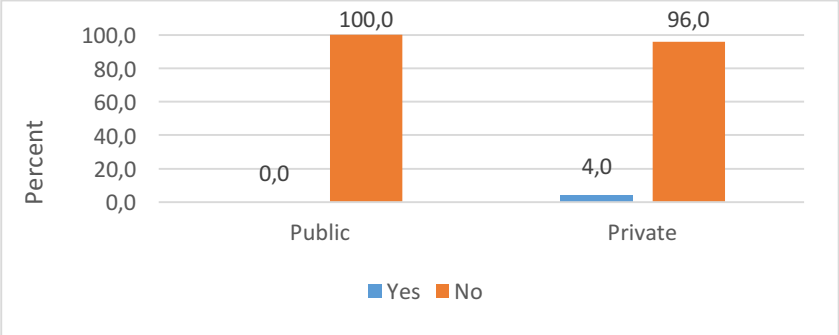

Figure 4.9: Lower limb surgery in radiographers

As can be seen in **Figure 4.9,** none of the radiographers in the public sector reported ever having lower limb surgery, in contrast to 4,0% in the private sector.

4.7.6 Other clinical conditions

Table 4.5: Radiographers suffering from clinical conditions

			Sector of employment		Total
			Public	Private	
Do you suffer from any clinical condition?	Yes	Count	9	12	21
		% within Sector of employment	23,7%	24,0%	23,9%
	No	Count	29	38	67
		% within Sector of employment	76,3%	76,0%	76,1%

Table 4.5 illustrates the number of radiographers from both sectors suffering from other clinical conditions, excluding low back pain. The total number of radiographers suffering from clinical conditions was similar in both sectors, with 24,0% (private) and 23,7% (public) reporting a clinical condition. The

major conditions reported include asthma; scoliosis; diabetes mellitus; polycystic ovarian syndrome; sinusitus; hypertension; anemia; gastro-oesophageal reflux disease; and inflamatory conditions which included rheumatoid arthritis and ankylosing spondylitis.

4.7.7 Pregnancy history

Table 4.6: Pregnancy history of radiographers

			Sector of employment		Total
			Public	Private	
Have you ever been pregnant?	Yes	Count	21	23	44
		% within Sector of employment	55,3%	46,0%	50,0%
	No	Count	12	21	33
		% within Sector of employment	31,6%	42,0%	37,5%
	N/A	Count	5	6	11
		% within Sector of employment	13,2%	12,0%	12,5%

Table 4.6 illustrates that overall, 50,0% of all radiographers reported being pregnant at least once. There were more radiographers in the public sector who had been pregnant previously (55,3%) as opposed to the private sector (46,0%). Within the public sector, 31,6% of radiographers reported never being pregnant before; within the private sector the percentage was higher at 42,0%.

Table 4.7: Low back pain during pregnancy

			Sector of employment		Total
			Public	Private	
If "yes" did you experience any low back pain while pregnant?	Yes	Count	15	20	35
		% within Sector of employment	39,5%	40,0%	39,8%
	No	Count	6	5	11
		% within Sector of employment	15,8%	10,0%	12,5%
	N/A	Count	17	25	42
		% within Sector of employment	44,7%	50,0%	47,7%

Table 4.7 illustrates that radiographers within both the public (39,5%) and private (40,0%) sectors experienced low back pain during pregnancy.

4.7.8 Smoking

Table 4.8: Smoking status of radiographers

			Sector of employment		Total
			Public	Private	
What is your smoking status?	Current smoker	Count	2	6	8
		% within Sector of employment	5,3%	12,0%	9,1%
	Ex-smoker	Count	3	3	6
		% within Sector of employment	7,9%	6,0%	6,8%
	Non-smoker	Count	33	41	74
		% within Sector of employment	86,8%	82,0%	84,1%

Table 4.8 illustrates that 5,3% of public sector radiographers were current smokers; 7,9% were ex-smokers; and 86,3% were non-smokers. Private sector radiographers reported that 12,0% were current smokers; 6,0% ex-smokers; and 82,0% were non-smokers. Out of the total sample 15,9% of the radiographers recorded a current or past smoking habit. The average number of cigarettes smoked per day by current and past smokers were respectively reported as 1,2 and 1,5 for the public sector and private sector radiographers. Additionally, the public and private sector radiographers reported smoking for a mean for 1,1 years and 1,2 years respectively.

4.7.9 Sleeping patterns

Table 4.9: Routine sleeping pattern

			Sector of employment		Total
			Public	Private	
Do you have a routine sleeping pattern?	Yes	Count	15	29	44
		% within Sector of employment	39,5%	58,0%	50,0%
	No	Count	23	21	44
		% within Sector of employment	60,5%	42,0%	50,0%

Overall, radiographers in this sample slept an average of seven hours per night. The public sector radiographers reported sleeping for between five and eleven hours per night, with an average of 7,2 hours per night, whereas the

private sector radiographers reportedly slept between four and ten hours per night, with an average of 7,0 hours per night. **Table 4.9** illustrates that many radiographers in both the public (60,5%) and private sectors (50,0%) did not have a routine sleeping pattern.

Table 4.10: Sleeping position

			Sector of employment		Total
			Public	Private	
What is your predominant sleeping position?	On your side	Count	27	36	63
		% within Sector of employment	71,1%	72,0%	71,6%
	On your back	Count	3	2	5
		% within Sector of employment	7,9%	4,0%	5,7%
	On your stomach	Count	8	12	20
		% within Sector of employment	21,1%	24,0%	22,7%

Table 4.10 illustrates that the majority of radiographers in the public (71,1%) and private (72,0%) sectors preferred to sleep on their side, although 21,1% of public sector radiographers and 24,0% of private sector radiographers preferred to sleep on their stomach. Only 7,9% of the public sector radiographers and 4,0% of the private sector radiographers preferred to sleep on their back.

4.7.10 Activities of daily living

Table 4.11: Activities of daily living

Activity	Total number of radiographers (n = 88)	Percentage
Sitting for long periods	18	20,5%
Lifting heavy objects	18	20,5%
Turning your body (twisting)	16	18,2%
Working at a computer	16	18,2%
Working with your arms overhead	9	10,2%
Bending	26	29,5%
Continuous pulling/ pushing	10	11,4%
Forward positioned arms	8	9,1%

There were 29,0% of the radiographers who reported being exposed to bending; 20,5% reported exposure to lifting heavy items outside of work and sitting for prolonged periods; 18,2% reported being engaged in twisting movements and computer work; 11,4% reported being involved in continuous pushing/pulling activities; 10,2% reported being exposed to working with their arms overhead; and 9,1% of radiographers participated in activities that required forward positioned arms.

4.7.11 Exercise

Table 4.12: Exercise

			Sector of employment		Total
			Public	Private	
Do you exercise regularly (3 times a week)?	Yes	Count	6	20	26
		% within Sector of employment	15,8%	40,0%	29,5%
	No	Count	32	30	62
		% within Sector of employment	84,2%	60,0%	70,5%

Table 4.13: Exercise versus job demands

			Sector of employment		Total
			Public	Private	
If no, do you feel it is due to your demanding/ physical job?	Yes	Count	28	28	56
		% within Sector of employment	73,7%	56,0%	63,6%
	No	Count	10	22	32
		% within Sector of employment	26,3%	44,0%	36,4%

Table 4.14: Types of sporting activities

Activity	Total number of radiographers (n = 88)	Percentage
Running	17	19,3%
Walking	60	68,2%
Swimming	10	11,4%
Cycling	9	10,2%
Yoga	9	10,2%
Pilates	5	5,7%
Weight training	12	13,6%
Aerobics	8	9,1%
Other	5	5,7%

Table 4.12 illustrates that 84,2% of the public sector radiographers and 60,0% of the private sector radiographers do not exercise regularly. Only 15,8% of public sector radiographers reportedly exercised regularly, whereas 40,0% of the private sector radiographers stated that they exercise at least three times per week. **Table 4.13** portrays that from those who reported that they did not exercise regularly, 73,7% of the public sector radiographers and 56,0% of private sector radiographers cited the physically demanding nature of their job as the reason for not exercising. **Table 4.14** illustrates the preferred forms of exercise reported by the study sample (n = 88). The most preferred form of exercise was walking (68,0%) followed by running (19,3%); weight training (13,6%); swimming (11,4%); cycling and yoga (10,2%); aerobics (9,1%); and lastly, yoga (5,7%).

4.7.12 Transport to work

Table 4.15: Transport options

			Sector of employment		Total
			Public	Private	
How do you get to work each day?	Drive yourself	Count	27	48	75
		% within Sector of employment	71,1%	96,0%	85,2%
	Bus	Count	2	1	3
		% within Sector of employment	5,3%	2,0%	3,4%
	Get a lift in a car	Count	3	1	4
		% within Sector of employment	7,9%	2,0%	4,5%
	Taxi	Count	1	0	1
		% within Sector of employment	2,6%	0,0%	1,1%
	Walk	Count	4	0	4
		% within Sector of employment	10,5%	0,0%	4,5%

Table 4.16: Travel time to work

Time spend seated per day whilst travelling to and from work	Sector of employment	
	Public (Mean)	Private (Mean)
	35mins	39mins

Table 4.17: Distance to work

Distance from residence to place of work	Sector of employment	
	Public (Mean)	Private (Mean)
	20km	15,7km

The majority (96,0%) of private sector radiographers responded that they drive to work themselves, as opposed to 71,1% of public sector radiographers (see **Table 4.15)**. Other methods of transport that public sector radiographers utilised to get to work were taking a bus (5,3%); getting a lift in a car (7,9%); using a taxi (2,6%); and walking (10,5%). The only other modes of transport used by the private sector radiographers were the bus (2,0%) or getting a lift in a car (2,0%). **Table 4.16** illustrates that the average time spent seated per day whilst travelling was 35 minutes and 39 minutes for public and private sector radiographers respectively. The average travel distance to work each day was stated as 20km for the public sector radiographers and 15,7km for private sector radiographers, as seen in **Table 4.17.**

4.7.13 Stress

Table 4.18: Stress experienced

Stress	Public	Private	Total number of radiographers (n = 88)	Percentage
Finances	11	19	30	34,1%
Family	10	15	25	28,4%
Work	18	24	42	47,2%
Health	6	2	8	9,1%
Marriage	2	4	6	6,8%
None	9	12	21	23,9%
Other	4	6	10	11,4%

Table 4.19: Level of stress experienced

			Sector of employment		Total
			Public	Private	
Please rate the stress you are experiencing above	High	Count	8	8	16
		% within Sector of employment	21,1%	16,0%	18,2%
	Moderate	Count	17	26	43
		% within Sector of employment	44,7%	52,0%	48,9%
	Low	Count	7	6	13
		% within Sector of employment	18,4%	12,0%	14,8%
	None	Count	6	10	16
		% within Sector of employment	15,8%	20,0%	18,2%

Table 4.18 illustrates that the most common overall stress factor amongst radiographers was due to work (47,2%), followed by finances (34,1%) and then stress related to family (28,4%). More radiographers in the private sector reportedly experienced work, finance, family and marriage related stress than radiographers in the public sector. Interestingly, public sector radiographers experienced stress related to their health more commonly than private sector radiographers. Other causes (11,4%) of stress that radiographers experienced included stress related to their current post-graduate studies (n = 6), reproductive inability (n = 1), and the escalating cost of living (n = 1). Only 23,9% of radiographers reported that they were not currently experiencing any stress. When it came to rating the level of stress they experienced, 21,1% of public sector radiographers as opposed to 16,0% of private sector radiographers experienced a high level of stress, as illustrated in **Table 4.19.** The most common level of stress experienced by public sector radiographers (44,7%) and private sector radiographers (52,0%) was a moderate level of stress. Of the public sector radiographers, 18,4% experienced a low level of stress and 15,8% experienced no stress. Similarly, 12,0% of private sector radiographers experienced a low level of stress and 20,0% experienced no stress. Overall, 67,1% of the radiographers experienced moderate to high level of stress.

Table 4.20: Work absenteeism for stress

			Sector of employment		Total
			Public	Private	
Have you ever been booked of work for stress?	Yes	Count	6	4	10
		% within Sector of employment	15,8%	8,0%	11,4%
	No	Count	32	46	78
		% within Sector of employment	84,2%	92,0%	88,6%

Table 4.21: Medication use for stress

			Sector of employment		Total
			Public	Private	
Do you currently take any medication for stress?	Yes	Count	1	5	6
		% within Sector of employment	2,6%	10,0%	6,8%
	No	Count	37	45	82
		% within Sector of employment	97,4%	90,0%	93,2%

Table 4.20 illustrates that only 15,8% of public sector radiographers reported being absent from work previously due to stress, as opposed to 8,0% of public sector radiographers. There were 10,0% of private sector radiographers who reported that they have previously used medication for stress as opposed to only 2,6% of public sector radiographers; this can be seen in **Table 4.21.**

4.8 Section C: Work history and current employment

4.8.1 Number of years in practice

Table 4.22: Number of years in past and current clinical practice

Sector of employment		How many years have you been in clinical practice?	How many years have you been working for this current hospital/practice?
Public	n	38	38
	Mean	10,39	6,39
	Median	6,50	4,50
Private	n	50	50
	Mean	13,22	6,96
	Median	10,00	5,50

Table 4.23: Significance in number of years in past and current clinical practice

	How many years (in total) have you been in clinical practice?	How many years have you been working for this current hospital/practice?
Asymp. Sig. (2-tailed)	0,034	0,439

In the public sector, the mean number of years the radiographers spent in clinical practice was 10,39 years, of which 6,39 years was at their current place of employment as noted in **Table 4.22**. The radiographers in the private sector had a mean number of 13,22 years in clinical practice, of which seven years was at their current place of employment. **Table 4.23** illustrates that there was a significant difference between the radiographers in the public and private sectors in terms of total number of years in clinical practice (p = 0,034), with those in the private sector having significantly more years in clinical practice when compared with those in the public sector.

4.8.2 Work status

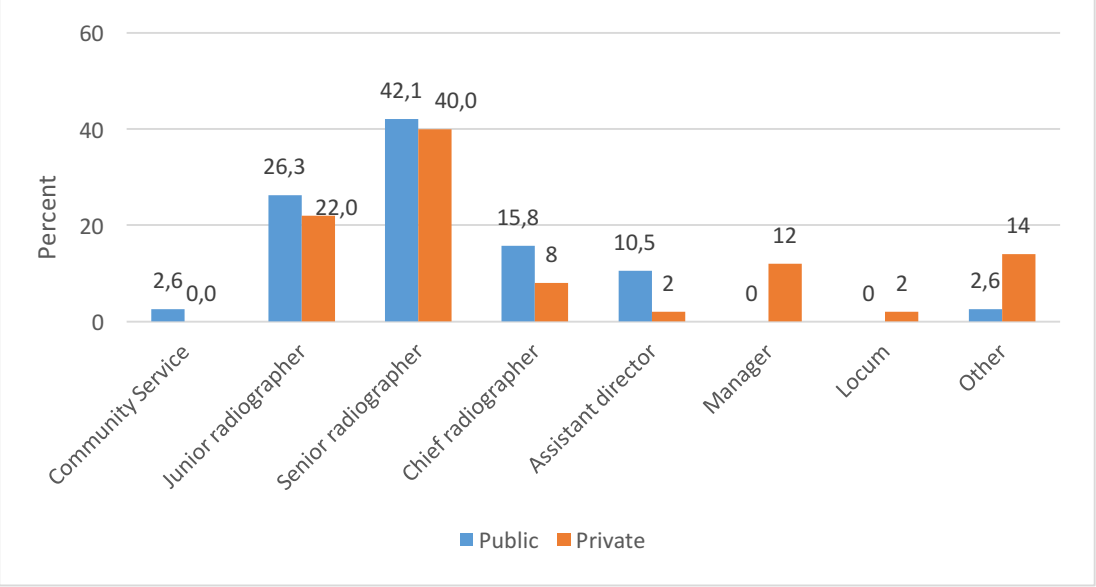

Figure 4.10: Current position of radiographers in public and private sectors

Figure 4.10 illustrates the distribution of work status among the radiographers according to sector of employment. The majority of both the public and private sector radiographers within the sample population of this study were employed as senior radiographers. There were more junior radiographers employed in the public sector (26,3%) as opposed to the private sector (22,0%). There were more chief radiographers in the public sector (15,8%) as opposed to the private sector (8,0%). Although there were also more assistant directors in the public sector (10,5%) as opposed to the private sector (2,0%), the private sector had more managers (12,0%) than the public sector (0%)

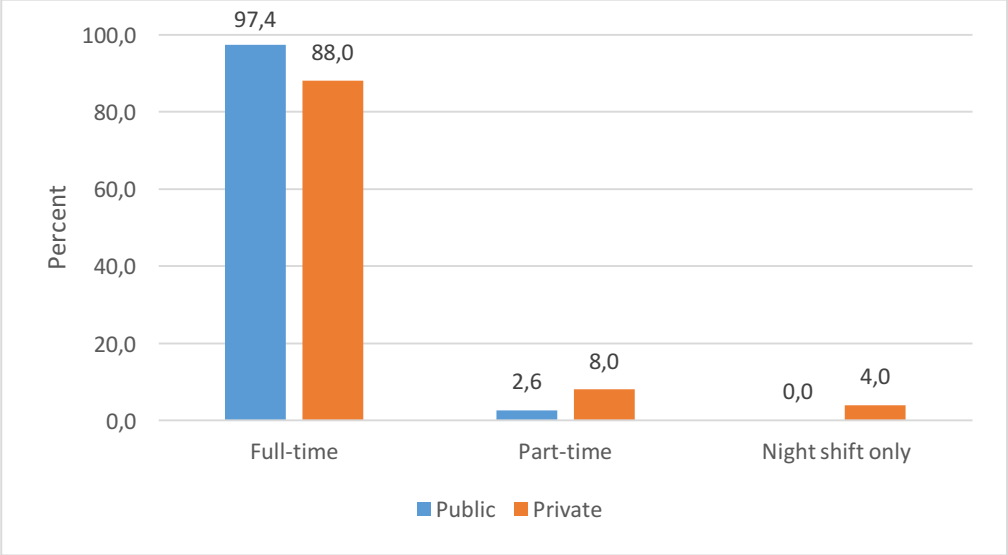

Figure 4.11: Present work status

The majority of radiographers within both sectors (public: 97,4%; private: 88,0%) were employed as full time staff, as illustrated in **Figure 4.11.** The private sector had 4,0% of radiographer working only night shifts, and also had 8,0% of radiographer working part-time. The public sector only had 2,6% of radiographers working part time and no night shift only radiographers.

4.8.3 Modalities

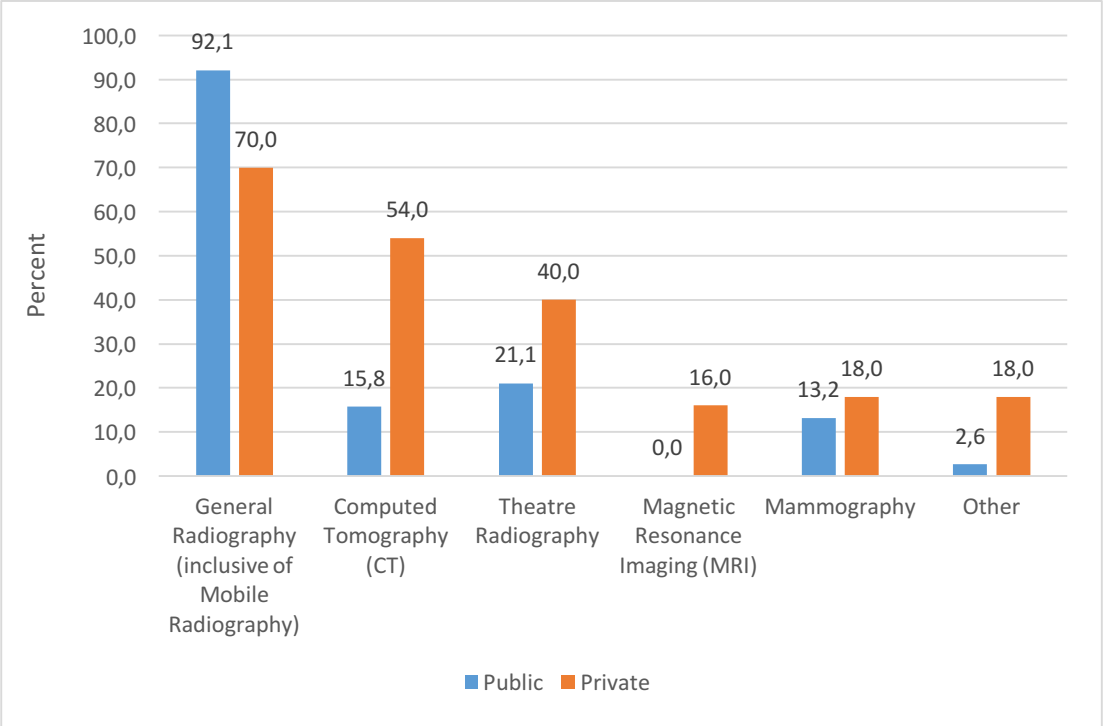

Figure 4.12: Modalities of radiographers

Figure 4.12 illustrates that the majority of the public (92,1%) and the private (70,0%) sector radiographers were working in a general radiographic department which included mobile radiography. The private sector radiographers reported working in: a) computed tomography (54,0%); b) theatre (40,0%); c) Magnetic Resonance Imaging (16,0%); and d) mammography (18,0%). This was in contrast to 15,8%, 21,1%, 0%, and 13,2% of the public sector radiographers working in the same modalities. The 'other' modalities, which included night duty, administration, and self-owned practices, were reported by 18,0% of the private sector radiographers and 2,6% of the public sector radiographers.

4.8.4 Type of x-ray units

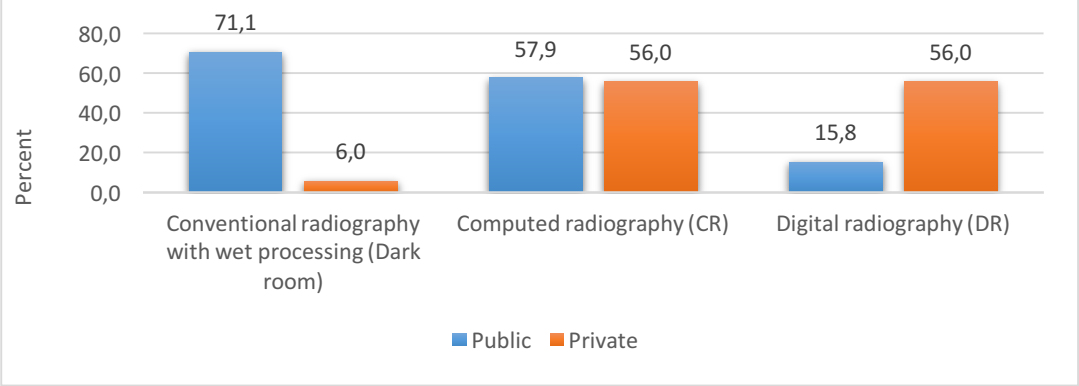

Figure 4.13: Type of x-ray unit

As seen in **Figure 4.13**, 71,0% of the public sector radiographers reported working on conventional radiography x-ray units as opposed to 6,0% of the private sector radiographers. Furthermore, 56,0% of the private sector radiographers reported working on computed radiography x-ray units as well as digital radiography units. This was in contrast to the public sector who reported 57,9% of the radiographers working on computed radiography x-ray units and 15,8% working on digital radiography units.

4.8.5 Age of x-ray equipment

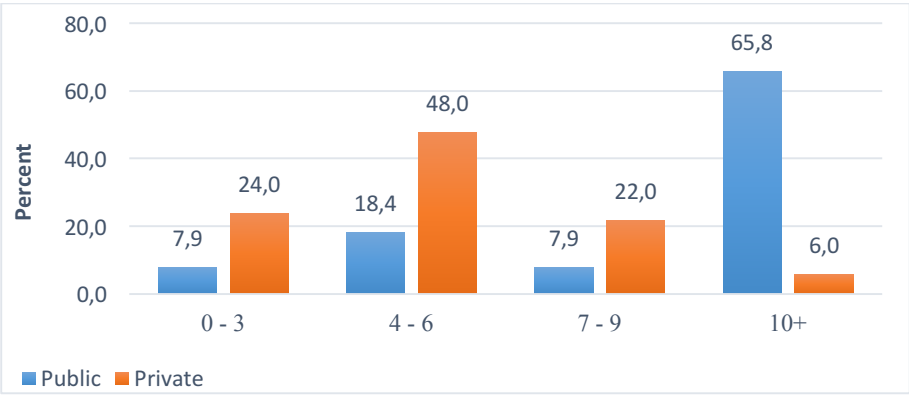

Figure 4.14: Age of x-ray equipment

Figure 4.14 highlights the age of the equipment housed in the radiography departments in both the public and private sectors. A greater percentage

(65,8%) of the radiographers in the public sector reported working on x-ray units older than ten years, as opposed to 6,0% of the private sector radiographers in the same category. There were 22,0% of the private sector radiographers and 7,9% of the public sector radiographers currently working on x-ray units between 7-9 years old. A greater percentage (48,0%) of private sector radiographers reported working with x-ray units that were 4-6 years old as opposed to public sector radiographers (18,4%). Of the radiographers polled, 7,9% in the public sector and 24,0% in the private sector currently worked with x-ray units aged 0-3 years old.

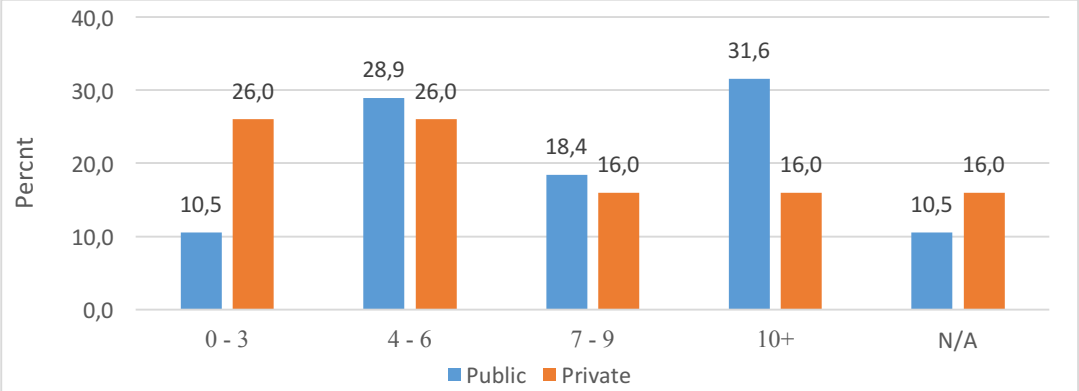

Figure 4.15: Age of mobile x-ray unit/c-arm

Figure 4.15 highlights the age of the mobile x-ray units/c-arms currently in use by the radiography departments in the private and public sectors. Use of mobile units of ten years and older were reported by 31,6% of public sector radiographers as opposed to 16,0% of private sector radiographers. The use of mobile x-ray units/c-arms aged 7-9 years was reported by 18,4% of public sector radiographers and 16,0% of private sector radiographers, while 28,9% of public sector radiographers as opposed to 26,0% of private sector radiographers reported working on mobile units/c-arms aged between 4-6 years. Mobile x-ray units/c-arms aged 0-3 years are currently used by 26,0% of private sector radiographers as opposed to 10,5% of the public sector radiographers.

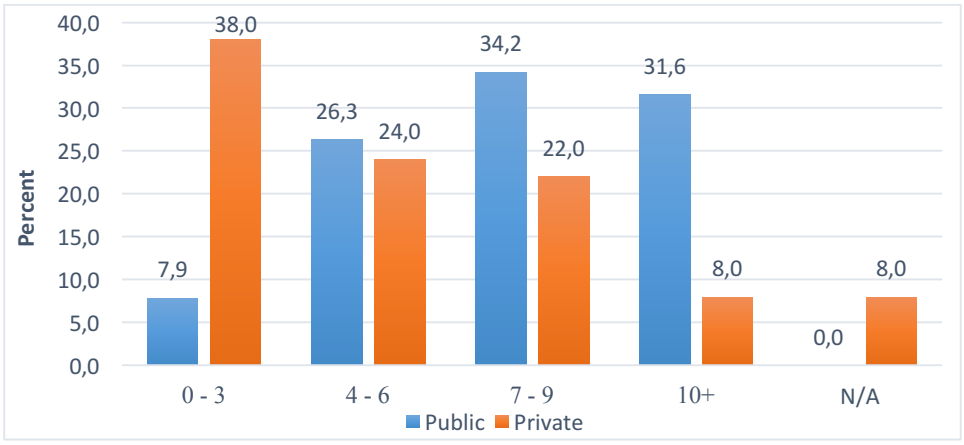

Figure 4.16: Age of lead jackets

It was reported that the majority of the lead jackets used by radiographers in the private sector were between 0-3 years (38,0%) and 4-6 years (24,0%) old. This was in contrast to the lead jackets used by the majority of the radiographers in the public sector, which were reported to be between 7-9 years (34,2%) and older than 10 years (31,6%) as seen in **Figure 4.16** above.

4.8.6 Working hours

Table 4.24: Working hours and days per week

Sector of employment		Hours of work per week	Days of work per week
Public	n	38	38
	Mean	39,32	5,05
Private	n	50	50
	Mean	37,88	5,28

Table 4.24 shows that the public sector radiographers worked an average of 39,3 hours per week and the private sector radiographers worked an average of 37,8 hours per week. The average amount of days worked per week in the public sector were 5,1 days and in the private sector 5,3 days.

4.8.7 Work activities

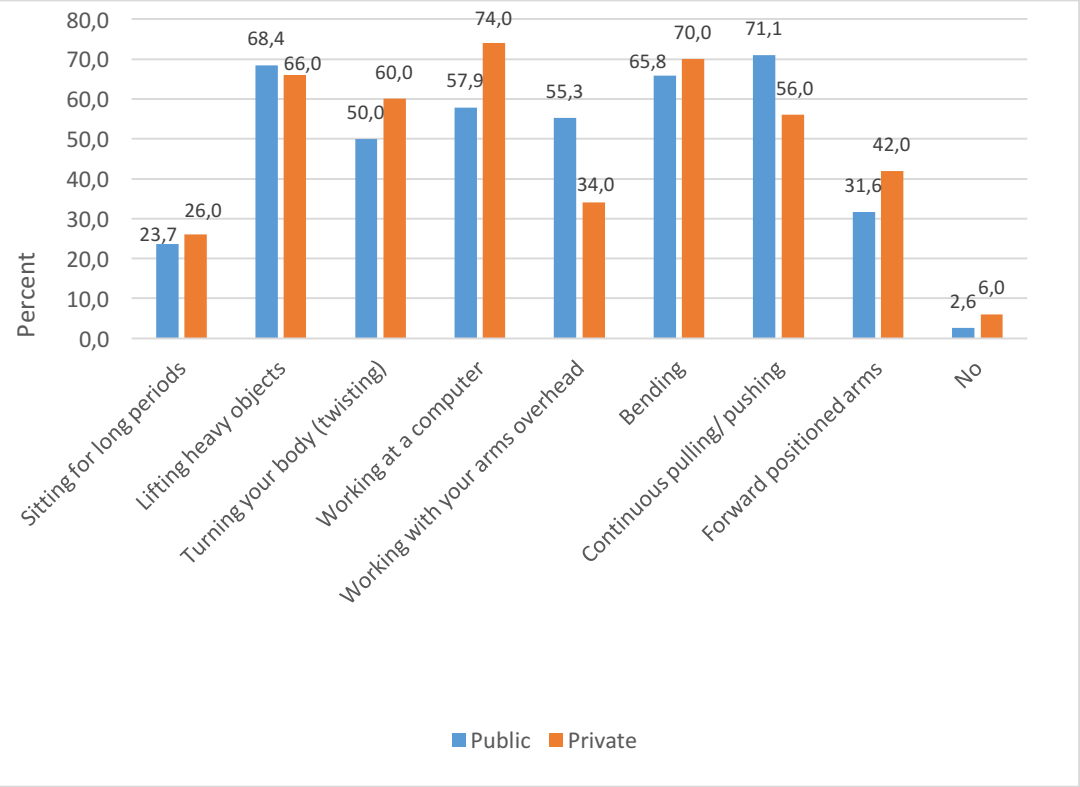

Figure 4.17: Activities at work

Figure 4.17 illustrates that the five most common activities public sector radiographers were exposed to at work included continuous pulling/pushing (71,1%); lifting heavy objects (68,4%); bending (65,8%); working at a computer (57,9%); and working with their arms overhead (55,3%). Similarly, private sector radiographers were mostly exposed to activities such as working at a computer (74,0%); bending (70,0%); lifting heavy objects (66,0%); twisting (60,0%); and continuous pulling/pushing (56,0%).

Table 4.25: Radiographer specific activities at work

	Public	Private
Push around mobile X-ray unit	57,9%	66,0%
Wear a lead apron	55,3%	74,0%
Lift patients	81,6%	84,0%
Transfer patients to a chair/bed	81,6%	88,0%
Position the overhead X-ray tube	81,6%	68,0%
Sit for more than 3 hours	26,3%	30,0%
Stand for more than 3 hours a day	73,7%	74,0%
Push hospital bed-patients	63,2%	72,0%
Carry imaging cassettes	81,6%	50,0%
Work fast due to radiation exposure	68,4%	58,0%
None	2,6%	2,0%

Table 4.25 demonstrates the radiographer-specific activities that radiographers in the public and private sectors are exposed to on a daily basis. On a daily basis, radiographers in the public sector were expected to lift patients (81,6%); transfer patients to a bed/chair (81,6%); position the overhead x-ray tube (81,6%); and carry imaging cassettes (81,6%). To a lesser degree, public sector radiographers were also expected to stand for prolonged hours of the day (73,7%), work fast due to being exposed to radiation (68,4%) and push hospital bed patients (63,2%). Lastly, public sector radiographers were also expected to push around a mobile x-ray unit (57,9%), wear a lead apron (55,3%) and to sit for prolonged hours (26,3%). Private sector radiographers were equally expected to transfer patients to a bed/chair (88,0%); lift patients (84,0%); wear a lead apron (74,0%); stand for prolonged hours (74,0%); push hospital bed patients (72,0%); and position the overhead x-ray tube (68,0%). Lastly, private sector radiographers were also expected to push around the mobile x-ray unit (66,0%); work fast due to radiation exposure (58,0%); carry imaging cassettes (50,0%); and sit for prolonged hours (30,0%).

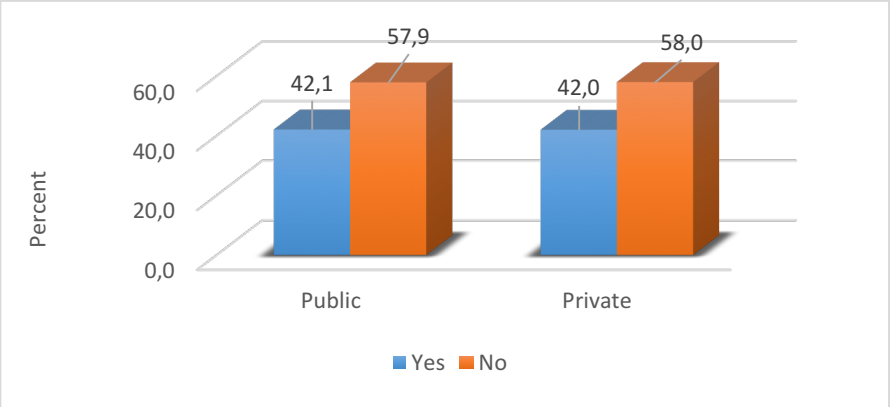

Figure 4.18: Injury at work

Figure 4.18 illustrates that the majority of private sector radiographers (58,0%) and public sector radiographers (57,9%) have not previously injured themselves at work due to any activity expected to be performed by them. There were 42,1% of public sector radiographers and 42,0% of private sector radiographers, however, who reported to have previously injured themselves performing activities at work.

Table 4.26: Chi-square tests comparing injury at work between the two sectors

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.000[a]	1	0,992	1,000	0,582	
Fisher's Exact Test				1,000	0,582	
Linear-by-Linear Association	.000[c]	1	0,992	1,000	0,582	0,172
n of Valid Cases	88					

Table 4.26 further demonstrates that there was no significant relationship between the different sectors with regard to injury at work (p = 1,000). When the radiographers were asked what they were lifting at the time of injury, their responses included lifting a heavy patient; catching a patient; carrying imaging cassettes; wearing a lead apron for long periods; pushing bed patients; transferring a patient to and from a bed/chair; pulling a tight x-ray tube; and pushing/moving of the mobile x-ray unit and other equipment.

4.8.8 Lifting

Table 4.27: Weight of objects being lifted at work

			Sector of employment		Total
			Public	Private	
If your job involves lifting of heavy objects, how much weight (kg) on average do you lift?	1 - 10	Count	7	7	14
		% within Sector of employment	18,4%	14,0%	15,9%
	11 - 20	Count	1	4	5
		% within Sector of employment	2,6%	8,0%	5,7%
	21- 30	Count	3	6	9
		% within Sector of employment	7,9%	12,0%	10,2%
	31 - 40	Count	1	2	3
		% within Sector of employment	2,6%	4,0%	3,4%
	41 - 50	Count	2	0	2
		% within Sector of employment	5,3%	0,0%	2,3%
	51 - 60	Count	2	6	8
		% within Sector of employment	5,3%	12,0%	9,1%
	61 - 70	Count	3	5	8
		% within Sector of employment	7,9%	10,0%	9,1%
	71 - 80	Count	3	6	9
		% within Sector of employment	7,9%	12,0%	10,2%
	81 - 90	Count	3	2	5
		% within Sector of employment	7,9%	4,0%	5,7%
	> 90	Count	3	4	7
		% within Sector of employment	7,9%	8,0%	8,0%
	N/A	Count	10	8	18
		% within Sector of employment	26,3%	16,0%	20,5%

Table 4.27 illustrates that 36,9% of the weight being lifted by public sector radiographers on a daily basis is above 50kg, whereas in the private sector 46,0% of the weights lifted were above 50kg. There were 26,3% of the public sector radiographers and 16,0% of private sector radiographers who reportedly did not do any lifting at work. Overall, 58,0% of all radiographers were exposed to lifting objects weighing more than 20kg. When asked what they were lifting at work, the responses included patients; boxes; imaging cassettes; theatre equipment; detectors; calibration phantoms; x-ray tube; and benches for patients.

Table 4.28: Number of times lifting tasks are required

			Sector of employment		Total
			Public	Private	
On average, how many times a day do you repeat the lifting tasks required of you?	0 - 10	Count	16	28	44
		% within Sector of employment	42,1%	56,0%	50,0%
	11 - 20	Count	6	9	15
		% within Sector of employment	15,8%	18,0%	17,0%
	21 - 30	Count	4	0	4
		% within Sector of employment	10,5%	0,0%	4,5%
	Continuous	Count	9	4	13
		% within Sector of employment	23,7%	8,0%	14,8%

As seen in **Table 4.28** above, the frequency at which the of public sector radiographers were required to perform lifting activities ranged from 0-10 times per day (42,1%); 11-20 times a day (15,8%); 21-30 times a day (10,5%); and lastly, 23,7% were expected to participate in continuous lifting activities. Similarly, 56,0% of private sector radiographers were involved in 0-10 lifting activities per day, 18,0% in 11-20 lifting activities per day, and 8,0% were required to perform continuous lifting activities.

Table 4.29: Relationship between lifting activities and different sectors

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	11.371[a]	4	0,023	0,018	
Fisher's Exact Test	10,775			0,022	
Linear-by-Linear Association	.602[b]	1	0,438	0,482	0,241
n of Valid Cases	88				

As noted in **Table 4.29**, there was a significant relationship between the times required to perform lifting activities and the radiographers working in the different sectors, with the public sector repeating lifting activities 21-30 times a day as well as continuously, more often than the private sector (p = 0,022).

Table 4.30: Number of patients lifted per day

Sector of employment		Number of patients lifted per day
Public	n	38
	Mean	10,18
	Median	8,00
Private	n	50
	Mean	6,18
	Median	5,00

Table 4.30 shows that the average number of patients lifted per day by public sector radiographers was 10,18. In the private sector, radiographers lifted an average of 6,18 patients per day.

Table 4.31: Relationship between sectors for lead apron wear/patients lifted

	Days per month wearing lead apron?	Weight (kg) of lead apron at work.	Number of patients lifted per day?
Asymp. Sig. (2-tailed)	0,484	0,169	0,005

Table 4.31 indicates that there was no significant difference between the two sectors in terms of days of wearing a lead apron per month (p = 0,484) and the weight of the lead apron (p = 0,169). There was a significant relationship, however, between the two sectors in terrms of the number of patients lifted per day (p = 0,005).

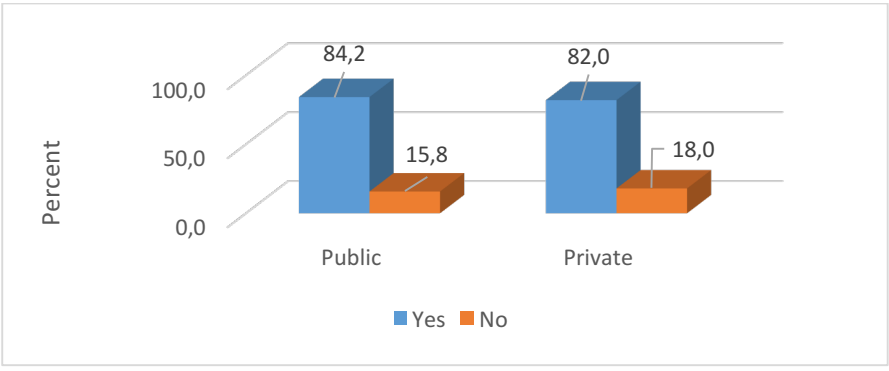

Figure 4.19: Low back pain from lifting a patient

Figure 4.19 illustrates that 84,2% of public sector radiographers and 82,0% of private sector radiographers have previously experienced LBP due to lifting a patient.

4.8.9 Seated hours per day

Table 4.32: Hours seated per day

Sector of employment		How many hours per day are you seated?
Public	n	38
	Mean	3,03
Private	n	50
	Mean	3,02

Table 4.32 shows that the radiographers in both the public and private sectors spend a similar amount of time seated per day, viz. 3,03 hours and 3,02 hours respectively.

4.8.10 Lead apron

Table 4.33: Lead apron

Sector of employment		Hours per day wearing lead apron	Days per month required to wear lead apron	Weight (kg) of lead apron at work.
Public	n	38	38	38
	Mean	1,58	7,47	3,87
	Median	1,00	4,50	3,00
Private	n	50	50	50
	Mean	1,96	8,60	3,12
	Median	1,00	5,00	3,00

Table 4.33 reveals that public sector radiographers spend an average of 1,58 hours per day wearing a lead apron, as opposed to private sector radiographers who reported wearing a lead apron for 1,96 hours per day. Radiographers in the public sector wore a lead apron for an average of 7,47 days every month as opposed to 8,60 days in the private sector. The average

weight of the lead jacket used by radiographers in the public and private sectors was recorded as 3,87kg and 3,12kg respectively.

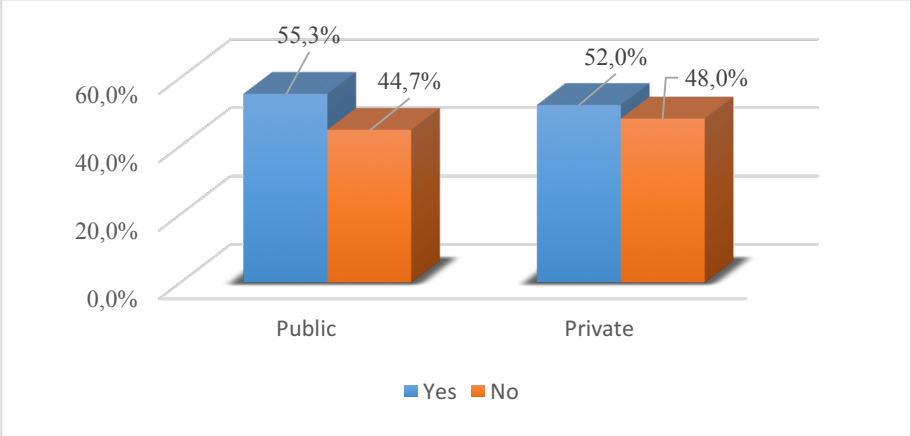

Figure 4.20: Low back pain from wearing a lead apron

Figure 4.20 below illustrates that more public sector radiographers (55,3%) as opposed to private sector radiographers (44,7%) were experiencing LBP due to the wearing of a lead apron.

4.8.11 Mobile x-ray unit

Table 4.34: Days per month working with a mobile x-ray unit

Sector of employment	n	Mean
Public	38	9,32
Private	50	8,38
Total	88	8,78

The public sector radiographers reported an average of 9,32 days per month working with a mobile x-ray unit as opposed to 8,38 days per month reported by the private sector radiographers, indicated in **Table 4.34**.

4.8.12 Physical demands

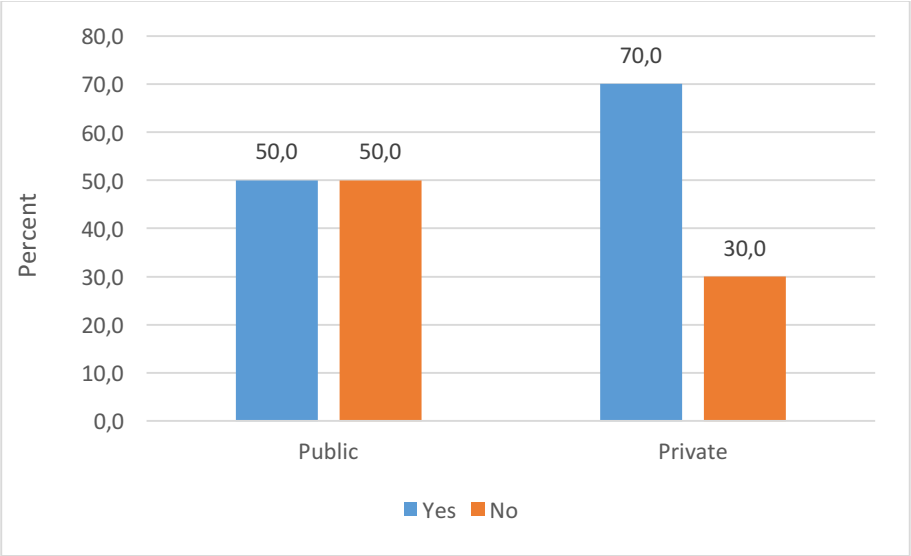

Figure 4.21: Satisfied with physical demands expected at work

Figure 4.21 illustrates that 70,0% of private sector radiographers as opposed to 50,0% of public sector radiographers reported current satisfaction with the physical demands expected from them at work.

Table 4.35: Relationship between sectors for satisfaction with physical demands

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	3.643[a]	1	0,056	0,077	0,046	
Fisher's Exact Test				0,077	0,046	
Linear-by-Linear Association	3.601[c]	1	0,058	0,077	0,046	0,029
n of Valid Cases	88					

As seen above in **Table 4.35**, there was no significant difference between the two sectors with regard to satisfaction of their current physical job demands (*p* = 0,077).

Table 4.36: Reasons for dissatisfaction with current physical demands

Reasons provided	Number of radiographers (n)
Working on feet for prolonged hours	2,94%
Had a work related injury and currently have pain	11,76%
Old / faulty equipment	5,88%
Rooms are too small	2,94%
Staff shortage / too many patients	26,47%
Lifting or moving of heavy / sedated patients	32,35%
Working conditions	5,88%
Job too physical	29,41%
Too many days working with the mobile x-ray unit	2,94%
Job is too stressful	5,88%

The radiographers who were not satisfied with the physical demands expected from them at work provided further explanation for their dissatisfaction, as illustrated in **Table 4.36**.

4.9 Objective 1: Point, period and lifetime prevalence

4.9.1 Point prevalence

Table 4.37: Point prevalence of low back pain

			Sector of employment		Total
			Public	Private	
Do you currently have low back pain? (today)	Yes	Count	16	18	34
		% within Sector of employment	42,1%	36,0%	38,6%
	No	Count	22	32	54
		% within Sector of employment	57,9%	64,0%	61,4%

According to **Table 4.37**, the point prevalence of LBP in radiographers in the public sector was 42,1% as opposed to 36,0% for those in the private sector. The total point prevalence of LBP amongst radiographers was 38,6%. The percentage distributions were similar in the two sectors ($p > 0,05$).

4.9.2 Period prevalence

Table 4.38 Period prevalence for low back pain

			Sector of employment		Total
			Public	Private	
At any time during the past 1 year, have you had low back pain? If yes, indicate the time frame.	No	Count	18	28	46
		% within Sector of employment	47,4%	56,0%	52,3%
	Yes, 0 - < 3 months	Count	4	3	7
		% within Sector of employment	10,5%	6,0%	8,0%
	Yes, 3 - < 6 months	Count	1	0	1
		% within Sector of employment	2,6%	0,0%	1,1%
	Yes, 4 - < 9 months	Count	6	2	8
		% within Sector of employment	15,8%	4,0%	9,1%
	Yes, 9 - < 12 months	Count	9	17	26
		% within Sector of employment	23,7%	34,0%	29,5%

Table 4.38 shows that the period prevalence for LBP in radiographers in the public sector was 10,5% (0-3 months); 2,6% (3-6 months); 15,8% (4-9 months); and 23,7% (9-12 months). The period prevalence for LBP in radiographers in the private sector for the same time periods were recorded as 6,0%, 0%, 4,0%, and 34,0% respectively. The cumulative annual prevalence for LBP in radiographers in the public and in the private sectors were recorded as 52,6% and 44,0%. There was no significant difference between the two sectors in terms of period prevalence of LBP ($p > 0,05$).

4.9.1 Lifetime prevalence

Table 4.39 Lifetime prevalence for low back pain

			Sector of employment		Total
			Public	Private	
Have you ever had low back pain?	Yes	Count	34	45	79
		% within Sector of employment	89,5%	90,0%	89,8%
	No	Count	4	5	9
		% within Sector of employment	10,5%	10,0%	10,2%

According to **Table 4.39** the lifetime prevalence for LBP in radiographers in the public and private sectors was 89,5% and 90,0% respectively. The total lifetime prevalence for LBP in radiographers was 89,8%. No significant difference was noted between the two sectors in terms of lifetime prevalence of LBP ($p > 0,05$).

4.10 Objective 2: Nature, severity and clinical presentation of low back pain

4.10.1 Severity of current and past low back pain

Table 4.40: Current low back pain severity

How would you score your current low back pain? (0 being no pain, 10 being the worst pain)

Sector of employment	n	Mean	Median	Std. Deviation	Minimum	Maximum	Range
Public	16	5,88	5,50	2,187	2	10	8
Private	15	4,60	5,00	0,828	3	6	3

Table 4.40 demonstrates the severity of LBP in radiographers from both sectors with current LBP. The public sector radiographers rated their current LBP as an average of 5,88 on a 0-10 pain rating scale (where 0 means no pain at all and 10 means worst pain imaginable). The private sector radiographers rated their current LBP as an average of 4,60 on a 0-10 pain rating scale.

Table 4.41: Past low back pain severity

How would you score the past low back pain? (0 being no pain, 10 being the worst pain)

Sector of employment	n	Mean	Median	Std. Deviation	Minimum	Maximum	Range
Public	21	5,90	5,00	2,406	2	10	8
Private	30	5,20	5,00	2,398	1	10	9

Table 4.41 shows the severity of LBP in radiographers from both sectors with past LBP. The public sector radiographers rated their past LBP as an average of 5,90 on a 0-10 pain rating scale and the private sector radiographers rated their past LBP as an average of 5,20 on a 0-10 pain rating scale. There was a

significant relationship between the two sectors in terms of current LBP severity, with the public sector rating their LBP higher than the private sector (p = 0,031). There were no significant differences, however, between the sectors in terms of past LBP.

4.10.2 Nature of current and past low back pain

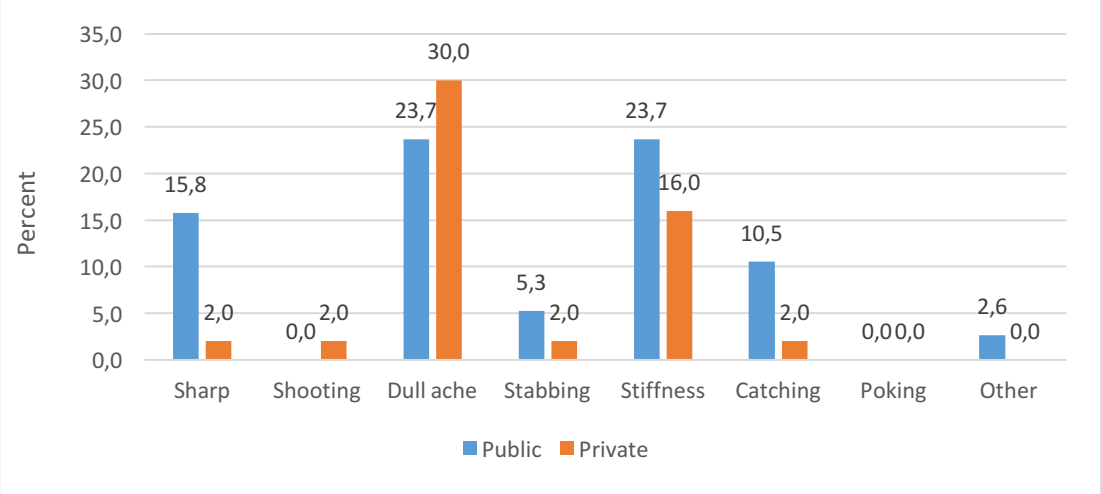

Figure 4.22: Current low back pain nature

Figure 4.22 illustrates that radiographers in the public sector described their current LBP as a) stiffness (23,7%); b) a dull ache (23,7%); c) a sharp pain (15,8%); d) a catching pain (10,5%); and e) a stabbing pain (5,3%). Radiographers in the private sector recorded their current LBP as stiffness (16,0%); a dull ache (30,0%); as sharp pain (2,0%); a catching pain (2,0%); and a stabbing pain (2,0%). In addition to the aforementioned categories of pain, 2,0% of the radiographers in the private sector reported their current LBP as a shooting pain.

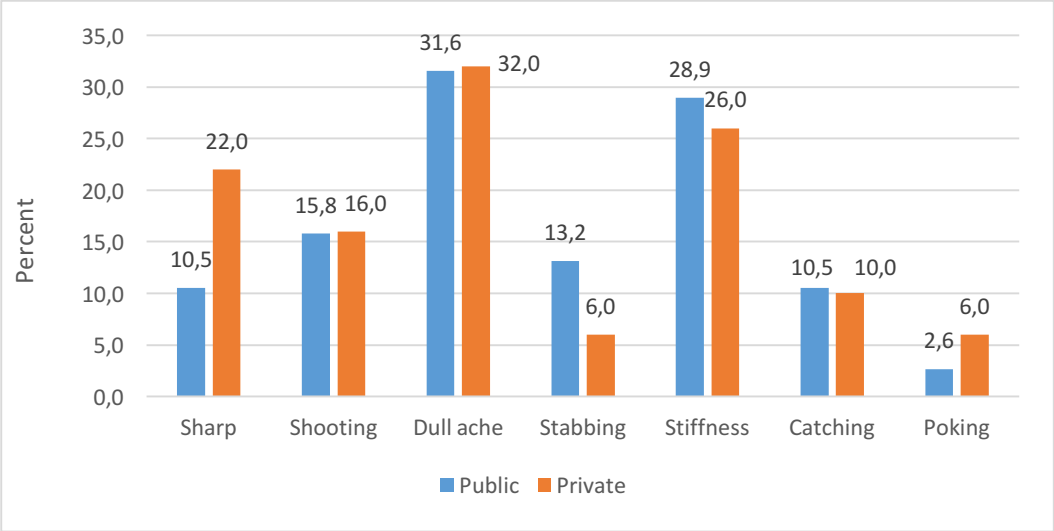

Figure 4.23: Past low back pain nature

With reference to past LBP, **Figure 4.23** highlights that 31,6% of public sector radiographers described the pain as a dull ache; 28,9% as stiffness;15,8% as shooting pain; 13,2% as stabbing pain; 10,5% as sharp pain; 10,5% as catching pain; and 2,6% as poking pain. Radiographers in the private sector recorded their past LBP as a dull ache (32,0%); as stiffness (26,0%); as sharp pain (22,0%); as shooting pain (16,0%); as catching pain (10,0%); as stabbing pain (6,0%); and as a poking pain (6,0%).

4.10.3 Location of pain

Table 4.42: Location of current low back pain

			Sector of employment		Total
			Public	Private	
Is the location of the low back pain one side or both sides?	One side-left	Count	0	1	1
		% within Sector of employment	0,0%	6,7%	3,2%
	One side-right	Count	4	1	5
		% within Sector of employment	25,0%	6,7%	16,1%
	Both sides	Count	12	13	25
		% within Sector of employment	75,0%	86,7%	80,6%

Table 4.42 demonstrates that 75,0% of public sector radiographers and 86,7% of private sector radiographers had current bilateral LBP (pain on both sides). Twenty-five percent of public sector radiographers had current right-sided LBP only, and none of the public sector radiographers had current left-sided LBP only. There was 6,7% of the private sector radiographers who had only current right-sided LBP and 6,7% who only had current left-sided LBP. Overall, 80,6% of the radiographers had current bilateral LBP. There was no significant difference between the two sectors with regard to the location of current LBP (p = 0,333).

Table 4.43: Location of past low back pain

			Sector of employment		Total
			Public	Private	
Was the location of the low back pain one side or both sides?	One side-left	Count	2	5	7
		% within Sector of employment	9,5%	16,7%	13,7%
	One side-right	Count	4	9	13
		% within Sector of employment	19,0%	30,0%	25,5%
	Both sides	Count	15	16	31
		% within Sector of employment	71,4%	53,3%	60,8%

Table 4.43 demonstrates that 71,4% of public sector radiographers and 53,3% of private sector radiographers had past bilateral LBP (pain on both sides). Nineteen percent of public sector radiographers had past right-sided LBP only, with 9,5% of public sector radiographers having past left-sided LBP only. Of the private sector radiographers, 30,0% had only past right-sided LBP and 16,7% only had past left-sided LBP. Overall, 60,8% of radiographers had past bilateral LBP, 25,5% had right-sided LBP and 13,7% had left sided LBP only. There was no significant difference between the two sectors with regard to the location of past LBP (p = 0,425)

4.10.4 Associated signs and symptoms

Table 4.44: Pins and needles with current low back pain

			Sector of employment		Total
			Public	Private	
Do you ever get the feeling of pins and needles in your legs when the low back pain presents?	Yes	Count	8	5	13
		% within Sector of employment	50,0%	33,3%	41,9%
	No	Count	8	10	18
		% within Sector of employment	50,0%	66,7%	58,1%

According to **Table 4.44**, 50,0% of public sector radiographers and 33,3% of private sector radiographers reported experiencing a 'pins and needles' sensation in their legs in conjunction with their current LBP. There was no significant relationship between the two sectors in terms of 'pins and needles' with their current LBP (p = 0,473).

Table 4.45: Pins and needles with past low back pain

			Sector of employment		Total
			Public	Private	
Did you ever get the feeling of pins and needles in your legs when the low back pain presented?	Yes	Count	9	9	18
		% within Sector of employment	42,9%	30,0%	35,3%
	No	Count	12	21	33
		% within Sector of employment	57,1%	70,0%	64,7%

In addition, **Table 4.45** demonstrates that 42,9% of public sector radiographers and 30,0% of private sector radiographers experienced a 'pins and needles' sensation in their legs, when their past LBP presented. There was no significant relationship between the two sectors in terms of 'pins and needles' with their past LBP (p = 0,385).

Table 4.46: Numbness with current low back pain

			Sector of employment		Total
			Public	Private	
Do you ever get a numb feeling in your legs and feet when the low back pain presents?	Yes	Count	7	3	10
		% within Sector of employment	43,8%	20,0%	32,3%
	No	Count	9	12	21
		% within Sector of employment	56,3%	80,0%	67,7%

Table 4.47: Numbness with past low back pain

			Sector of employment		Total
			Public	Private	
Did you ever get a numb feeling in your legs and feet when the low back pain presented?	Yes	Count	6	5	11
		% within Sector of employment	28,6%	16,7%	21,6%
	No	Count	15	25	40
		% within Sector of employment	71,4%	83,3%	78,4%

Table 4.46 illustrates that 43,8% of public sector radiographer and 20,0% of private sector radiographers reported experiencing numbness in their legs/feet along with their current LBP. Similarly, 28,6% of public sector radiographers and 16,7% of private sector radiographers reported experiencing numbness in their legs/feet along with their past LBP, as seen in **Table 4.47.** No significant differences were noted between the two sectors in terms of numbness in the legs/feet and current LBP (p = 0,252) and numbness in the legs/feet and past LBP (p = 0,327).

Table 4.48: Other associated current low back pain symptoms

Symptom experienced	Public	Private
Weakness/fatigue of the legs:	13,63%	14,29%
Hip pain	4,55%	0%
Muscle cramps	4,55%	0%

Table 4.48 highlights other current LBP-associated signs and symptoms reported by the public sector radiographers, which included weakness/fatigue of the legs (13,63%), hip pain (4,55%) and muscle cramps (4,55%). This was in contrast to the private sector radiographers who only reported weakness/fatigue of the legs (14,29%). There was no signicant difference

between the two sectors in terms of current LBP and other associated symptoms (p = 0,723).

Table 4.49: Other associated past low back pain symptoms

Symptom experienced	Public	Private
Weakness/fatigue of the legs:	35,29%	50,00%
Hip pain	0%	5,00%

Table 4.49 demonstrates other past LBP-associated signs and symptoms reported by the public sector radiographers, which included weakness/fatigue of the legs (35,29%), hip pain (4,55%) and muscle cramps (4,55%). Similarly, other past LBP associated signs and symptoms reported by the private sector radiographers included weakness/fatigue of the legs (50,00%) and hip pain (5,00%). There was no signicant difference between the two sectors in terms of current LBP and other associated symptoms (p = 0,644).

4.10.5 Number of days with current and past low back pain

Table 4.50: Approximate number of days with current low back pain

Sector of employment	n	Mean	Median	Std. Deviation
Public	16	132,38	70,00	139,768
Private	15	114,20	90,00	114,745

Table 4.51: Approximate number of days with past low back pain

Sector of employment	n	Mean	Median	Std. Deviation
Public	21	104,62	50,00	134,724
Private	30	77,97	20,50	122,887

Radiographers in the public sector experienced their current LBP for an average of 132,38 days as compared with an average 114,20 days of current LBP experienced by the private sector radiographers, shown in **Table 4.50**. The public sector radiographers with past LBP reported experiencing past LBP for 104,62 days on average, whereas the private sector radiographers with

past LBP reported experiencing LBP for an average of 77,97 days, as seen in **Table 4.51.** There was no significant relationship between the two sectors in terms of days of experiencing current LBP (p = 0,921) and past LBP (p = 0,283).

4.10.6 Duration of current and past low back pain

Table 4.52: Duration of current low back pain

			Sector of employment	
			Public	Private
Is the low back pain constant or intermittent?	Constant	Count	7	3
		% within Sector of employment	43,8%	20,0%
	Intermittent	Count	9	12
		% within Sector of employment	56,3%	80,0%

The majority of public sector radiographers with current LBP described the duration of their current LBP as intermittent (56,3%), as opposed to constant (43,8%). Similarly, the majority of private sector radiographers described their current LBP duration as intermittent (80,0%), as opposed to constant (20,0%), as shown in **Table 4.52**.

Table 4.53: Duration of past low back pain

			Sector of employment	
			Public	Private
Was the low back pain constant or intermittent?	Constant	Count	7	8
		% within Sector of employment	33,3%	26,7%
	Intermittent	Count	14	22
		% within Sector of employment	66,7%	73,3%

With regard to the duration of pain associated with past LBP (**Table 4.53)**, the majority of public sector radiographers (66,7%) and private sector radiographers (72,3%) described pain as intermittent. Constant pain was reportedly experienced by 33,3% of the public sector radiographers and 26,7% the private sector radiographers. There were no significant differences between the two sectors in terms of the duration of current LBP (p = 0,252) and past LBP (p = 0,757).

4.10.7 Low back pain while seated

Table 4.54: Current low back pain due to work chair

			Sector of employment		Total
			Public	Private	
I can only sit in my work chair for "x" amount of time before experiencing low back pain.	10 minutes	Count	2	0	2
		% within Sector of employment	12,5%	0,0%	6,5%
	30 minutes	Count	5	7	12
		% within Sector of employment	31,3%	46,7%	38,7%
	60 minutes	Count	2	5	7
		% within Sector of employment	12,5%	33,3%	22,6%
	120 minutes	Count	3	1	4
		% within Sector of employment	18,8%	6,7%	12,9%
	None	Count	4	2	6
		% within Sector of employment	25,0%	13,3%	19,4%

Table 4.54 reveals that the duration the public sector radiographers with current LBP could sit in their work chair for before experiencing LBP was 10 minutes (12,5%); 30 minutes (31,5%); 60 minutes (12,5%); and 120 minutes (18,8%). Of the public sector radiographers with current LBP however, 25,0% stated that sitting at their work chair did not aggravate their LBP. Similarly, the public sector radiographers with current LBP reported to experience LBP after being seated in their work chair for 10 minutes (0%); 30 minutes (46,7%); 60 minutes (33,3%); and 120 minutes (6,7%). Only 13,3% of private sector radiographers with current LBP did not experience LBP from their work chair.

Table 4.55: Past low back pain due to work chair

			Sector of employment		Total
			Public	Private	
I could only sit in my work chair for "x" amount of time before experiencing low back pain.	10 minutes	Count	3	2	5
		% within Sector of employment	14,3%	6,7%	9,8%
	30 minutes	Count	8	8	16
		% within Sector of employment	38,1%	26,7%	31,4%
	60 minutes	Count	3	5	8
		% within Sector of employment	14,3%	16,7%	15,7%
	120 minutes	Count	2	2	4
		% within Sector of employment	9,5%	6,7%	7,8%
	180 minutes	Count	1	0	1
		% within Sector of employment	4,8%	0,0%	2,0%
	None	Count	4	13	17
		% within Sector of employment	19,0%	43,3%	33,3%

Table 4.55 reveals the duration that public sector radiographers with past LBP could remain seated in their work chairs before experiencing LBP, viz. 10 minutes (14,3%); 30 minutes (38,1%); 60 minutes (14,3%); 120 minutes (9,5%); and 180 minutes (4,8%). Nineteen percent of the public sector radiographers with past LBP stated that sitting at their work chair did not aggravate their LBP. Similarly, the public sector radiographers with past LBP reported experiencing LBP after being seated in their work chair for 10 minutes (6,7%); 30 minutes (26,7%); 60 minutes (16,7%); and 120 minutes (6,7%). It is noted that 43,3% of private sector radiographers with past LBP did not experience LBP from sitting at their work chair.

4.10.8 Current and past low back pain affecting activities of daily living

Table 4.56: Current low back pain affecting activities of daily living

			Sector of employment		Total
			Public	Private	
Does the current low back pain make it difficult to perform activities of daily living?	Yes	Count	9	7	16
		% within Sector of employment	56,3%	46,7%	51,6%
	No	Count	7	8	15
		% within Sector of employment	43,8%	53,3%	48,4%

Table 4.57: Past low back pain affected activities of daily living

			Sector of employment		Total
			Public	Private	
Did the past low back pain make it difficult to perform activities of daily living?	Yes	Count	13	17	30
		% within Sector of employment	61,9%	56,7%	58,8%
	No	Count	8	13	21
		% within Sector of employment	38,1%	43,3%	41,2%

Table 4.56 below demonstrates that 56,3% of public sector radiographers and 46,7% of private sector radiographers reported that their current LBP was affecting their activities of daily living. Similarly, **Table 4.57** demonstrates that 61,9% of public sector radiographers and 56,7% of private sector

radiographers with past LBP reported that their past LBP affected their activities of daily living.

4.10.9 Current and past low back pain affecting leisure activities

Table 4.58: Current low back pain affecting leisure activities

			Sector of employment		Total
			Public	Private	
Does the current low back pain affect your leisure activities?	Yes	Count	12	8	20
		% within Sector of employment	75,0%	53,3%	64,5%
	No	Count	4	7	11
		% within Sector of employment	25,0%	46,7%	35,5%

Table 4.58 displays that 75,0% of the public sector radiographers and 53,3% of the private sector radiographers with current LBP reported that their current LBP was affecting their leisure activities.

Table 4.59: Past low back pain affecting leisure activities

			Sector of employment		Total
			Public	Private	
Did the past low back pain affect your leisure activities?	Yes	Count	11	19	30
		% within Sector of employment	52,4%	63,3%	58,8%
	No	Count	10	11	21
		% within Sector of employment	47,6%	36,7%	41,2%

Table 4.59 indicates that 52,4% of public sector radiographers and 63,3% of private sector radiographers with past LBP reported that their past LBP affected their leisure activities.

4.10.10 Bed rest for current and past low back pain

Table 4.60: Bed rest for current low back pain

			Sector of employment		Total
			Public	Private	
Have you ever needed bed rest for your current low back pain?	Yes	Count	13	6	19
		% within Sector of employment	81,3%	40,0%	61,3%
	No	Count	3	9	12
		% within Sector of employment	18,8%	60,0%	38,7%

Table 4.60 demonstrates that 81,3% of the public sector radiographers and 40,0% of the private sector radiographers with current LBP reportedly needed bed rest for their current LBP. While the public sector radiographers reported needing twice as much bed rest for current LBP than private sector radiographers, no significant difference was noted between the two sectors in terms of bed rest needed for current LBP (p = 0,029).

Table 4.61: Bed rest for past low back pain

			Sector of employment		Total
			Public	Private	
Did you ever need bed rest for your low back pain?	Yes	Count	15	14	29
		% within Sector of employment	71,4%	46,7%	56,9%
	No	Count	6	16	22
		% within Sector of employment	28,6%	53,3%	43,1%

Table 4.61 indicates that 71,4% of the public sector radiographers and 46,7% of the private sector radiographers with past LBP reportedly needed bed rest. There was no significant difference between the two sectors in terms of bed rest needed for past LBP (p = 0,094).

4.10.11 Onset of current and past low back pain

Table 4.62: Onset of current low back pain

			Sector of employment		Total
			Public	Private	
How did your current low back pain begin?	Gradually over time	Count	10	10	20
		% within Sector of employment	62,5%	66,7%	64,5%
	Suddenly	Count	4	4	8
		% within Sector of employment	25,0%	26,7%	25,8%
	Not sure	Count	2	1	3
		% within Sector of employment	12,5%	6,7%	9,7%

With regard to the onset of current LBP, **Table 4.62** highlights that 62,5% of public sector radiographers and 66,7% of private sector radiographers reported that their current LBP started gradually over time. While 25,0% of public sector radiographers and 26,7% of private sectors who reported sudden onset, 12,5% of public sector radiographers and 6,7% of private sector radiographers with current LBP were not sure how their current LBP started. There was no significant difference between the two sectors in terms of onset of current LBP (p = 1,000).

Table 4.63: Onset of past low back pain

			Sector of employment		Total
			Public	Private	
How did your low back pain begin?	Gradually over time	Count	10	11	21
		% within Sector of employment	47,6%	36,7%	41,2%
	Suddenly	Count	8	14	22
		% within Sector of employment	38,1%	46,7%	43,1%
	Not sure	Count	3	5	8
		% within Sector of employment	14,3%	16,7%	15,7%

Table 4.63 demonstrates that 47,6% of public sector radiographers and 36,7% of private sector radiographers reported that their past LBP started gradually over time. There were 38,1% of public sector radiographers and 46,7% of private sector radiographers who reported their past LBP started suddenly.

Lastly, 14,3% of public sector radiographers and 16,7% of private sector radiographers with past LBP were not sure how their past LBP started. There was no significant difference between the two sectors in terms of onset of past LBP (p = 0,745).

4.10.12 Attributing factors of current and past low back pain

Table 4.64: Current low back pain at work

			Sector of employment		Total
			Public	Private	
Do you have current low back pain only at work?	Yes	Count	8	7	15
		% within Sector of employment	50,0%	46,7%	48,4%
	No	Count	8	8	16
		% within Sector of employment	50,0%	53,3%	51,6%

Table 4.64 demonstrates that 50,0% of public sector radiographers and 46,7% of private sector radiographers reported only having current LBP at work.

Table 4.65: Current low back pain at home

			Sector of employment		Total
			Public	Private	
Do you have current low back pain only at home?	Yes	Count	0	1	1
		% within Sector of employment	0,0%	6,7%	3,2%
	No	Count	16	14	30
		% within Sector of employment	100,0%	93,3%	96,8%

Table 4.65 indicates that 0% of public sector radiographers and 6,7% of private sector radiographers who reportedly only had current LBP at work.

Table 4.66: Current low back pain on weekends and days off

			Sector of employment		Total
			Public	Private	
Does the low back pain get better over weekends/days off from work?	Yes	Count	13	12	25
		% within Sector of employment	81,3%	80,0%	80,6%
	No	Count	3	3	6
		% within Sector of employment	18,8%	20,0%	19,4%

Table 4.66 shows that 81,3% of public sector radiographers and 80,0% of private sector radiographers reported that their current LBP improved over weekends and holidays.

Table 4.67: Past low back pain at work

			Sector of employment		Total
			Public	Private	
Did you have low back pain only at work?	Yes	Count	11	8	19
		% within Sector of employment	52,4%	26,7%	37,3%
	No	Count	10	22	32
		% within Sector of employment	47,6%	73,3%	62,7%

Table 4.67 demonstrates that 52,4% of public sector radiographers and 26,7% of private sector radiographers reported having had past LBP only at work.

Table 4.68: Past low back pain at home

			Sector of employment		Total
			Public	Private	
Did you have low back pain only at home?	Yes	Count	5	3	8
		% within Sector of employment	23,8%	10,0%	15,7%
	No	Count	16	27	43
		% within Sector of employment	76,2%	90,0%	84,3%

Table 4.68 indicates that 23,8% of public sector radiographers and 10,0% of private sector radiographers reportedly had past LBP only at home.

Table 4.69: Past low back pain on weekends and days off

			Sector of employment		Total
			Public	Private	
Did the low back pain get better over weekends/days off from work?	Yes	Count	13	20	33
		% within Sector of employment	61,9%	66,7%	64,7%
	No	Count	8	10	18
		% within Sector of employment	38,1%	33,3%	35,3%

Table 4.69 shows that 61,9% of public sector radiographers and 66,7% of private sector radiographers reported that their past LBP improved over weekends and holidays.

4.10.13 Work-related current and past low back pain

Table 4.70: Work-related current low back pain

			Sector of employment		Total
			Public	Private	
Do you think your low back pain is related to your work?	Yes	Count	14	13	27
		% within Sector of employment	87,5%	86,7%	87,1%
	No	Count	2	2	4
		% within Sector of employment	12,5%	13,3%	12,9%

Table 4.70 demonstrates that 87,5% of public sector radiographers and 86,7% of private sector radiographers reported that the cause of their current LBP was work-related. There was no significant difference between the two sectors (p = 1,000).

Table 4.71: Work-related past low back pain

			Sector of employment		Total
			Public	Private	
Do you think your past low back pain was related to your work?	Yes	Count	18	23	41
		% within Sector of employment	85,7%	76,7%	80,4%
	No	Count	3	7	10
		% within Sector of employment	14,3%	23,3%	19,6%

Table 4.71 identifies that 85,7% of public sector radiographers and 76,7% of private sector radiographers reported that the cause of their past LBP was work-related. There was no significant difference between the two sectors (p = 0,495).

4.10.14 Aggravating factors to current and past low back pain

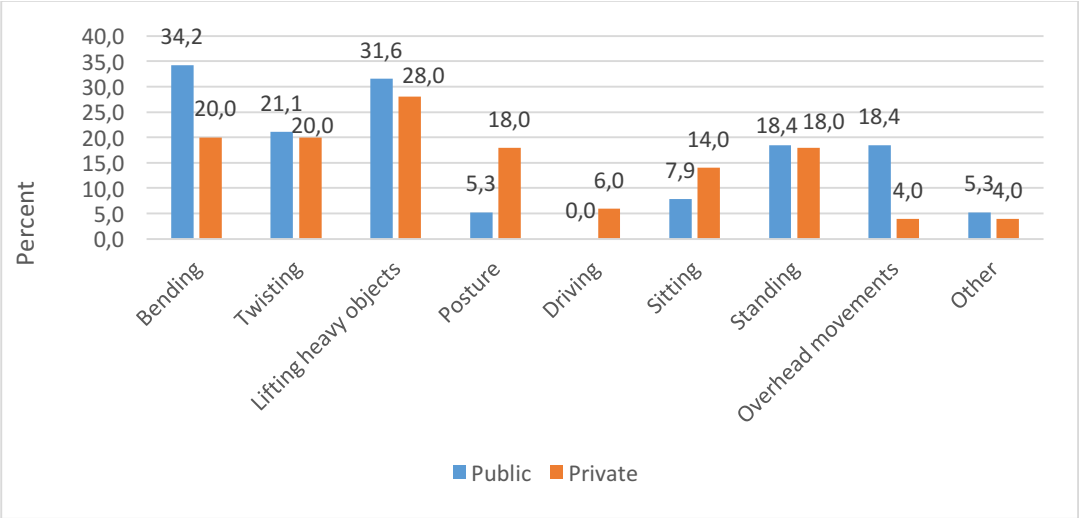

Figure 4.24 Current low back pain aggravating factors

Figure 4.24 illustrates the factors that reportedly aggravate current LBP. These were reported by the public sector radiographers as bending (34,2%); lifting of heavy objects (31,6%); twisting (21,1%); standing (18,4%); overhead movements (18,4%); sitting (7,9%); and posture (5,3%). The aggravating factors reported by the private sector radiographers included lifting heavy objects (28,0%); bending (20,0%); twisting (20,0%); posture (18,0%); standing (18,0%); sitting (14,0%); driving (6,0%); and overhead movements (4,0%).

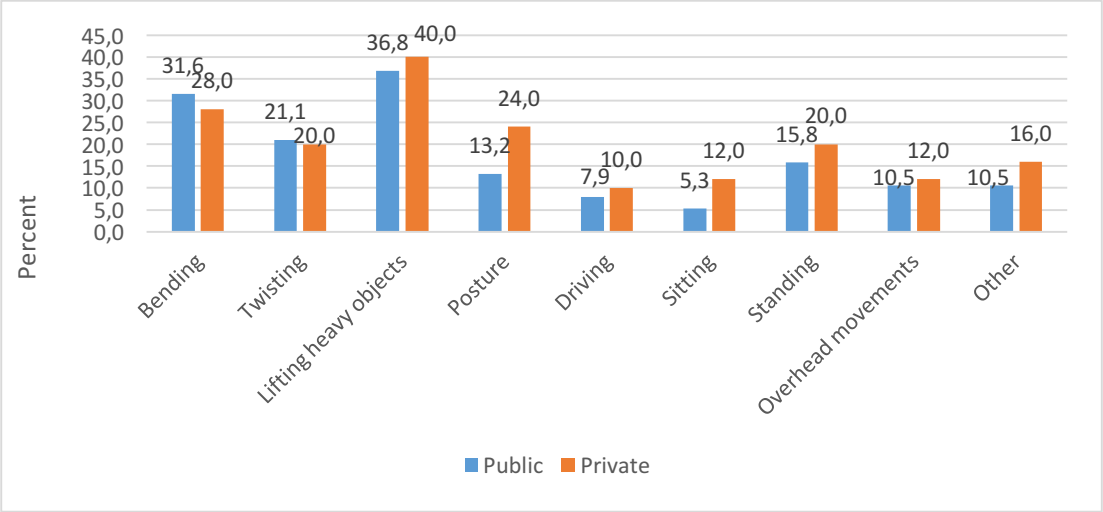

Figure 4.25 Past low back pain aggravating factors

Figure 4.25 illustrates the factors that reportedly aggravate past LBP. These were reported by radiographers in the public sector as lifting heavy objects (36,8%); bending (31,6%); twisting (21,1%); standing (15,8%); posture (13,2%); overhead movements (10,5%); driving (7,9%); and sitting (5,3%). The aggravating factors reported by private sector radiographers included lifting heavy objects (40,0%); bending (28,0%); posture (24,0%); twisting (20,0%); standing (20,0%); sitting (12,0%); overhead movements (12,0%); and driving (10,0%).

Table 4.72: Work aggravated current low back pain

			Sector of employment		Total
			Public	Private	
Do you feel your work activities aggravate your current low back pain?	Yes	Count	14	13	27
		% within Sector of employment	87,5%	86,7%	87,1%
	No	Count	2	2	4
		% within Sector of employment	12,5%	13,3%	12,9%

Table 4.72 identifies that 87,5% of public sector radiographers and 86,7% of private sector radiographers with current LBP who reported their work as an aggravating factor to their current LBP. There were no signicant differences between the two sectors in terms of work aggravated LBP (p = 1,000).

Table 4.73: Work aggravated past low back pain

			Sector of employment		Total
			Public	Private	
Do you feel your work activities aggravate your past low back pain?	Yes	Count	18	24	42
		% within Sector of employment	85,7%	80,0%	82,4%
	No	Count	3	6	9
		% within Sector of employment	14,3%	20,0%	17,6%

Table 4.73 demonstrates that there were 85,7% of public sector radiographers and 80,0% of private sector radiographers with past LBP, who reported their work as an aggravating factor to their past LBP. There were no signicant differences between the two sectors in terms of work aggravated LBP (p = 0,335).

4.10.15 Treatment for current and past low back pain

Table 4.74: Treatment for current low back pain

			Sector of employment		Total
			Public	Private	
Have you ever received treatment for your current low back pain?	Yes	Count	12	9	21
		% within Sector of employment	75,0%	60,0%	67,7%
	No	Count	4	6	10
		% within Sector of employment	25,0%	40,0%	32,3%

Table 4.74 identifies that 75,0% of public sector radiographers and 60,0% of private sector radiographers with current LBP who have received treatment for their current LBP. There was no significant relationship between the two sectors in terms of treatment sought for current LBP (p = 0,458).

Table 4.75: Treatment for past low back pain

			Sector of employment		Total
			Public	Private	
Have you ever received treatment for your past low back pain?	Yes	Count	15	21	36
		% within Sector of employment	71,4%	70,0%	70,6%
	No	Count	6	9	15
		% within Sector of employment	28,6%	30,0%	29,4%

Table 4.75 notes that 71,4% of public sector radiographers and 70,0% of private sector with past LBP who had received treatment for their past LBP. There was no significant relationship between the two sectors in terms of treatment sought for past LBP (p = 1,000).

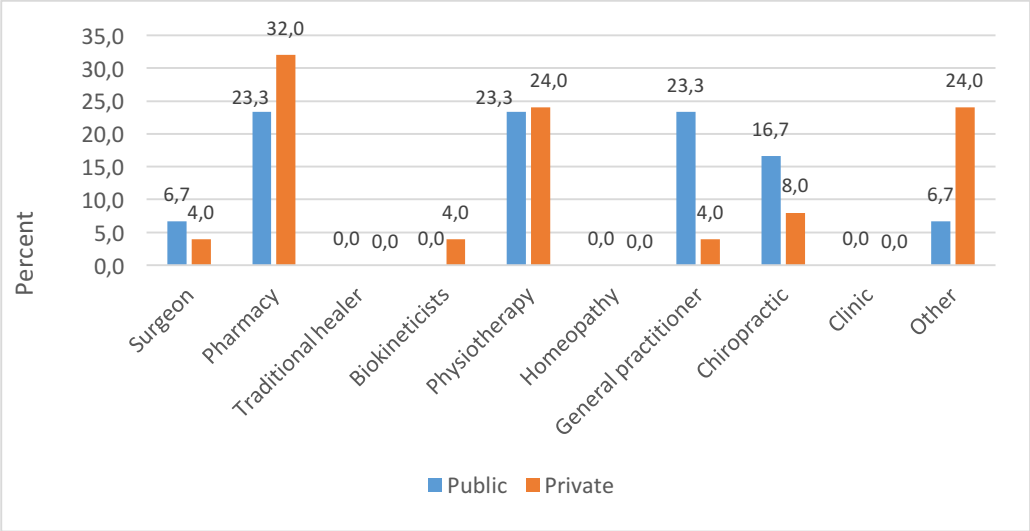

Figure 4.26 Type of treatment received for current low back pain

Figure 4.26 identifies that the most common treatments sought for current LBP by public sector radiographers were from the pharmacy (23,3%); physiotherapist (23,3%); general practitioner (23,3%); and chiropractor (16,7%). Only 6,7% of public sector radiographers opted to see a surgeon for their current LBP. Private sector radiographers visited the pharmacy (32,0%), physiotherapist (24,0%); chiropractor (8,0%); general practitioner (4,0%); and biokineticist (4,0%) for their current LBP. Only 4,0% of private sector radiographers opted for surgery for their current LBP.

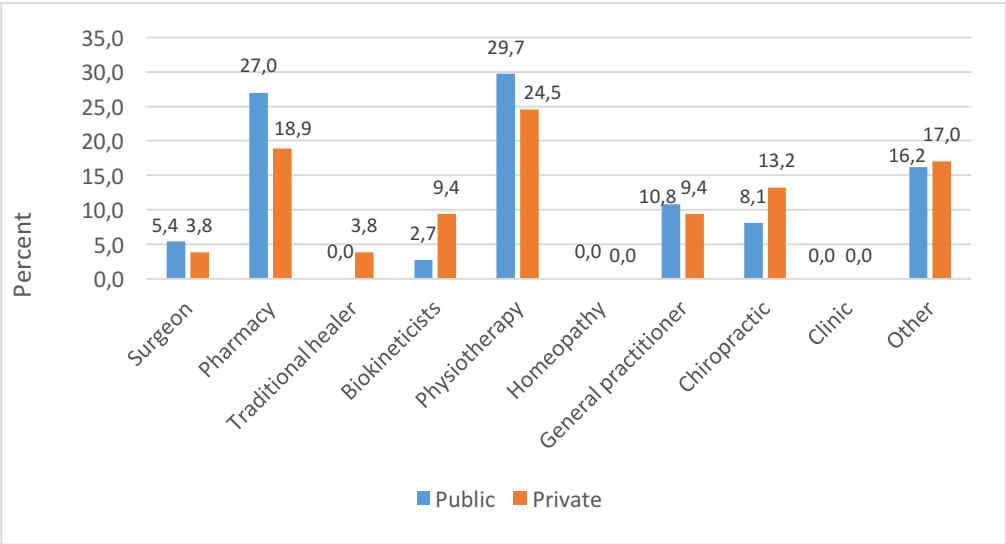

Figure 4.27 Type of treatment received for past low back pain

Figure 4.27 illustrates that the most common treatments sought for past LBP by public sector radiographers were from the physiotherapist (29,7%); pharmacy (27,0%); general practitioner (10,8%); chiropractor (8,1%); and biokineticist (2,7%). Only 5,4% of public sector radiographers opted to see a surgeon for their past LBP. The private sector radiographers visited the physiotherapist (24,5%); pharmacy (18,9%); chiropractor (13,2%); general practitioner (9,4%); biokineticist (9,4%); and traditional healer (3,8%) for their past LBP. Only 3,8% of private sector radiographers opted for surgery for their current LBP.

4.10.16 Stretches for current and past low back pain

Table 4.76: Stretches for current low back pain

			Sector of employment		Total
			Public	Private	
Do you ever do stretches to relieve your current low back pain?	Yes	Count	11	10	21
		% within Sector of employment	68,8%	66,7%	67,7%
	No	Count	5	5	10
		% within Sector of employment	31,3%	33,3%	32,3%

Table 4.76 illustrates that 68,8% of public sector radiographers and 66,7% of private sector radiographers reported doing stretches for their current LBP.

Table 4.77: Stretches for past low back pain

			Sector of employment		Total
			Public	Private	
Did you ever do stretches to relieve your past low back pain?	Yes	Count	14	20	34
		% within Sector of employment	66,7%	66,7%	66,7%
	No	Count	7	10	17
		% within Sector of employment	33,3%	33,3%	33,3%

Table 4.77 shows similar percentages, with 66,7% of public sector radiographers and 66,7% of private sector radiographers reporting that they did stretches for their past LBP. There was no significant difference between the two sectors in terms of stretches for current (p = 1,000) and past LBP (p = 1,000).

Table 4.78: Duration of stretching in minutes for current low back pain

Sector of employment	n	Mean	Median	Std. Deviation
Public	16	5,81	5,00	5,588
Private	15	5,40	5,00	6,220

Table 4.79: Duration of stretching in minutes for past low back pain

Sector of employment	n	Mean	Median	Std. Deviation
Public	18	5,94	5,00	4,684
Private	29	8,34	5,00	9,722

Table 4.78 identifies that the public sector radiographers were stretching an average of 5,81 minutes for their current LBP as opposed to 5,40 minutes by the private sector radiographers. Similarly, for their past LBP the average time the public sector radiographers stretched was 5,94 minutes as opposed to 8,34 minutes by the private sector radiographers, as seen in **Table 4.79.** There was no significant difference between the two sectors with regard to stretching for past (p = 0,850) or current LBP (p = 0,850).

4.10.17 Medication for current and past low back pain

Table 4.80: Medication use for current low back pain

			Sector of employment		Total
			Public	Private	
Are you taking any medication for the current low back pain?	Yes	Count	13	9	22
		% within Sector of employment	81,3%	60,0%	71,0%
	No	Count	3	6	9
		% within Sector of employment	18,8%	40,0%	29,0%

Table 4.81: Medication use for past low back pain

			Sector of employment		Total
			Public	Private	
Were you taking any medication for the low back pain?	Yes	Count	17	25	42
		% within Sector of employment	81,0%	83,3%	82,4%
	No	Count	4	5	9
		% within Sector of employment	19,0%	16,7%	17,6%

Table 4.80 demonstrates that 81,3% of public sector radiographers and 60,0% of private sector radiographers use medication for their current LBP. Similarly, 81,0% of public sector radiographers and 83,3% of private sector radiographers used medication for their past LBP, as shown in **Table 4.81.** There was a significant relationship between the two sectors in terms of current LBP and medication use, with the public sector reporting more medication use for current LBP (p = 0,039). There was no significant relationship between the two sectors, however, in terms of past LBP and medication use (p = 0,098).

Table 4.82: Type of medication use for current low back pain

			Sector of employment		Total
			Public	Private	
What medication are you taking for the current low back pain?	Pain killers	Count	10	4	14
		% within Sector of employment	62,5%	26,7%	45,2%
	Anti-inflammatory	Count	2	5	7
		% within Sector of employment	12,5%	33,3%	22,6%
	Rubs	Count	3	0	3
		% within Sector of employment	18,8%	0,0%	9,7%
	Patches	Count	0	1	1
		% within Sector of employment	0,0%	6,7%	3,2%
	Traditional medicine	Count	0	1	1
		% within Sector of employment	0,0%	6,7%	3,2%
	I don't know	Count	1	4	5
		% within Sector of employment	6,3%	26,7%	16,1%

Table 4.82 shows the most common medications used for current LBP. These were reported by the public sector radiographers as pain killers (62,5%), anti-inflammatories (12,5%) and rubs (18,8%). The most commonly used medication for current LBP by private sector radiographers included pain killers (26,7%); anti-inflammatories (33,3%); patches (6,7%); and traditional medicine (6,7%). There was a significant relationship (p = 0,039) between the two sectors pertaining to the type of medication used for current LBP.

The vast majority of public sector radiographers reported the use of pain killers, while the majority of private sector radiographers reported the use of anti-inflammatories. In addition, the public sector radiographers were the only respondents to report the use of rubs, as opposed to the private sector radiographers who were the only sector to report the use of patches.

Table 4.83: Type of medication use for past low back pain

			Sector of employment		Total
			Public	Private	
What medication were you taking for the past low back pain?	Pain killers	Count	8	7	15
		% within Sector of employment	38,1%	23,3%	29,4%
	Anti-inflammatory	Count	5	18	23
		% within Sector of employment	23,8%	60,0%	45,1%
	Rubs	Count	3	2	5
		% within Sector of employment	14,3%	6,7%	9,8%
	Patches	Count	3	1	4
		% within Sector of employment	14,3%	3,3%	7,8%
	I don't know	Count	2	2	4
		% within Sector of employment	9,5%	6,7%	7,8%

Table 4.83 demonstrates that the most common medications used for past LBP by the public sector radiographers were pain killers (38,1%); anti-inflammatories (23,8%); rubs (14,3%); and patches (14,3%). The most commonly used medication for past LBP by the private sector radiographers included anti-inflammatories (60,0%); pain killers (23,3%); rubs (6,7%); and patches (3,3%). There was no significant relationship between the two sectors in terms of past LBP and type of medication use (p = 0,098).

Table 4.84: Decreased current low back pain due to medication use

			Sector of employment		Total
			Public	Private	
Does the medication help reduce the pain?	Yes	Count	7	9	16
		% within Sector of employment	43,8%	60,0%	51,6%
	No	Count	4	2	6
		% within Sector of employment	25,0%	13,3%	19,4%
	N/A	Count	5	4	9
		% within Sector of employment	31,3%	26,7%	29,0%

Table 4.84 identifies that 43,8% of public sector radiographers and 60,0% of private sector radiographers reported that their current LBP was improved by medication use.

Table 4.85: Decreased past low back pain due to medication use

			Sector of employment		Total
			Public	Private	
Did the medication help reduce the pain?	Yes	Count	15	23	38
		% within Sector of employment	71,4%	76,7%	74,5%
	No	Count	3	3	6
		% within Sector of employment	14,3%	10,0%	11,8%
	N/A	Count	3	4	7
		% within Sector of employment	14,3%	13,3%	13,7%

Table 4.85 demonstrates that 71,4% of public sector radiographers and 76,7% of private sector radiographers reported that their past LBP improved after the use of medication.

4.11 Objective 3: Socio-demographic, environmental and psychosocial low back pain risk factors

4.11.1 Socio-demographic low back pain risk factors

Table 4.86: Socio-demographic risk factors and low back pain

		Sector of employment											
		Public						Private					
		Previous low back pain						Previous low back pain					
		Yes			No			Yes			No		
		Mean	Row n %	Column n %	Mean	Row n %	Column n %	Mean	Row n %	Column n %	Mean	Row n %	Column n %
Age (years)		32			26			34			37		
Height (meters)		1,60			1,69			1,63			1,76		
Weight in kg		66			66			65			81		
Gender	Female		91,2%	91,2%		8,8%	75,0%		95,5%	93,3%		4,5%	40,0%
	Male		75,0%	8,8%		25,0%	25,0%		50,0%	6,7%		50,0%	60,0%
Race	African		95,5%	61,8%		4,5%	25,0%		91,7%	48,9%		8,3%	40,0%
	Coloured		100,0 %	2,9%		0,0%	0,0%		50,0%	2,2%		50,0%	20,0%
	Indian		76,9%	29,4%		23,1%	75,0%		75,0%	6,7%		25,0%	20,0%
	White		100,0 %	5,9%		0,0%	0,0%		95,0%	42,2%		5,0%	20,0%
Marital status	Single		81,0%	50,0%		19,0%	100,0 %		88,9%	35,6%		11,1%	40,0%
	Married		100,0 %	47,1%		0,0%	0,0%		90,3%	62,2%		9,7%	60,0%
	Divorced		100,0 %	2,9%		0,0%	0,0%		100,0 %	2,2%		0,0%	0,0%
Level of education	National diploma		84,6%	64,7%		15,4%	100,0 %		86,7%	57,8%		13,3%	80,0%
	Bachelor degree		100,0 %	35,3%		0,0%	0,0%		100,0 %	40,0%		0,0%	0,0%
	Master degree		0,0%	0,0%		0,0%	0,0%		50,0%	2,2%		50,0%	20,0%
	Doctorate degree		0,0%	0,0%		0,0%	0,0%		0,0%	0,0%		0,0%	0,0%

Table 4.86 shows that the mean age of public sector radiographers with previous LBP was 32 years as opposed to a mean age of 34 years in the private sector. The mean height for public sector radiographers with previous LBP was 1,60 meters and in the private sector the mean height for radiographers with previous LBP was 1,63 meters. The mean weight of public sector radiographers with previous LBP was 66kg, which was similar to that of the private sector radiographers with previous LBP (65kg).

Female public sector radiographers were more prone to LBP (91,5%) than their male counterparts (75,0%). In the private sector, 95% of female radiographers reported previous LBP in contrast to only 50,0% of the male radiographers. Within the public sector, previous LBP was reported by 100,0% of Coloured and White radiographers; 95,5% of African radiographers; and 76,9% of Indian radiographers. In the private sector, however, previous LBP was reported by 95,0% of White radiographers; 91,7% of African radiographers; 75,0% of Indian radiographers; and 50,0% of Coloured radiographers.

With regard to marital status of the public sector radiographers and reports of previous LBP, 100,0% of the married and divorced radiographers and 81,0% of single radiographers reported previous LBP. Similarly, 88,9% single, 90,3% married and 100,0% of divorced private sector radiographers had previous LBP. Previous LBP was reported by 84,6% and 86,7% of radiographers with a National Diploma in radiography in the public and private sectors respectively. All radiographers with a Bachelor's degree in radiography in both the public and private sectors reported previous LBP, while 50,0% of those with a Master's degree in radiography in the private sector also had previous LBP.

4.11.2 Environmental low back pain risk factors

Table 4.87: Environmental risk factors and low back pain

		Sector of employment											
		Public						Private					
		Previous low back pain						Previous low back pain					
		Yes			No			Yes			No		
		Row n %	Column n %	Mean	Row n %	Column n %	Mean	Row n %	Column n %	Mean	Row n %	Column n %	Mean
Do you have a routine sleeping pattern?	Yes	93,3%	41,2%		6,7%	25,0%		93,1 %	60,0%		6,9%	40,0%	
	No	87,0%	58,8%		13,0%	75,0%		85,7 %	40,0%		14,3%	60,0%	
What is your predominant sleeping position?	Side	88,9%	70,6%		11,1%	75,0%		91,7 %	73,3%		8,3%	60,0%	
	Back	66,7%	5,9%		33,3%	25,0%		100,0 %	4,4%		0,0%	0,0%	
	Stomach	100,0 %	23,5%		0,0%	0,0%		83,3 %	22,2%		16,7%	40,0%	
Sitting for long periods	Yes	88,9%	100,0%		11,1%	100,0%		88,9 %	100,0%		11,1%	100,0%	
Lifting heavy objects	Yes	100,0 %	100,0%		0,0%	0,0%		91,7 %	100,0%		8,3%	100,0%	
Turning your body (twisting)	Yes	87,5%	100,0%		12,5%	100,0%		100,0 %	100,0%		0,0%	0,0%	
Working at a computer	Yes	85,7%	100,0%		14,3%	100,0%		88,9 %	100,0%		11,1%	100,0%	
Working with your arms overhead	Yes	83,3%	100,0%		16,7%	100,0%		100,0 %	100,0%		0,0%	0,0%	
Bending	Yes	100,0 %	100,0%		0,0%	0,0%		100,0 %	100,0%		0,0%	0,0%	
Continuous pulling/ pushing	Yes	100,0 %	100,0%		0,0%	0,0%		100,0 %	100,0%		0,0%	0,0%	
Forward positioned arms	Yes	100,0 %	100,0%		0,0%	0,0%		100,0 %	100,0%		0,0%	0,0%	
How do you get to work each day?	Drive yourself	88,9%	70,6%		11,1%	75,0%		89,6 %	95,6%		10,4%	100,0%	
	Bus	100,0 %	5,9%		0,0%	0,0%		100,0 %	2,2%		0,0%	0,0%	
	Get a lift in a car	100,0 %	8,8%		0,0%	0,0%		100,0 %	2,2%		0,0%	0,0%	
	Taxi	100,0 %	2,9%		0,0%	0,0%		0,0%	0,0%		0,0%	0,0%	
	Walk	75,0%	8,8%		25,0%	25,0%		0,0%	0,0%		0,0%	0,0%	
Minutes spend seated per day whilst traveling				34			44			42			13
Distance to / from work (km's)				18			34			16			16

Table 4.87 demonstrates that 93,3% of public sector radiographers and 93,1% of private sector radiographers with previous LBP had a routine sleeping pattern. One hundred percent of the public sector radiographers who preferred sleeping on their stomach reported previous LBP, as opposed to 66,7% of the public sector radiographers who preferred to sleep on their back and 88,9% who preferred to sleep on their side. This was in contrast to the private sector radiographers with previous LBP, who preferred to sleep on their side (91,7%), on their back (100,0%), and on their stomach (83,3%). In the public sector, previous LBP was reported by the radiographers who sit for prolonged periods of time (88,9%).

Low back pain was also reported by those who lift heavy objects (100,0%); were involved in twisting activities (87,5%); worked at a computer (85,7%); worked with their arms overhead (83,3%); did activities involving bending (100,0%) and continuous pushing/pulling (100,0%); and lastly, those involved in activities requiring forward positioned arms (100,0%). Similarly, previous LBP was reported by radiographers in the private sector who sit for prolonged periods of time (88,9%); lift heavy objects (91,7%); were involved in twisting activities (100,0%); working at a computer (88,9%); and working with their arms overhead (100,0%). Further activities involved bending (100,0%) and continuous pushing/pulling (100,0%), and lastly, those involved in activities requiring forward positioned arms (100,0%). With regard to transport to/from work, the public sector radiographers with previous LBP drove themselves to work (88,9%); took a bus (100,0%); lift in a car (100,0%); taxi (100,0%); or walked to work (75,0%). The private sector radiographers with previous LBP reported driving themselves (89,6,0%), taking a bus (100,0%) or getting a lift (100,0%). The public sector radiographers with previous LBP reported spending an average of 34 minutes a day travelling to and from work and lived 18km away from work. The private sector radiographers with previous LBP also reported that they spend an average of 42 minutes travelling to work each day, and that they lived an average of 16km away from their place of work.

4.11.3 Psychosocial low back pain risk factors

Table 4.88: Psychosocial risk factors and low back pain in the public sector

		Sector of employment							
		Public							
		Past low back pain				Current low back pain			
		Yes		No		Yes		No	
		Column n %	Mean	Column n %	Mean	Column n %	Mean	Column n %	Mean
Current health status	Excellent	8,8%		25,0%		6,3%		13,6%	
	Good	64,7%		25,0%		56,3%		63,6%	
	Fair	20,6%		50,0%		25,0%		22,7%	
	Poor	5,9%		0,0%		12,5%		0,0%	
Smoking status	Current smoker	5,9%		0,0%		12,5%		0,0%	
	Ex-smoker	8,8%		0,0%		0,0%		13,6%	
	Non-smoker	85,3%		100,0%		87,5%		86,4%	
Number of cigarettes smoked per day			1		0		2		1
Years of smoking			1		0		2		0
Hours of sleep per night			7		8		7		7
Regular exercise (3x per week)	Yes	11,8%		50,0%		6,3%		22,7%	
	No	88,2%		50,0%		93,8%		77,3%	
Level of stress	High	20,6%		25,0%		12,5%		27,3%	
	Moderate	44,1%		50,0%		50,0%		40,9%	
	Low	20,6%		0,0%		25,0%		13,6%	
	None	14,7%		25,0%		12,5%		18,2%	

Table 4.88 indicates that from the public sector radiographers with past LBP, 8,8% rated their current health status as excellent; 64,7% rated their current health status as good; 20,6% rated their current health status as fair; and only 5,9% rated their current health status as poor. The public sector radiographers with current LBP rated their health as excellent (6,3%); good (56,3%); fair (25,0%); and poor (12,5%).

The smoking status of public sector radiographers with past LBP was reported as current smoker (5,9%), ex-smoker (8,8%) and non-smoker (85,3%). The smoking status of public sector radiographers with current LBP was reported as current smoker (12,5%) and non-smoker (87,5%). The average number of

cigarettes smoked by current/past smoking public sector radiographers with past LBP was one cigarette per day, as opposed to current/past smoking public sector radiographers with current LBP who indicated that they smoke two cigarettes per day on average. The average number of years as a smoker for current/past smoking public sector radiographers with past LBP was one year, as opposed to current/past smoking public sector radiographers with current LBP who indicated that they have smoked for an average of two years.

Both the public sector radiographers with past and current LBP reported that they sleep for an average of seven hours per night. From the public sector radiographers with past LBP, 11,8% exercised regularly whereas only 6,3% of the public sector radiographers with current LBP exercised regularly.

The public sector radiographers with past LBP rated their current level of stress as high (20,6%), moderate (44,1%), low (20,6%). Of the public sector radiographers with past LBP, 14,7% were not currently experiencing any stress. The public sector radiographers with current LBP, however, rated their current level of stress as high (12,5%), moderate (50,0%), low (25,0%). Of the public sector radiographers with past LBP, 12,5% were not currently experiencing any stress.

Table 4.89: Psychosocial risk factors and low back pain in the private sector

		Sector of employment							
		Private							
		Past low back pain				Current low back pain			
		Yes		No		Yes		No	
		Column n %	Mean	Column n %	Mean	Column n %	Mean	Column n %	Mean
Current health status	Excellent	28,9%		80,0%		11,1%		46,9%	
	Good	60,0%		20,0%		72,2%		46,9%	
	Fair	11,1%		0,0%		16,7%		6,3%	
	Poor	0,0%		0,0%		0,0%		0,0%	
Smoking status	Current smoker	6,7%		60,0%		5,6%		15,6%	
	Ex-smoker	6,7%		0,0%		11,1%		3,1%	

	Non-smoker	86,7%		40,0%		83,3%		81,3%	
Number of cigarettes smoked per day			1		5		2		1
Years of smoking			1		5		1		2
Hours of sleep per night			7		7		7		7
Regular exercise (3x per week)	Yes	35,6%		80,0%		33,3%		43,8%	
	No	64,4%		20,0%		66,7%		56,3%	
Level of stress	High	17,8%		0,0%		5,6%		21,9%	
	Moderate	53,3%		40,0%		66,7%		43,8%	
	Low	11,1%		20,0%		16,7%		9,4%	
	None	17,8%		40,0%		11,1%		25,0%	

Table 4.89 demonstrates that the private sector radiographers with past LBP rated their current health status as excellent (28,9%), good (60,0%), and fair (11,1%). The private sector radiographers with current LBP rated their health status as excellent (11,1%), good (72,2%) and fair (16,7%). The smoking status of private sector radiographers with past LBP was reported as current smoker (6,7%), ex-smoker (6,7%) and non-smoker (86,7%), whereas the smoking status of private sector radiographers with current LBP was reported as current smoker (5,6%), ex-smoker (11,1%) and non-smoker (83,3%). The average number of cigarettes smoked by current/past smoking private sector radiographers with past LBP was one cigarette per day as opposed to current/past smoking private sector radiographers with current LBP who indicated that they smoke two cigarettes per day on average. Both the average number of years smoked by current/past smoking private sector radiographers with current and past LBP were reported as one year.

Both the private sector radiographers with past and current LBP reported that they sleep an average of seven hours per night. From the private sector radiographers with past LBP, 35,6% exercised regularly, whereas 33,3% of the private sector radiographers with current LBP exercised regularly. The private sector radiographers with past LBP rated their current level of stress as high (17,8%); moderate (53,3%); low (11,1%); and none (17,8%). Private sector radiographers with current LBP rated their current level of stress as high (5,6%); moderate (66,7%); low (16,7%); and none (11,1%).

4.12 Objective 4: The association between work history, occupational risk factors and low back pain

4.12.1 Work history, occupational risk factors and low back pain

Table 4.90: Occupational risk factors and low back pain

		Sector of employment							
		Public				Private			
		Previous low back pain				Previous low back pain			
		Yes		No		Yes		No	
		Row n %	Mean	Row n %	Mean	Row n %	Mean	Row n %	Mean
What is your current work status?	Community Service Radiographer	100,00%		0,00%		0,00%		0,00%	
	Junior Radiographer	80,00%		20,00%		100,00%		0,00%	
	Senior Radiographer	87,50%		12,50%		95,00%		5,00%	
	Chief Radiographer	100,00%		0,00%		75,00%		25,00%	
	Assistant Director Radiographer	100,00%		0,00%		100,00%		0,00%	
	Manager	0,00%		0,00%		66,70%		33,30%	
	Locum Radiographer	0,00%		0,00%		100,00%		0,00%	
What is your present work status?	Full-time	89,20%		10,80%		88,60%		11,40%	
	Part-time	100,00%		0,00%		100,00%		0,00%	
	Night shift only	0,00%		0,00%		100,00%		0,00%	
Total years in clinical practice?			11		5		13		15
Years at current hospital/practice?			7		2		7		7
General Radiography/ Mobile Radiography)	Yes	88,60%		11,40%		91,40%		8,60%	
Computed Tomography (CT)	Yes	100,00%		0,00%		88,90%		11,10%	
Theatre Radiography	Yes	100,00%		0,00%		85,00%		15,00%	
Magnetic Resonance Imaging (MRI)	Yes	0,00%		0,00%		62,50%		37,50%	
Mammography	Yes	100,00%		0,00%		100,00%		0,00%	
Conventional radiography (Dark room)	Yes	92,60%		7,40%		66,70%		33,30%	
Computed radiography (CR)	Yes	86,40%		13,60%		89,30%		10,70%	
Digital radiography (DR)	Yes	100,00%		0,00%		89,30%		10,70%	
How old is the x-ray unit you work with?	0 - 3	100,00%		0,00%		91,70%		8,30%	
	4 - 6	85,70%		14,30%		91,70%		8,30%	
	7 - 9	100,00%		0,00%		90,90%		9,10%	
	10+	88,00%		12,00%		66,70%		33,30%	
How old is the mobile x-ray unit/ c-arm you work with?	0 - 3	100,00%		0,00%		92,30%		7,70%	
	4 - 6	90,90%		9,10%		92,30%		7,70%	
	7 - 9	85,70%		14,30%		100,00%		0,00%	
	10+	83,30%		16,70%		75,00%		25,00%	
How old is the lead jacket you are currently wearing?	0 - 3	100,00%		0,00%		78,90%		21,10%	
	4 - 6	100,00%		0,00%		100,00%		0,00%	
	7 - 9	76,90%		23,10%		90,90%		9,10%	
	10+	91,70%		8,30%		100,00%		0,00%	

How many hours do you work per week?			40		37		38		39
How many days do you work per week?			5		5		5		6
Sitting for long periods	Yes	88,90%		11,10%		84,60%		15,40%	
Lifting heavy objects	Yes	92,30%		7,70%		90,90%		9,10%	
Turning your body (twisting)	Yes	89,50%		10,50%		93,30%		6,70%	
Working at a computer	Yes	86,40%		13,60%		91,90%		8,10%	
Working with your arms overhead	Yes	85,70%		14,30%		100,00%		0,00%	
Bending	Yes	84,00%		16,00%		94,30%		5,70%	
Continuous pulling/ pushing	Yes	88,90%		11,10%		96,40%		3,60%	
Forward positioned arms	Yes	100,00%		0,00%		90,50%		9,50%	
Push around mobile X-ray unit	Yes	86,40%		13,60%		93,90%		6,10%	
Wear a lead apron	Yes	85,70%		14,30%		91,90%		8,10%	
Lift patients	Yes	87,10%		12,90%		92,90%		7,10%	
Transfer patients to a chair/bed	Yes	87,10%		12,90%		93,20%		6,80%	
Position the overhead X-ray tube	Yes	90,30%		9,70%		91,20%		8,80%	
Sit for more than 3 hours	Yes	90,00%		10,00%		80,00%		20,00%	
Stand for more than 3 hours a day	Yes	92,90%		7,10%		94,60%		5,40%	
Push hospital bed-patients	Yes	87,50%		12,50%		91,70%		8,30%	
Carry imaging cassettes	Yes	87,10%		12,90%		96,00%		4,00%	
Work fast due to radiation exposure	Yes	88,50%		11,50%		93,10%		6,90%	
Have you ever injured your lower back at work?	Yes	100,00%		0,00%		100,00%		0,00%	
How much weight (kg) on average do you lift at work?	1-10	100,00%		0,00%		85,70%		14,30%	
	11-20	100,00%		0,00%		100,00%		0,00%	
	21- 30	100,00%		0,00%		100,00%		0,00%	
	31 - 40	100,00%		0,00%		50,00%		50,00%	
	41 - 50	100,00%		0,00%		0,00%		0,00%	
	51 - 60	100,00%		0,00%		83,30%		16,70%	
	61 - 70	66,70%		33,30%		80,00%		20,00%	
	71 - 80	100,00%		0,00%		100,00%		0,00%	
	81 - 90	66,70%		33,30%		100,00%		0,00%	
	> 90	100,00%		0,00%		75,00%		25,00%	
How many times a day do you repeat lifting tasks?	0 - 10	75,00%		25,00%		92,90%		7,10%	
	11-20	100,00%		0,00%		88,90%		11,10%	
	21 - 30	100,00%		0,00%		0,00%		0,00%	
	Continuous	100,00%		0,00%		100,00%		0,00%	
Hours per day are you seated			3,03		3		2,96		3,6
Hours per day wearing a lead apron			1,68		0,75		2,02		1,4
Low back pain from wearing a lead apron	Yes	95,20%		4,80%		100,00%		0,00%	
How many days per month are you required to wear a lead apron?			6,65		14,5		9,04		4,6
Please select the weight (kg) of the lead apron you are wearing at work.			3,62		6		3,16		2,8
How many patients do you lift per day?			10,47		7,75		6,42		4
How many days per month are you working with a mobile x-ray unit?			9,5		7,75		8,87		4

Table 4.90 shows that within the public sector previous LBP was reported by 100,0% of community service radiographers; 80,0% of the junior radiographers; 87,5% of the senior radiographers; 100,0% of the chief radiographers; and 100,0% of the assistant directors. The private sector radiographers with previous LBP included junior radiographers (100,0%); senior radiographers (95,0%); chief radiographers (75,0%); assistant directors (100,0%); managers (66,7%); and locum radiographers (100,0%). There were 89,2% full-time and 100,0% part-time public sector radiographers who reported previous LBP. Within the private sector 88,6% of the full-time radiographers, 100,0% of the part-time radiographers and 100,0% of the night-shift only radiographers reported previous LBP. The average total amount of years of clinical practice amongst public sector radiographers with previous LBP was eleven years, with the average number of years at their current place of work being seven years. Similarly, the average number of years of clinical practice amongst private sector radiographers was thirteen years, with the average number of years at their current place of work being seven years.

The public sector radiographers with previous LBP were employed in various radiographic modalities, including general radiography (88,6%); computed tomography (100,0%); theatre radiography (100,0%); mammography (100,0%); conventional radiography (92,6%); computed radiography (86,4%); and digital radiography (100,0%). Private sector radiographers who reported previous LBP were comparably employed in different modalities, including general radiography (91,4%); computed tomography (88,9%); theatre radiography (85,0%); magnetic resonance imaging (62,5%); mammography (100,0%); conventional radiography (66,7%); computed radiography (89,3%); and digital radiography (89,3%).

The age of the x-ray unit also played a role with regard to previous LBP, with radiographers in the public sector with previous LBP reporting work on x-ray units aged 0-3 years (100,0%); 4-6 years (85,7%); 7-9 years (100,0%); and older than ten years (88,0%). Within the private sector 91,7% of radiographers

were working on x-ray units aged 0-3 years, 91,7% on x-ray units aged 4-6 years, and 90,9% of radiographers working on x-ray units aged 7-9 years who reported previous LBP. Only 66,7% of the private sector radiographers working in x-ray units older than ten years reported previous LBP. One hundred percent of the public sector radiographers with previous LBP were working on a mobile x-ray/c-arm unit aged 0-3 years. Other public sector radiographers with previous LBP were working on mobile x-ray/c-arm units aged 4-6 years (90,9%), 7-9 years (85,7%) and older than ten years (83,3%). In contrast, the private sector radiographers with previous LBP were working on mobile x-ray/c-arm units aged 0-3 years (92,3%); 4-6 years (92,3%); 7-9 years (100,0%); and older than ten years (75,0%).

One hundred percent of public sector radiographers wearing lead aprons aged 0-3 years had previous LBP; 100,0% wearing lead aprons aged 4-6 years; 76,9% wearing lead aprons aged 7-9 years; and lastly, 91,7% of public sector radiographers wearing lead aprons ages ten years and older. Similarly, 78,9% of public sector radiographers wearing lead aprons aged 0-3 years had previous LBP; 100,0% wearing lead aprons aged 4-6 years; 90,9% wearing lead aprons aged 7-9 years; and lastly, 100,0% of public sector radiographers wearing lead aprons aged ten years and older. The public sector radiographers with previous LBP reported working for an average of 40 hours per week with an average of five days a week. The private sector radiographers with previous LBP stated that the average work hours per week was 38 hours and the average number of days at work per week was five days. Work-related activities and the percentage of public sector radiographers with previous LBP involved in them included sitting for long periods (88,9%); lifting heavy objects (92,3%); twisting (89,5%); working at a computer (86,4%), working with their arms overhead (85,7%); and bending (84,0%). Also involved were continuous pushing/pulling (88,9%); working with forward positioned arms (100,0%); pushing around the mobile x-ray unit (86,4%); wearing a lead apron (85,7%); lifting patients (87,1%); transferring a patient to a bed/chair (87,1%); and positioning of the overhead x-ray tube (90,3%). Further factors

included sitting for more than three hours (90,0%); standing for more than three hours (92,9%); pushing hospital bed patients (87,5%); carrying imaging cassettes (87,1%); and working fast due to radiation exposure (88,5%).

Within the private sector, the activities causing previous LBP was similar and included sitting for long periods (84,6%); lifting heavy objects (90,9%); twisting (93,3%); working at a computer (91,9%); working with their arms overhead (100,0%); and bending (94,3%). Other activities included continuous pushing/pulling (96,4%); working with forward positioned arms (90,5%); pushing around the mobile x-ray unit (93,9%); wearing a lead apron (91,9%); lifting patients (92,9%); and transferring a patient to a bed/chair (93,2%). Additionally, activities also included positioning of the overhead x-ray tube (91,2%); sitting for more than three hours (80,0%); standing for more than three hours (94,6%); pushing hospital bed patients (91,7%); carrying imaging cassettes (96,0%); and working fast due to radiation exposure (93,1%).

One hundred percent of public and private sector radiographers had injured their backs previously at work and reported experiencing LBP in the past. Public sector radiographers who lift objects weighing 1-60kg at work who reported previous LBP was at 100,0%, as well as 66,7% of those who lift objects weighing 61-70kg; 100,0% of those who lift objects weighing 71-80kg; 66,7% of those who lift 81-90kg objects; and lastly, 100,0% of those who lift objects weighing in excess of 90kg at work. There were 85,7% private sector radiographers with previous LBP who lifted 1-10kg; 100,0% who lift objects weighing 11-30kg; 50,0% who lift objects weighing 31-40kg; 83,3% who lift objects weighing 51-60kg; 80,0% who lift objects weighing 61-70kg; 100,0% who lift objects weighing 71-90kg; and 75,0% who lift objects 90kg and more. Within the public sector 75,0% of radiographers with previous LBP reported repeating the lifting activities required of them between 0-10 times a day. There was, however, 100,0% of the public sector radiographers with previous LBP who reported repeating the lifting tasks required of them between 11-30 times per day. Of the private sector radiographers with previous LBP, 92,9%

reported they repeat lifting tasks 0-10 times a day, whilst 88,9% of the private sector radiographers with previous LBP reported repeating lifting tasks 11-20 times a day.

Public sector radiographers with previous LBP were seated for an average of 3,03 hours per day and were expected to wear a lead apron for 1,68 hours a day. Similarly, private sector radiographers with previous LBP were seated for an average of 2,96 hours per day and were expected to wear a lead apron for an average of 2,02 hours a day. There were 95,2% of public sector radiographers and 100,0% of private sector radiographers with previous LBP who reported that they experience LBP from wearing a lead apron. The public sector radiographers with previous LBP were expected to wear a lead apron for 6,65 days a month, as opposed to the private sector radiographers with previous LBP who were expected to wear a lead apron for an average of 9,04 days a month. The average weight of the lead apron worn by public sector radiographers with previous LBP was 3,62kg, as opposed to the lead apron worn by private sector radiographers with previous LBP weighing a reported 3,16kg on average.

The public sector radiographers with previous LBP indicated that they lift an average of 10,47 patients per day, compared with private sector radiographers with previous LBP who lift an average of 6,42 patients per day. The public sector radiographers with previous LBP indicated that they work with a mobile x-ray unit for an average of 9,5 days per month, as opposed to the private sector radiographers with previous LBP who indicated that they work with a mobile x-ray unit an average of 8,87 days per month.

4.13 The impact of work-related low back pain.

4.13.1 Work injury

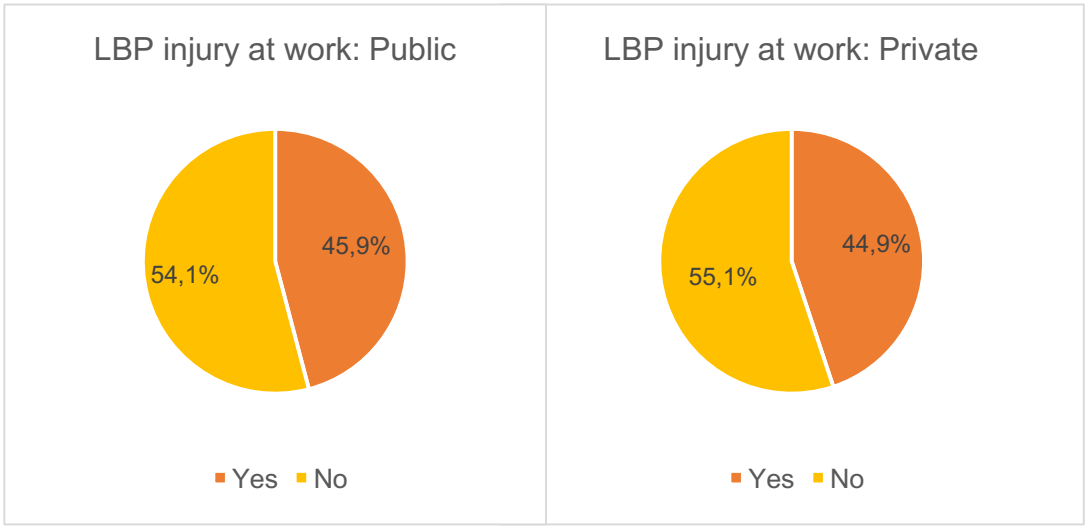

Figure 4.28: Low back pain injury at work

There was 54,1% of the public sector radiographers and 55,1% of the private sector radiographers who had never had an injury at work that resulted in LBP. It is noted that 45,9% of the public sector radiographers and 44,9% of the private sector radiographers reported that they have previously had an injury at work resulting in them experiencing LBP, as seen in **Figure 4.28.**

4.13.2 Absenteeism due to low back pain

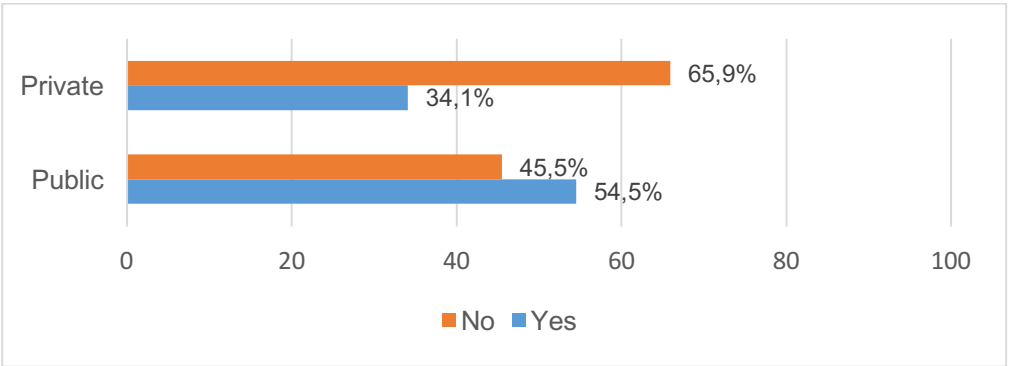

Figure 4.29: Absenteeism due to low back pain

The majority of private sector radiographers (65,9%) reported that they had not been absent from work due to LBP in the past, however 34,1% of private sector radiographers stated that they have previously been absent from work due to LBP. Within the public sector there were more radiographers (54,5%) who had been previously absent form work due to LBP than radiographers who had not been previously absent from work due to LBP (45,5%), as seen in **Figure 4.29**.

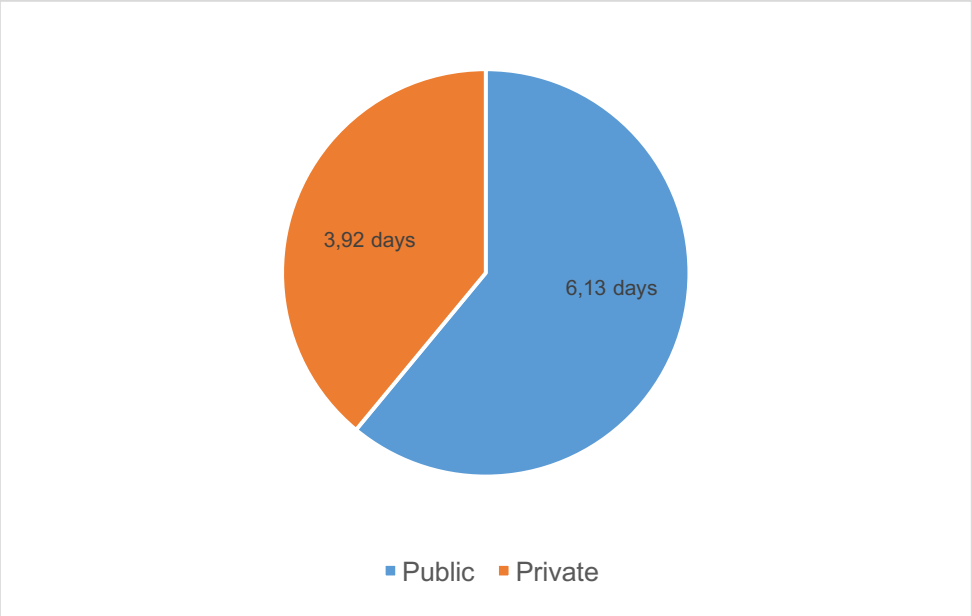

Figure 4.30: Average number of days absent in the past due to low back pain

The average number of days absent in the past due to LBP was reported as 6,13 days by public sector radiographers and 3,92 days by private sector radiographers, as seen in **Figure 4.30** below.

4.13.3 Loss of employment due to low back pain

None of the private or public sector radiographers have ever lost their job due to LBP.

4.14.4 Expenditure due to low back pain treatment

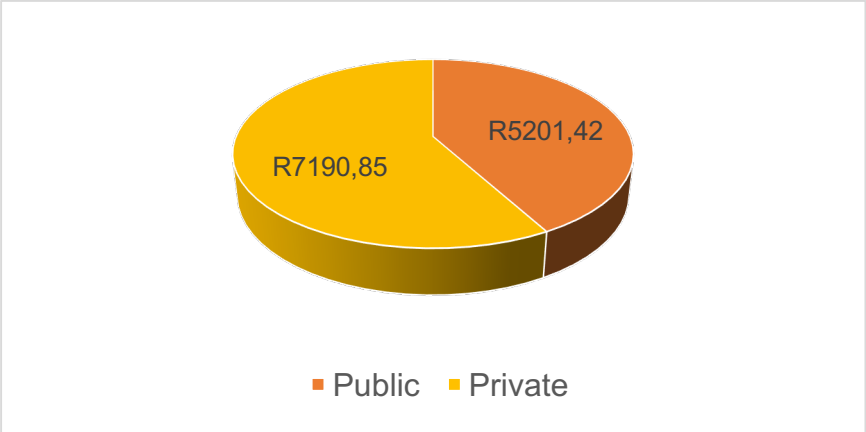

Figure 4.31: Money spend on low back pain treatment in ZAR

The average amount of money spent on LBP treatment in the past was recorded as R5201,40 by a public sector radiographer, and R7190,80 by a private sector radiographer, as noted in **Figure 4.31**.

4.14 Conclusion

With the conclusion of the results as presented in this chapter, the following chapter elaborates on the significance of these results in the context of the literature. This will allow accurate comparison with regard to the epidemiology of LBP between the literature and this study, particularly highlighting the differences between public and private sector radiographers within the eThekwini Municipality.

CHAPTER 5
DISCUSSION

5.1 Introduction

This chapter will provide an analysis of the results presented in Chapter 4 and the findings of the study conducted. The response rate and the objectives of the study will be discussed. Furthermore, the limitations and strengths of the research study are listed.

5.2 Response rate

The response rate for this study was 55,0%, however 43 of the respondents were excluded from the statistical analysis due to incomplete surveys, leaving 88 valid questionnaires. The final response rate thereafter was 37,0%, which was slightly lower than expected. A similar pattern was observed in a recent study targeting radiographers in the eThekwini Municipality, which had a response rate of 42,6% (Gam 2015). The lower response rate was attributed to not receiving permission from one of the largest public sector hospitals in the eThekwini Municipality. This prevented the researcher from being able to undertake the study amongst radiographers in that facility. Another possible factor which could have played a role in the lower response rate could have been the nature of the work done by radiographers. This does not always allow time for lunch breaks, when the radiographers could have been approached to participate in this research study. When processing the data it also became apparent that some radiographers might not have been sufficiently computer literate. Many therefore ended the online questionnaire before it was fully completed, which resulted in those questionnaires deemed incomplete and being eliminated from the research study. While the response rate for this research study may seem to be low it is, however, above the minimum 33,3% is considered as being statistically significant as recommended in literature

(Nulty 2008). This was further supported by Sauermann and Roach (2012) who concluded that online surveys tend to produce lower response rates.

5.3 Demographic factors related to the public and private sector radiographers

When looking at individual factors, the vast majority of the respondents in this study were between the ages of 25 and 40 years. The higher participation rate from this age group, as opposed to the older radiographers, may have been due to them being more computer literate and that they had internet facilities for the online research tool. Hoy *et al.* (2010) stated that the incidence of LBP is highest in the third decade of life. This contradicts a study by Manek and MacGregor (2005), which found that workers aged between 45 and 64 years have the highest LBP prevalence rates.

There were 88,6% female participants in this research study. This corresponds with another study conducted on eThekwini Municipality radiographers by Gam (2015) who reportedly had 88,4% female participants, which was on par with the gender profile of South African radiographers. The gender distribution was in contrast with an Italian study by Lorusso, Bruno and L'Abbate (2007), who had study participants consisting of 77,8% male radiographers which is representative of the radiography population of that country. Similarly, a study on radiographers in Ghana found that 81,0% of their study participants were male (Adesi, Kwadwo and Kab 2015). Bohman *et al*. (2014) reported that females have a higher prevalence, are more severely affected, and often have a poorer prognosis with respect to LBP than males.

The public sector had more African and Indian radiographers than the private sector; in contrast, the private sector had more White and Coloured radiographers than the public sector. Portenoy *et al.* (2004) indicated that ethnicity played a significant role in the experience and reporting of LBP, with certain ethnicities being more prone to over/under report the experience of pain. There were more single radiographers in the public sector (55,5%) than

private sector (36,0%), and more married radiographers in the private sector (62,0%) as opposed to the public sector (42,1%). Hammed and Agbonlahor (2016) found that single individuals had a higher prevalence of LBP than married ones. The majority of radiographers in both sectors only had a national diploma in radiography. A global study by Williams *et al*. (2015) found a link between LBP and socio-economic status, and stated that individuals with a lower economic and education status were at greater risk of developing LBP.

In summary, the majority of the public sector radiographers were African or Indian female radiographers who were slightly overweight, single with one dependent, and only had a National Diploma in Radiography. The majority of the private sector radiographers were African or White female radiographers who had a normal weight, married with one dependent and also only had a National Diploma in radiography.

5.4 Objective 1: To establish the point, period and lifetime prevalence of LBP amongst diagnostic radiographers employed in the eThekwini Municipality.

5.4.1 Point prevalence

The results of this study demonstrated that the point prevalence of LBP in public sector radiographers working in the eThekwini Municipality was 42,1%. The point prevalence of radiographers working in the private sector was 36,0%. The total point prevalence amongst radiographers working in the eThekwini Municipality was therefore 38,6%.

The point prevalence results of this study was slightly higher than the point prevalence of 34,0% purported by Dyer (2012) from a study done on White individuals in the eThekwini Municipality. The results of this study were also in contrast to a global review on the prevalence of LBP in the adult general population, which indicated a point prevalence of 12,0% (Manchikanti *et al*. 2014). The point prevalence in radiographers may be due to the physical nature of the job when compared to the general public. A study conducted on

radiographers in Ghana by Adesi, Kwadwo and Kab (2015), found a point prevalence of 20,0%, which is lower than the findings of this study. Lastly, the results were on par with a German population study by Schmidt *et al*. (2007), which reported a point-prevalence of 37,1%.

5.4.2 Period prevalence

This study found that in the public sector the 0-3 months' prevalence for LBP was 10,5%; the 3-6 months' prevalence was 2,6%; the 4-9 months' prevalence was 15,8%; and the 9-12 months' prevalence was 23,7%. In the private sector, the 0-3 months' prevalence for LBP was 6,0%; the 3-6 months' prevalence was 0%; the 4-9 months' prevalence was 4,0%; and lastly, the 9-12 months' prevalence was 34,0%. The period prevalence of this study was therefore lower than the findings from a global review of LBP by Manchikanti (2000), who reported that the incidence of chronic LBP at three, six and twelve months ranged from 35,0% to 79,0%.

The period prevalence results of this study was also lower than the results found by Dyer (2012) in White individuals in the eThekwini Metropolitan area, where the period prevalence was noted to be i) 0-3 months at 21,3% and ii) 6-12 months at 18,3%. The results by Dyer (2012) may be due to over reporting of pain in the white population. The results of this study also contradict the findings of a study on Malaysian radiographers by Ibrahim and Mohanadas (2012), who revealed a LBP prevalence of 88,2% over a 12-month period.

The cumulative annual prevalence for LBP in the public sector was 52,6% and in the private sector it was 44,0%. This was lower than a study conducted in the Netherlands by Bos *et al*. (2007) who found the annual prevalence of LBP in radiographers to be 75,1 %. The results were slightly higher than those of Manchikanti *et al.* (2014), however, who reported the annual prevalence of LBP of the global general population to be in the 15,0%-40,0% range.

5.4.3 Lifetime prevalence

The findings of this study demonstrated that the lifetime prevalence for LBP in the public sector and private sector radiographers was 89,5% and 90,0% respectively. The total lifetime prevalence for LBP in radiographers working in the eThekwini Municipality was 89,8%. These findings were noticeably higher than the lifetime prevalence of 48,0% found in the general White population within the eThekwini municipality by Dyer (2012), and also the lifetime prevalence of 40,0% found amongst the general population in a global review by Manchikanti *et al.* (2014). Similarly, the results were also higher than the 78,2% LBP prevalence rates found by Docrat (1999) in the Coloured and Indian community in the Greater KwaZulu-Natal area. This suggested that the prevalence of LBP in radiographers was higher when compared with the general population.

In conclusion, the period prevalence of both the private and public sector radiographers was lower than those found in the literature. The annual prevalence was, however, on par with the ranges stated by previous research studies. The lifetime prevalence of LBP in the public and private sector radiographers in the eThekwini Municipality was found to be higher than the general population of the eThekwini Municipality and worldwide lifetime prevalence rates for the general population.

5.5 Objective 2: To determine the nature, severity and clinical presentation of LBP in diagnostic radiographers in the eThekwini Municipality

5.5.1 Low back pain nature

More than 80,0% (experiencing current LBP) and more than 60,0% (experiencing past LBP) of the participants described bilateral LBP. The majority of radiographers also stated that their current and past LBP started gradually over time, which may indicate that the cause of the LBP was not as a result of acute injury but rather repetitive micro-trauma over time. This is supported by previous studies which indicated that occupations requiring

prolonged periods of sitting, lifting, stooping, twisting or standing can result in an increased likelihood of LBP (Bos *et al*. 2007; Alghadir, Zafar and Iqbal 2015; Adesi, Kwadwo and Kab 2015). Kim and Roh (2014) stated that due to the increase of imaging required and the ever-growing patient population in today's society, the exposure to risk factors causing LBP in radiographers can be described as increasing. While performing these tasks, the radiographer is at risk for developing LBP as the actions of pushing, lifting heavy objects, overhead work and prolonged computer work has been well documented as risk factors for LBP (Lurusso, Bruno and L'Abbate 2007; Kim and Roh 2014; Alghadir, Zafar and Iqbal 2015). The majority of the public and private sector radiographers described the nature of their current LBP as either stiffness, a dull ache or a sharp pain. The nature of past LBP in both the private and public sector radiographers was described as a dull ache, stiffness, sharp or shooting pain. There was no significant difference between the two sectors in terms of the nature of current and past LBP. Bearing in mind that most radiographers indicated the nature of their current and past LBP as stiffness or a dull ache sensation, it is possible that this may be of muscle origin, rather than the involvement of nerves which will often be associated with tingling, weakness and numbness of the lower limbs.

5.5.2 Low back pain severity

The severity for current LBP was rated at 5,88 by the public sector radiographers in this study and at 4,60 by the private sector radiographers when using a 0-10 numerical pain rating scale, where 0 means no pain and 10 means the worst pain imaginable. It can therefore be said that the public sector radiographers suffered from more severe current LBP than the private sector. When it came to past LBP experience, the public sector radiographers rated their past LBP severity as an average of 5,90 out of 10 whilst the private sector radiographers rated their past LBP severity as an average of 5,20 out of 10, on a 0-10 pain rating scale. Past LBP severity was therefore similar in both sectors. Public sector radiographers typically have higher workloads and staff shortages, which may be a reason why they reported more severe current LBP

in this study. Overall, this correlates with Bos *et al.* (2007) who found that 75,1% of radiographers had severe LBP.

5.5.3 Low back pain clinical presentation

There were 50,0% of public sector and 33,3% of private sector radiographers with current LBP, and 42,9% of public sector and 30,0% of private sector radiographers with past LBP who were also experiencing a 'pins and needles' sensation in their legs along with their LBP. This may be due to nerve root entrapments, degenerative changes in the lumbar spine or sitting for prolonged hours, as 80,6% of the participants reported LBP while seated at work. Less than 22,0% of the participants with past and current LBP reported experiencing numbness and weakness of the legs associated with their LBP, which indicates that nerve involvement was less likely.

The majority of public and private sector radiographers described the duration of their current and past LBP as intermittent, which indicated that the radiographers were not constantly experiencing LBP. More than 50,0% of the participants stated that their current and past LBP episodes were affecting their daily and leisure activities. There was a significant difference between the two sectors in terms of bed rest needed for current LBP, with the public sector radiographers reporting twice as much bed rest required for current LBP than their private sector radiographer counterparts. This validated the fact that work-related factors may be a causative, or at minimum an aggravating factor in LBP experiences. This is supported by the results of this research study, which found that nearly 81,0% (current LBP) and 65,0% (past LBP) had improvement or no LBP during days off work.

Low back pain aggravating work activities were reported, included bending; lifting heavy objects; twisting; standing; and overhead movements. More than 82,0% of the participants felt their working activities aggravated their LBP, which is supported in the literature. While performing these tasks, the radiographer is at risk of developing LBP as the actions of bending, pushing,

lifting, sitting and prolonged computer work have been well documented as risk factors for LBP in radiographers (Lurusso, Bruno and L'Abbate 2007; Kim and Roh 2014; Alghadir, Zafar and Iqbal 2015).

Only 60,0% to 75,0% of radiographers reported that they have sought treatment for their current and past LBP, which mostly included treatment options such as visiting a GP, the pharmacy or a physiotherapist. Only 8,0% to 17,0% reportedly sought the help of a chiropractor. This is in contrast to a study conducted by Bergeron, Wright and Killion (2006) on USA radiographers, which found that all participants who experienced chronic LBP chose chiropractic care or surgery as their primary treatment choice. The higher incidence of LBP in the participants as opposed to the general public may also be due to the fact that around 30,0% of the participants have not yet sought any treatment for their current and past LBP. There was a significant relationship between the two sectors pertaining to the type of medication used for current LBP. The vast majority of public sector radiographers reported that they made use of pain killers. This is in contrast to the response amongst the private sector radiographers, who indicated that they most commonly use anti-inflammatories. In addition, the public sector radiographers were the only respondents to report the use of rubs, as opposed to the private sector radiographers who were the only sector to report the use of patches.

There were 46,6% (current LBP) and 37,8% (past LBP) of the participants who preferred the use of the general practitioner or pharmacy, which are ultimately both pharmaceutical-based treatment modalities. The fact that more than 80,0% of radiographers were still suffering from work-related LBP may therefore suggest that pharmaceutical therapy did not have a positive outcome in decreasing the prevalence of LBP in this population. This is justified by 71,0% (current LBP) and 82,4% (past LBP) of the participants who reported medication use for their current and past LBP. There were 25,0% to 50,0% of the participants who reported that the medication they were using did not help to relieve their current and past LBP. Due to the low percentage of

radiographers who utilised chiropractic therapy for the treatment of their LBP, it can be argued that perhaps chiropractic therapy could have decreased the incidence of LBP in this population.

In summarising objective two, it is apparent that a trend of similarity can be distinguished between current and past LBP experiences reported by the participants. When comparing both sectors in terms of current and past LBP, a tendency shows that radiographers may be unfamiliar with the injurious nature of their work environment or the work-related risk factors to which they are exposed. The participants were characterised with bilateral, intermittent current and past LBP that was moderate in nature; described as stiffness, a dull ache or sharp/shooting pain; that was worse at work; reduced on days off work; and was affecting their daily and leisure activities. The pain was noted to have started gradually over time, some had numbness, weakness and 'pins and needles' as associated factors. The most common work-related cause of LBP included bending, lifting heavy objects, twisting, standing and overhead movements. Treatment options included bed rest and pharmaceuticals. These study findings suggest that South African radiographers are more prone to detrimental occupational LBP risk factors, prevalence and injury rates when compared with radiographers in other countries such as Ghana, Korea, Italy and the Netherlands (Lurusso, Bruno and L'Abbate 2007; Bos *et al*. 2007; Kim and Roh 2014).

5.6 Objective 3: To identify possible socio-demographic, environmental, occupational and psychosocial risk factors that may contribute to LBP in diagnostic radiographers in the eThekwini Municipality.

5.6.1 Socio-demographic risk factors

The results of this study found the mean age of public sector radiographers with previous LBP to be 32 years as opposed to a mean age of 34 years amongst the private sector. The mean height for public sector radiographers with previous LBP was 1,60 meters and in the private sector the mean height

for radiographers with previous LBP was 1,63 meters. The mean weight of public sector radiographers with previous LBP was 66kg, which was similar to that of the private sector radiographers with previous LBP (66,7kg). The average BMI value of radiographers in the private sector can therefore be calculated to be 24,8kg/m^2 which puts them in the normal range of 18,5-24,9 kg/m^2 (Shiri *et al.* 2013). The radiographers in the public sector, however, had a BMI value of 25,6 kg/m^2 which puts them in the overweight range of 25,0-29,9 kg/m^2 (Shiri *et al.* 2013). Shiri *et al.* (2013) and Hoy *et al.* (2010) expressed the view that obesity and not just excess weight is a significant contributing risk factor to the development of LBP. Additionally, obesity is believed to have systemic metabolic effects on an individual that results in low level systemic inflammation, which can further increase the risk for developing LBP (Shiri *et al.* 2013; Hoy *et al.* 2010). This is supported by Jensen *et al.* (2012), who highlighted that female health care workers with excessive physical workloads had a 78,0% increased risk for developing LBP. The participants in this study who were overweight may therefore have an increased risk in developing LBP due to the physical nature of work within the radiography profession.

There were more single radiographers in the public sector (55,5%) than the private sector (36,0%), and more married radiographers in the private sector (62,0%) than the public sector (42,1%). The majority of public sector radiographers were therefore single. The average number of dependents for both sectors was reported as one. Hammed and Agbonlahor (2016) reported that a higher prevalence of LBP exists in single individuals as opposed to married individuals. Rana *et al*. (2016) explained that companionship resulted in a decreased chance of an individual experiencing LBP due to care and support from their partner. This is in contrast to the results of this study, which found that both the single private and public sector radiographers were less likely to suffer from current and past LBP than married radiographers.

Low back pain was more common in White and Coloured radiographers in the public sector and more common in African and White radiographers in the

private sector. In contrast, population studies conducted on LBP in the eThekwini Municipality by Van der Meulen (1997), Docrat (1999) and Dyer (2012) found the lifetime prevalence of Coloured and Indian South Africans to be higher than those of Black and White origin, with White individuals having the lowest prevalence rate for developing LBP. Portenoy *et al.* (2004) stated that different ethnicities have various cultural influences that cause individuals to experience pain in a varied way. This can lead to over- and under-reporting of LBP that is experienced. It is therefore possible that some individuals within this study may or may not have over/under reported their LBP experiences.

Female public sector radiographers were more prone to LBP (91,5%) when compared with their male counterparts (75,0%). In the private sector, 95,0% of female radiographers reported previous LBP in contrast to only 50,0% of the male radiographers. Bohman *et al*. (2014) reported that females have a higher LBP prevalence, are more severely affected and often have a poorer prognosis with respect to LBP than males. Lardon *et al.* (2014) noted that the higher prevalence rates of LBP in younger females can be due to the onset of puberty and the resultant gynecological changes. The points made by Lardon *et al.* (2014) were contradicted by Clays *et al.* (2007) and Ochsmann *et al.* (2009), who reported that overweight males had a higher prevalence for developing LBP as opposed to females who are of equal weight. Manchikanti *et al.* (2014) found that some studies reported occupational LBP to be more prevalent in men. An explanation for the variances of the different gender prevalence rates found in the literature was proposed by Morris (2006), who explained that these variances may be due to differences in characteristics of the study populations of the previous studies.

There was 84,6% of the public sector radiographers who possessed a National Diploma in radiography who reported previous LBP. One hundred percent of the public sector radiographers with a Bachelor's degree in radiography reported previous LBP. Within the private sector 86,7% of radiographers with a National Diploma in radiography reported previous LBP. One hundred

percent of those with a Bachelor's degree in radiography and 50,0% of those with a Master's degree in radiography also had previous LBP. Participants with a Bachelor's degree were therefore more prone to LBP. A study by Hu *et al*. (2013) found no statistically significant difference amongst people with a different economic status with respect to LBP risk factors. As this study shows that radiographers with less education (a National Diploma) as well as the radiographers with a higher education (a Master's degree) had less LBP than the ones with a Bachelor's degree, the findings of Hu *et al*. (2013) hold truth.

5.6.2 Environmental risk factors

More than 93,0% of the participants had a routine sleeping pattern. The sleeping position of participants did not reveal any increased risk of LBP. All the participants who engaged in activities involving prolonged sitting; lifting heavy objects; twisting their bodies; bending; prolonged computer work; activities requiring forward positioned arms and continuous pushing/pulling, had an 83,0%-100,0% chance of experiencing LBP. Bos *et al*. (2007) elaborated on this by stating that radiographers are required to perform daily tasks such as positioning and repositioning of patients horizontally; lifting heavy patients from a wheelchair; prolonged standing and carrying of heavy items like x-ray cassettes; and the wearing of lead jackets, which can cause increased compression loads in the lumbar and sacral region. While performing these tasks, the radiographer is at risk of developing LBP as these tasks predispose the individual to LBP (Lurusso, Bruno and L'Abbate 2007; Kim and Roh 2014; Alghadir, Zafar and Iqbal 2015).

The participants who walked to work had the lowest prevalence of LBP, whereas the participants who drove themselves to work, took a bus or taxi and those who got a lift in a car had the highest reported rates of LBP. This may be due to them all involving prolonged sitting during travelling. This was further highlighted by the fact that the average distance and time to and from work was 17km and 38 minutes respectively for the participants of this study. A study on nurses in the eThekwini Municipality by Kumalo (2014) found a

significant relationship between work-related musculoskeletal pain and exercise. Staff involved in exercise were less likely to report musculoskeletal complaints, which may be the reason that the participants who walked to work every day had less incidents of LBP.

5.6.3 Psychosocial low back pain risk factors

There was 5,9% of public sector radiographers with past LBP and 12,5% with current LBP who rated their current health status as poor, whereas none of the private sector radiographers rated their current health status as poor. Karahan *et al.* (2009) found that smoking, a lack of exercise and work stress can result in an increased likelihood of experiencing LBP. Private sector radiographers with past LBP who currently smoked had a 6,7% chance of experiencing LBP, whereas the private sector radiographers with current LBP who currently smoked had a 5,6% chance. The public sector radiographers with past LBP who were smokers had a 5,9% chance of experiencing LBP, whereas the private sector radiographers with current LBP who smoked had a 12,5% chance of experiencing LBP. The average number of cigarettes smoked by participants per day was 1-2 cigarettes and the average number of years was 1-2 years. A strong association has been found between smoking and LBP (Manchikanti *et al*. 2012) and an increase in frequency and duration of LBP has been associated with an increase in smoking. It has been posited by Alkherayf and Agbi (2009) that daily smoking could significantly increase the risk of LBP in adults, and the intensity of LBP was directly linked to the dose smoked. Systematic reviews have found that 51,0%-77,0% of epidemiological investigations have found a causal link between smoking cigarettes and LBP (Wai *et al*. 2008). The pathophysiology attributed to an increase in LBP due to smoking has been thought to include repeated micro trauma from a continuous chronic cough, which can result in disc herniation (Wai *et al*. 2008). Another possible cause includes damage to the blood vessels, which can lead to a decrease in blood supply to the IVD's and vertebral bodies, potentially leading to early vertebral and disc degeneration (Wai *et al*. 2008).

Both the public sector radiographers with past and current LBP reported that they sleep for an average of seven hours per night. Less than 12,0% of the public sector radiographers with past or current LBP exercised regularly as opposed to more than 33,0% within the private sector. A consensus exists within the literature that exercise is beneficial and preventative to the development of LBP (Moreira *et al.* 2014). Harvin (2014) raised the point that workers who participated in regular exercise activities had a better prognosis and a stronger likelihood of recovering from spinal pain than colleagues who did not exercise. A study conducted on nurses in eThekwini by Kumalo (2014) found a significant relationship between work-related musculoskeletal pain and exercise. Staff involved in exercise were less likely to report musculoskeletal complaints. In contrast, Heneweer *et al.* (2011) argued that women who perform high intensity exercises were at greater risk of experiencing LBP.

More than 62,0% of public sector radiographers with past or current LBP rated their stress as moderate or high, as opposed to 71,0% of private sector radiographers with current or past LBP. A study on radiographers in the eThekwini Municipality by Gam (2015) found that the three main sources of stress amongst radiographers were workload, faulty equipment and staff shortages. Verrier and Harvey (2009) noted that psychological morbidity rates were greater amongst healthcare professionals when compared with the general public. Work-related stress has led to an increase in work-related injuries and disease within both first- and third- world countries (Rajan 2014). This was argued by Hartvigsen *et al.* (2004) who recorded that no strong evidence currently exists to support that stress originating from work-related events can be associated with the development of LBP. Gam (2015) argued that physical exercises, counselling and wellness days were used to decrease stress. He further submitted that the employment of more staff; the repair of faulty equipment; team building activities; reduced workloads; and improvements in working conditions were recommended as ways of reducing stress amongst radiographers.

To conclude, the role of increased levels of stress and smoking can therefore be linked to the experience of LBP in radiographers. Furthermore, adequate exercise and its preventative role in LBP amongst radiographers is evident and should be encouraged within the radiography profession.

5.7 Objective 4: To establish the association, if any, between work history and risk factors for LBP in diagnostic radiographers

5.7.1 Occupational risk factors, work history and low back pain

Community service radiographers and those in management positions had the highest reported rates of LBP. Full-time employed radiographers had the lowest incidence of LBP, whereas part-time and night shift had the highest. This may be due to the shortage of staff on night duty or when employed as part-time staff, which can often result in high volumes of patients per radiographers on duty thereby potentially resulting in an increased risk factor for LBP. The radiographers with a work history of between 11-13 years had the highest incidence of LBP, which emphasises that the nature of injury is most likely due to long-term exposure to occupational risk factors compared with acute once-off injuries. The radiographers in this research study working in general radiography, theatre, mammography and computed tomography (CT) were most at risk of experiencing LBP. The age of the x-ray equipment played a role in the incidence of LBP, with more than 85,0% of participants working on mobile x-ray machines/C-arms aged seven years and older reporting previous LBP. This equipment often requires more physical input from the radiographer to move around and therefore increases the strain on the lumbar spine, which may result in LBP.

Roffey *et al*. (2010) also explained that harmful occupational activities included bending; standing; twisting; lifting; carrying; and manual handling. Work-related activities that radiographers with current and past LBP reported includes sitting for long periods; lifting heavy objects; twisting; working at a computer; working with their arms overhead; bending; continuous

pushing/pulling; and working with forward positioned arms. Other activities included pushing around the mobile x-ray unit; wearing a lead apron; lifting patients; transferring a patient to a bed/chair; positioning of the overhead x-ray tube; sitting for more than three hours and standing for more than three hours. Also involved were pushing hospital bed patients, carrying imaging cassettes, and working fast due to radiation exposure. Radiographers involved in these activities had an 80,0%-100,0% risk of experiencing LBP. Bergeron, Wright and Killion (2006) found that 36,0% of all LBP symptoms experienced by healthcare professionals occurred during patient handling, and that the professionals who participated in the direct transfer of patients experienced LBP 37 times more frequently than professionals who did not.

The radiographers who lifted patients or objects more than ten times a day had a higher than 89,0% chance of experiencing LBP, whereas the radiographers who lifted patients or objects weighing more than 70kgs had a higher than 75,0% chance of experiencing LBP.

All the participants who have injured their backs at work in the past had reported LBP. Adesi, Kwadwo and Kab (2015) elaborated on the above when it was stated that radiographers experience a number of difficulties at work that predispose them to LBP. These difficulties include continuous radiation exposure requiring them to work faster in order to reduce their radiation exposure; long hours at work; shift work; high physical workload; inadequate staffing; heavy weight of the mobile x-ray machine; and bending and lifting heavy patients (Bos *et al*. 2005; Kim and Roh 2014; Rajan 2014; Adesi, Kwadwo and Kab 2015).

In conclusion, it is therefore evident that radiographers are exposed to a variety of LBP risk factors on a daily basis in order to fulfill their job responsibilities.

5.8 Work environment changes to reduce low back pain

Table 5.1: Work environment modifications to decrease low back pain

Change suggested	% of radiographers (n)
Repair non-functioning equipment	13,04%
Assistance required to move/lift patients	78,26%
More staff needed	73,91%
Assistance needed to move equipment	21,74%
Management to help with lifting heavy patients	4,35%
Better chairs with back support are needed	39,13%
Newer equipment (mobile unit/x-ray unit) that required less energy to move	56,52%
Less administrative work/less sitting	13,04%
Better work terrain/floors needed	4,35%
Bigger room size	4,35%
Less bending	8,70%
Less standing/walking/more chairs	30,43%
Newer lighter lead aprons needed/less wear of lead apron	30,43%
Lumbar support belts	4,35%
Shorter working hours	4,35%
Better scheduling of workload/less workload	8,70%%
Better posture	4,35%
Education/refresher course on proper work ergonomics e.g. lifting	8,70%

Table 5.1 identifies the suggested changes to the work environment by both public and private sector radiographers, which will assist in the prevention and decrease of work-related LBP. Special attention is needed with regard to aid with the moving and lifting of patients (78,26%) and the need for an increased number of staff (73,91%). More than half of the radiographers suggested that newer equipment was needed.

5.9 Summary

A clear link can therefore be determined between the work environment, tasks required at work, and LBP within radiographers working in the eThekwini Municipality of KwaZulu-Natal. In keeping with the literature, a number of factors have been found to be causative to this finding. High physical demands, staff shortages and the need for newer equipment was cited in this study to be the leading occupational risk factors among radiographers, which require urgent review.

Due to the fact that radiographers are often exposed to radiation the focus of occupational health in the radiographer has always been on reducing their radiation exposure, to the neglect of their occupational LBP risk factors (Kim and Roh 2014). More emphasis should therefore be placed on musculoskeletal injury and LBP prevention in radiographers.

CHAPTER 6
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This research study has revealed the significant impact that LBP has on the diagnostic radiography community in the eThekwini Municipality. Diagnostic radiographers in the eThekwini Municipality have a significant risk of developing LBP with the total lifetime prevalence notable at 90,0%, further indicating the magnitude of this condition within diagnostic radiographers. The total point prevalence amongst diagnostic radiographers working in the eThekwini Municipality was 38,6%. The public sector radiographers had a higher point prevalence as opposed to the private sector radiographers.

This study found that the period prevalence in the public sector was: i) 0-3 months at 10,5%; ii) 3-6 months at 2,6%; iii) 4-9 months at 15,8%; and iv) 9-12 months at 23,7%. In the private sector the period prevalence was: i) 0-3 months at 6,0%; ii) 3-6 months at 0%; iii) 4-9 months at 4,0%; and iv) 9-12 months at 34,0%.

The public sector radiographers had a higher annual prevalence of LBP than the private sector radiographers (52,6% versus 44,0%). When the results of this study were compared with other studies done locally and internationally, it was noted that the point and lifetime prevalence were much higher for the diagnostic radiographers in the eThekwini Municipality when compared with the general public. The radiographers with a work history of between 11-13 years had the highest incidence of LBP, which emphasises that the nature of injury is most likely due to long-term exposure to occupational risk factors by comparison with once off injuries.

The public sector radiographers also rated their LBP as being more severe and requiring more bed rest than the private sector radiographers. More than 80,0% of radiographers from both sectors were convinced that their current and past LBP was work-related. High stress levels and smoking were also associated with increased incidence of LBP amongst the radiographers, whereas exercise was found to have a preventative role.

The study indicated that male radiographers were less at risk for the development of LBP as compared with females, who were twice as much at risk. Community service radiographers and those in management positions had the highest reported rates of LBP. The single radiographers from both sectors were less at risk than the married radiographers. Considering that the majority of the participants of this study were female and the significant lifetime prevalence that was obtained, different results may have emerged if there was a greater male population.

Work-related activities that radiographers with current and past LBP reported include sitting for long periods; lifting heavy objects; twisting; working at a computer; working with their arms overhead; bending; and continuous pushing/pulling. Other work-related activities included working with forward positioned arms; pushing around the mobile x-ray unit; wearing a lead apron; lifting patients; transferring a patient to a bed/chair; and positioning of the overhead x-ray tube. Further factors include sitting for more than three hours; standing for more than three hours; pushing hospital bed patients; carrying imaging cassettes; and working fast due to radiation exposure. Radiographers involved in these activities had an 80,0%-100,0% risk of experiencing LBP.

Forty-five percent of the participants reported previously injuring their lower back at work, with 34,1% of the private sector radiographers and 54,5% of the public sector radiographers being absent from work due to LBP. This suggests that there must to some degree be a financial impact on the

private and public sector, and will undeniably decrease service delivery at the various hospitals at which these radiographers are employed. The participants also reported spending an average of R5200-R7200 to date on LBP treatment, which is a financial implication that could be reduced if LBP prevention strategies are implemented in the work environment of these radiographers.

6.2 Strengths of the study

- This research study is the first of its kind in South Africa where socio-demographic, occupational, environmental and psychosocial risk factors for LBP specifically have been identified within the radiography profession.
- This research study obtained input from qualified radiographers who had a combined total of 1056 years of experiences (n=88), and which provided in-depth insight into the work environment and the risk factors associated with LBP within this population.
- The researcher being both a radiographer as well as a chiropractor provided a mix of knowledge that was invaluable in the conceptualisation and execution of this research study.

6.3 Limitations of the study

- This study only included diagnostic radiographers and did not include nuclear medicine radiographers, radiotherapy radiographers and ultrasonographers.
- This study only included diagnostic radiographers within the eThekwini Municipality.
- The study was focused on LBP only and did not include any of the other anatomical regions of the body such as the neck, mid-back or the extremities.
- A major public hospital in the eThekwini municipality denied access to include their radiographers in the research study population which resulted in a decreased number public sector radiographers as participants.

6.4 Recommendations

- This study did not limit the sample population to any particular diagnostic radiography modality, or limit the population to specific demographic in order to have a larger data collection population size available.
- For a closer look at specific diagnostic radiography modalities and certain risk factor correlations, the sample could be specified to these modalities, e.g. Computed Tomography, Magnetic Resonance Imaging, Theatre radiography, and general radiography.
- This study can be repeated on a national scale to include all the radiographers currently practicing in South Africa for a larger sample population.
- Ergonomic and chiropractic treatment intervention studies would be beneficial for the study population, as the current treatment of choice was pharmaceutical-based which did not decrease their LBP prevalence.
- Education should be provided to the radiographers in this research study with regard to LBP prevention as well as the occupational risk factors that they are exposed to, in order to help mitigate their risk in experiencing LBP.
- Clinical trials could be performed on this population to identify the actual contribution of individual risk factors and the effect of intervention through limited exposure to these risk factors
- It is recommended that similar studies are conducted to evaluate the epidemiology of neck and mid-back pain in radiographers, which may also be due to work-related activities.
- Future studies should be conducted to determine the financial viability of employing a full-time Chiropractor at each of the hospitals/private practices as occupational health practitioners, in order to prevent musculoskeletal health problems and to educate staff on work and lifestyle changes so as to decrease the LBP incidence and prevalence within this population group.

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APPENDIX A: PERMISSION LETTER FROM THE KWAZULU-NATAL DEPARTMENT OF HEALTH:

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

330 Langalibalele street,
Private Bag X9051 PMB, 3200
Tel: 033 395 2805/3189/3123 Fax: 033 394 3782
Email: hrkm@kznhealth.gov.za
www.kznhealth.gov.za

DIRECTORATE:
Health Research & Knowledge Management (HKRM)

Reference: HRKM060/17
KZ_2017RP53_478

14 March 2017

Dear Mr M Erasmus
(Durban University of Technology)

Subject: Approval of a Research Proposal

1. The research proposal titled **'The epidemiology of low back pain in radiographers working in the eThekwini Municipality'** was reviewed by the KwaZulu-Natal Department of Health (KZN-DoH).

   The proposal is hereby **approved** for research to be undertaken at Addington, King Edward VIII, RK Khan, Wentworth, Osindisweni, Prince Mshiyeni Memorial, Mahatma Gandhi, Clairwood and King Dinuzulu Hospitals.

2. You are requested to take note of the following:
   a. Make the necessary arrangement with the identified facility before commencing with your research project.
   b. Provide an interim progress report and final report (electronic and hard copies) when your research is complete.

3. Your final report must be posted to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Ms G Khumalo on 033-395 3189.

Yours Sincerely

[redacted]

Dr E Lutge
Chairperson, Health Research Committee
Date: 14/03/17

Fighting Disease, Fighting Poverty, Giving Hope

APPENDIX B:

Letter of Permission to the KwaZulu-Natal Department of Health to Conduct Research

KZN Department of Health

Private Bag X9051

Pietermaritzburg

3201

Dear Sir/Madam,

Permission to Conduct Research within the Department of Health Institutions

I am currently a registered MTech: Chiropractic student at the Durban University of Technology. One of the requirements for this qualification is to conduct a research study. I would like to therefore request your permission to conduct the following study, entitled: "The epidemiology of low back pain in radiographers working in the eThekwini Municipality."

The details of my intended study are briefly outlined below:
The aim of this study is to:

- Establish the point, period and lifetime prevalence of LBP amongst diagnostic radiographers employed in eThekwini Municipality.
- Determine the nature, severity and clinical presentation of LBP in diagnostic radiographers in the eThekwini Municipality
- Identify possible sociodemographic, environmental, occupational and psycholsocial risk factors that may contribute to LBP in diagnostic radiographers in the eThekwini Municipality.
- To establish the association, if any, between work history and risk factors for LBP in diagnostic radiographers

The study will attempt to determine the prevalence of LBP in diagnostic radiographers and to identify possible sociodemographic, environmental, occupational and psychosocial risk factors for developing LBP that diagnostic radiographers are exposed to. Permission is, therefore requested, in order to conduct this study among diagnostic radiographers within the public hospitals in the eThekwini Municipality area. Participation in this study will be voluntary and participants will only be required to complete a questionnaire adapted from the Dutch Musculoskeletal Questionnaire (Hildebrandt *et al*., 2001), in their personal time (lunch/tea time) so as not to disturb the work-flow within the various departments. The information will remain confidential, and will be available in the form of a dissertation in the Durban University of Technology Library after the data has been captured and analysed, and a conclusion drawn. Attached please find copies of letters of information and informed consent to be provided to the targeted diagnostic radiographers.

Please contact me should you have any queries.

_____

Researcher: **Mynhardt Erasmus (0824463043)**
Supervisors: **Dr JD Pillay (PhD: Physiology) (0313732398)**
Dr F Ally (PhD: Anatomy) (0313732389)

APPENDIX C:

INSTITUTIONAL RESEARCH ETHICS COMMITTEE (IREC) - LETTER OF INFORMATION

Dear participant,
Thank you for taking the time to read this letter and for considering participating in this research study.

Title of the research study:
The epidemiology of low back pain in radiographers working in the eThekwini Municipality.

Principal investigator/s/ researcher:
Full names and surname : Mynhardt Erasmus (mynhardterasmus@yahoo.com)
Qualifications : NDip. Radiography (NM) (CPUT)
: B.Tech in Radiography (NM) (DUT)
: NDip. Chiropractic (DUT)
: B.Tech Chiropractic (DUT)

Co-investigator/s/ supervisor/s:
- Full names and surname : Dr Julian David Pillay (pillayjd@dut.ac.za)
  Qualifications : PhD: Physiology (UCT)

- Full names and surname : Dr Fazila Ally (fazilaa@dut.ac.za)
  Qualifications : PhD: Anatomy (UKZN)

Brief introduction and purpose of the study:
Low back pain (LBP) is the most prevalent musculoskeletal condition and a major cause of disability in developing countries. It is a significant clinical, social, economic and public health problem affecting a large amount of the population. Occupations such as radiography, which require prolonged periods of standing, sitting, lifting, stooping or twisting results in increased likelihood for LBP. LBP has been reported as the most commonly reported musculoskeletal symptom in radiographers. Radiographers experience a number of difficulties at work which includes continuous radiation exposure that requires completing tasks faster and can increase the risk of injury. Long hours at work, shift work, high physical work load, inadequate staffing, heavy weight of the mobile x-ray machine and bending and lifting of heavy weighed patients are also common contributing factors to LBP. Musculoskeletal pain in health care workers leads to absenteeism, work restriction, loss of income and disability. There is a paucity in the literature for the occupational demographics, risk factors, work history and the incidence and prevalence of LBP in radiographers in South Africa. While numerous studies have been performed on LBP in other health care professionals locally and abroad, the lack of South African demographics and the uniqueness of the scope of practice of the diagnostic radiographer, warrants investigation in a South African population.

Inclusion Criteria

The participants must be:

- Qualified and registered with HPCSA under the category of Diagnostic Radiographer.
- Currently employed within the private and/or public sector of the eThekwini Municipality as a Diagnostic Radiographer.

Exclusion criteria

- Student Radiographers
- Nuclear Medicine Radiographers, Ultrasonographers and Radiotherapists

- Questionnaires that are less than 70% completed
- The two Radiographers who participated in the expert group and pilot study

Outline of the procedures:

Participants of the study will be approached directly by the researcher. A letter of information and informed consent will be signed before participation in the study can commence. The participant will then be required to complete a once-off questionnaire which will take approximately twenty (20) minutes. The questionnaire is an adaptation of the Dutch Musculoskeletal Questionnaire (Hildebrandt *et al*., 2001) and consists of a series of questions and statements regarding LBP experienced by the radiographer. The results of this study will provide key information about the demographics, risk factors, incidence, prevalence and clinical presentation of LBP in diagnostic radiographers.

Risks or discomforts to the participant:

This research study is a questionnaire-based study and therefore poses no anticipated risks or discomfort to the participant of any kind. Questionnaires will be anonymous. No names will appear on the questionnaire.

Benefits:

You will contribute to the establishment of radiographer specific sociodemographic, environmental, occupational and psychological risk factors to LBP. The nature, severity and clinical presentation of work-related LBP will also be established. Lastly, the incidence and prevalence of LBP in radiographers will be established from this research study. By identifying common work-related risk factors for LBP in radiographers, information can be obtained regarding which activities should be addressed by the radiographer in order to lower their risk for developing LBP. Benefits for the researchers may include a publication and/ or presentation of the results at a seminar/ congress/ academic journal.

Withdrawal from the study:
You may withdraw from the research study at any given time without penalty/ consequence.

Remuneration:
You will not receive any form of remuneration for your participation in this research study.

Costs of the study:
You will not be liable for any financial contribution/s towards this research study.
Confidentiality:
The information provided by you will be treated as highly confidential and will remain anonymous at all times. You will not be required to include your name or any identifiable details when completing the questionnaire. Data records may be inspected for data analysis by relevant Ethics Committees.

Persons to contact in the event of any problems or queries:
You may contact the researcher, Mr. M. Erasmus (0824463043) or the study supervisors, Dr J.D Pillay (031-373 2398) and Dr. F. Ally (031- 373 2389/082 703 0006). You may also contact the Institutional Research Ethics administrator on 031-373 2900.
Complaints can be reported to the DVC: TIP, Prof F. Otieno on 031- 373 2382 or dvctip@dut.ac.za.

Yours faithfully,
Mr. M. Erasmus
Principal researcher

APPENDIX D:

INSTITUTIONAL RESEARCH ETHICS COMMITTEE (IREC) – CONSENT LETTER

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Mr. Mynhardt Erasmus, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: REC 142/16.
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth and initials will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

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

I, Mr. Mynhardt Erasmus, herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the proposed research study.

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

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

APPENDIX E: ORIGINAL RESEARCH TOOL

Appendix D:

Please place an "X" in the relevant box:

Section A: Demographics

1.1) Age: (in years)				1.2) Height: (meters)				1.3) Weight: (kg)			1.4) Gender:			Male		Female			
1.5) Race:	Black	Colored	Indian	White	Other:		1.6) Marital Status:	Single	Married	Divorced/ Separated	Other:		1.7) Number of dependants						
1.8) Highest level of education?	National diploma in Radiography			Bachelors degree in Radiography			Masters degree in Radiography			PhD/DTech			Other: (explain)						

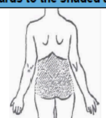
Section B: Social History

2.1) How would you rate your health, at the moment?					Excellent			Good			Fair			Poor					
2.2) Do you have medical health insurance? If yes, which option:				Yes			Hospital Scheme?			Comprehensive medical aid?			No					
2.3) Do you wear anything that supports your back? (back brace, tapping)				Yes (specify)					No	2.4) Have you had any back surgery?			Yes		No			
2.5) Have you had any lower limb surgery?		Yes		No	2.6) Have you ever been pregnant?		Yes		No	2.7) If "yes" did you experience any low back pain while pregnant?			Yes		No			
2.8) Do you suffer from Diabetes?		Yes		No	2.9) Have you been diagnosed with any health conditions? If so please specify					Yes(specify)								
2.10) Do you suffer with any condition in the following systems ↓ : Specify if answer yes																			
Cardiovascular system	Yes (specify)						No	Abdominal		Yes (specify)					No				
Neurological system	Yes (specify)						No	Urinary		Yes (specify)					No				
Respiratory	Yes (specify)						No	Haematological (Blood)		Yes (specify)					No				
Musculoskeletal	Yes (specify)						No	Skin		Yes (specify)					No				
Endocrine	Yes (specify)						No	Immune		Yes (specify)					No				
Smoking:	2.11) What is your smoking status?		Current smoker		Ex-smoker	Non- smoker	2.12) If yes, for current smoker or ex-smoker how many cigarettes do you/ did you smoke per day?			2.13) If yes, for current smoker or ex-smoker. How many years have you, or did you smoke? (Years)									
Sleeping habits:	2.14) On average, how many hours do you sleep per night?				2.15) Do you have a routine sleeping pattern?		Yes		No	2.16) What is your predominant sleeping position?			On your side		On your back			On your stomach	
Exercise:	2.17) Do you exercise?			Yes		No	2.18) If no, do you feel it's due to your demanding/ physical job?			Yes			No						
	2.19) If yes, what exercise do you do? Indicate how many times per week?		Running			Swimming		Aerobics		Soccer			Weight training		Cardio (gym)				
			Yoga			Pilates		Tennis		Walking		Other:							
	2.20) Do you adhere to a regular exercise routine?					Yes													
Travel	2.21) How do you get to work each day:		Drive yourself		Bus	Get a lift in a car		Taxi		Walk			Other:						
	2.22) How many hours do you spend per day seated while traveling?					2.23) Distance from residence to place of work (Kms)		0-5 Kms		6-10 Kms			11-15Kms		16-20 Kms			More than 20 Km's.	
Stress:	2.24) Have you had any domestic stress in the past year? (divorce, moving house, births, deaths)						Yes						No						
	2.25) How would you rate your stress levels generally at home?			High	Moderate	Low	None	2.26) How would you rate your stress levels generally at work?					High		Moderate		Low		None
	2.27) Have you ever been booked off work for stress?			Yes		No		2.28) Have you had any financial stress in the past year?					Yes		No				
	2.29) Are you currently taking any medication for stress?			Yes		No		2.30) Are you currently taking any medication for depression?					Yes		No				

Section C: Occupation

3.1) What is your current work status?	Community Service Radiographer	Junior Radiographer	Senior Radiographer	Chief Radiographer	Assistant Director Radiographer	Manager	Locum Radiographer	Other (explain)		
3.2) What is your present work status?	Full time	Part time	Night shift only	Unemployed	3.3) How many years have you been in this occupation (Radiographer)?					
3.4) How long have you been working for this current hospital/practice? (Years)		3.5) What division would you classify yourself mainly?	General Radiography	Computed Tomography (CT)	Theatre Radiography	Magnetic Resonance Imaging (MRI)	Mammography	Other (explain)		
3.6) In the general X-ray department, which of the following do you work on. (You may select more than one option)	Conventional radiography with wet processing (Dark room)			Computed radiography (CR)			Digital radiography (DR)			
3.7) How old is the X-ray unit you work with mostly?	0-3 years	4-6 years	7-9 years	More than 10 years	3.8) How old is the mobile X-ray unit you work with mostly?	0-3 years	4-6 years	7-9 years	More than 10 years	
3.9) How old is the lead jacket you are wearing currently?	0-3 years	4-6 years	7-9 years	More than 10 years	3.10) How many hours do you work per week?		3.11) Number of days you work per week?			
3.12) Have you ever experienced low back pain from working long hours?	Yes	No	3.13) Have you ever experienced low back pain for standing for long periods of time?	Yes	No					
3.14) Does your current occupation involve any of the following for majority of the day? (may indicate multiple options)	Sitting for long periods	Lifting heavy objects	Turning your body (twisting)	Working at a computer	Working with your arms overhead	Bending	Stress	Continuous pulling/ pushing	Forward positioned arms	Turbulence/ whole body vibration
3.15) Are you required to do any of the following on a daily basis:	Push around mobile X-ray unit?	Wear a lead apron?	Lift patients?	Transfer patients to a chair/bed.	Position the overhead X-ray tube?	Sit for more than 3 hours?	Stand for more than 3 hours a day?	Push hospital bed-patients?	Carry imaging cassettes?	Work fast due to radiation exposure?
3.16) Have you ever injured your back by doing any of the activities mentioned above? If yes, which activities?	Yes	No	Activities:							
3.17) Outside of work, are you exposed to any of the following?	Sitting for long periods	Lifting heavy objects	Turning your body (twisting)	Working at a computer	Working with your arms overhead	Bending	Stress	Continuous pulling/ pushing	Forward positioned arms	Turbulence/ whole body vibration
3.18) If your job involves lifting of heavy objects, how much weight (kg) on average do you lift?	1-10kg	11-20kg	21-30kg	31-40kg	41-50kg	51-60kg	61-70kg	71-80kg	81-90kg	More than 90kgs
3.19) If your job involves lifting of heavy objects, what is it you are lifting?		3.20) On average, how many times a day do you repeat the lifting tasks required of you?	0-10times	11-20times	21-30times	Continuous				
3.21) How many hours are you seated per day?		3.22) How many hours per day do you wear a lead apron?		3.23) Do you ever experience low back pain from wearing the lead apron?	Yes	No				
3.24) How many days per month are you required to wear a lead apron?		3.25) Please write the weight (kg) of the lead apron you wear		3.26) How many patients do you lift per day?						
3.27) Have you ever experienced low back pain from transferring or lifting a patient?	Yes	No	3.28) How many days per month are you working with a mobile X-ray unit?							
3.29) Are you satisfied with what is expected from you at work currently?	Yes	No	30.30) If "no" for the previous question, why not?							

Section: D - Characteristics of pain (LBP = Low back pain)

Low back pain history: Question 4.1-4.4 is applicable to this diagram with regards to the shaded area.	4.1) Have you ever had low back pain? (shaded area)	Yes		No	
	4.2) At any time during the past 12 months, have you had low back pain in the area shown in the diagram? (shaded area) If yes, indicate the time frame.	0-<3 months	3-<6 months	6-<9 months	9-12 months
The following questions apply to current and/ or past low back pain.	**May fill in both if have low back pain today and in the past**				
	Current Low Back Pain: (low back pain today)		**Past Low Back Pain experienced:**		

4.3) How would you score your low back pain? (0 being no pain, 10 being the worst pain)	0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10
4.4) Describe the pain?	1.Sharp	2.Shooting	3. Dull ache	4. Stabbing	5. Stiffness	6. Catching	7. Poking	8. No low back pain	9. Other (specify):			1.Sharp	2.Shooting	3. Dull ache	4. Stabbing	5. Stiffness	6. Catching	7. Poking	8. No low back pain	9. Other (specify)		
4.5) Is the location of the low back pain one side or both sides?	One side-left		One side -right		Both sides		No low back pain					One side-left		One side -right		Both sides		No low back pain				
4.6) Do you ever get the feeling of pins and needles in your legs when the low back pain presents?	Yes					No						Yes						No				
4.7) If indicated yes to the above question, did the pain spread down your legs to below your knees?	Yes					No						Yes						No				
4.8) Do you ever get a numb feeling in your legs and feet when the low back pain presents?	Yes					No						Yes						No				
4.9) Any other associated signs and symptoms you experience when you have the low back pain? (i.e. Weakness, giving way)	(Please specify)											(Please specify)										
The following questions apply to current and/ or past LBP.	**May fill in both if have low back pain today and in the past**																					
	Current Low Back Pain: (low back pain today)											**Past Low Back Pain experienced:**										
4.10) Approximately how many days of LBP have you experienced currently and in the past year?																		Have not had LBP in the past				
4.11) Is the LBP constant or intermittent?	Constant					Intermittent						Constant				Intermittent				Have not had LBP in the past		
4.12) Have you ever been absent from work due to your LBP?	Yes					No						Yes				No				Have not had LBP in the past		
4.13) If "yes" how many days in total?																						
4.14) I can only sit in my work chair for "X" time before experiencing LBP….	10 mins	30 mins	60 mins	180 mins	360 mins	As long as I like						10 mins	30 mins	60 mins	180 mins	360 mins	As long as I like					
4.15) I can only sit in a car seat for "X" time before experiencing LBP ….	10 mins	30 mins	60 mins	180 mins	360 mins	As long as I like						10 mins	30 mins	60 mins	180 mins	360 mins	As long as I like					
4.16) I can only sit in my favorite armchair for "X" time before experiencing LBP ….	10 mins	30 mins	60 mins	180 mins	360 mins	As long as I like						10 mins	30 mins	60 mins	180 mins	360 mins	As long as I like					
4.17) Did the LBP make it difficult to perform activities of daily living? (i.e. Tie your shoe laces/ put socks on)	Yes					No						Yes				No				Have not had LBP in the past		
4.18) Did the LBP affect your leisure activities?	Yes					No						Yes				No				Have not had LBP in the past		
4.19) Have you ever needed bed-rest for your LBP?	Yes					No						Yes				No				Have not had LBP in the past		
4.20) How did your LBP begin?	Gradually over time				Suddenly			Not sure				Gradually over time				Suddenly				Have no LBP		
4.21) Do you have LBP only at work?	Yes				No			Have no LBP				Yes				No				Have no LBP		
4.22) Do you have LBP only at home?	Yes				No			Have no LBP				Yes				No				Have no LBP		
4.23) Does the low back pain get better over weekends/days off from work?	Yes				No			Have no LBP				Yes				No				Have no LBP		

4.24) Do you think your LBP is related to your work?	Yes					No				Yes					No				
4.25) Have you ever lost your job due to LBP?	Yes					No				Yes					No				
4.26) What do you think has caused or aggravates your LBP?	Bending	Twisting	Lifting heavy objects	Posture	Driving	Sitting	Standing	Overhead movements	Other: (Specify)	Bending	Twisting	Lifting heavy objects	Posture	Driving	Sitting	Standing	Overhead movements	Other: (Specify)	
4.27) Have you ever injured your low back at work?	Yes					No				Yes					No				
4.28) Do you feel your work activities aggravate the low back pain?	Yes					No				Yes					No				
4.29) Have you ever received treatment for the low back pain?	Yes					No				Yes					No				
4.30) If "yes" to the previous question please specify what treatment (Multiple applicable)	Surgeon	Pharmacy	Traditional healer	Biokineticist	Physiotherapy	Homeopath	General practitioner (GP)	Chiropractic	Clinic	Surgeon	Pharmacy	Traditional healer	Biokineticist	Physiotherapy	Homeopath	General practitioner (GP)	Chiropractic	Clinic	
	Other (Specify)									Other (Specify)									
4.31) Do you ever do stretches to relieve your back pain? If "yes" how long?	0-5 mins			6-10 mins			More than 10 mins			0-5 mins			6-10 mins			More than 10 mins		
4.32) Are you taking any medication for the low back pain?(pain killers, muscle relaxants)	Yes					No				Yes					No				
4.33) If yes what medication are you taking?	Pain killers	Anti-inflammatory		Rubs	Patches	Traditional medicine		Don't know		Pain killers	Anti-inflammatory		Rubs		Patches	Traditional medicine		Don't know	
4.34) Does the medication help the pain?	Yes					No				Yes					No				
4.35) How much money have you spent on treatment for your low back pain?																			
4.36) Please can you list those things that you would change in your work area in order to decrease the chances of you getting LBP:	**Current Low Back Pain: (low back pain today)**									**Past Low Back Pain experienced:**									
	1									1									
	2									2									
	3									3									

APPENDIX F: AMMENDED FINAL RESEARCH TOOL:

The epidemiology of low back pain in radiographers working in the eThekwini Municipality

LETTER OF INFORMATION

INSTITUTIONAL RESEARCH ETHICS COMMITTEE (IREC) - LETTER OF INFORMATION

Dear participant,
Thank you for taking the time to read this letter and for considering participating in this research study.

Title of the research study:
The epidemiology of low back pain in radiographers working in the eThekwini Municipality.

Principal investigator/s/ researcher:
Full names and surname : Mynhardt Erasmus (mynhardterasmus@yahoo.com)
Qualifications : NDip. Radiography (NM) (CPUT)
: B. Tech in Radiography (NM) (DUT)
: NDip. Chiropractic (DUT)
: B. Tech in Chiropractic (DUT)

Co-investigator/s/ supervisor/s:
- Full names and surname : Prof Julian David Pillay (pillayjd@dut.ac.za)
  Qualifications : PhD: Physiology (UCT)
- Full names and surname : Dr. Fazila Ally (fazilaa@dut.ac.za)
  Qualifications : PhD: Anatomy (UKZN)

Brief introduction and purpose of the study:
Low back pain (LBP) is the most prevalent musculoskeletal condition and a major cause of disability in developing countries. It is a significant clinical, social, economic and public health problem affecting a large amount of the population. Occupations such as radiography, which require prolonged periods of standing, sitting, lifting, stooping or twisting results in increased likelihood for LBP. LBP has been reported as the most commonly reported musculoskeletal symptom in radiographers. Radiographers experience a number of difficulties at work which includes continuous radiation exposure that requires completing tasks faster and can increase the risk of injury. Long hours at work, shift work, high physical work load, inadequate staffing, heavy weight of the mobile x-ray machine and bending and lifting of heavy weighed patients are also common contributing factors to LBP. Musculoskeletal pain in health care workers leads to absenteeism, work restriction, loss of income and disability. There is a paucity in the literature for the occupational demographics, risk factors, work history and the incidence and prevalence of LBP in radiographers in South Africa. While numerous studies have been performed on LBP in other health care professionals locally and abroad, the lack of South African demographics and the uniqueness of the scope of practice of the diagnostic radiographer, warrants investigation in a South African population.

Inclusion Criteria
The participants must be:
- Qualified and registered with HPCSA under the category of Diagnostic Radiographer.
- Currently employed within the private and/or public sector of the eThekwini Municipality as a Diagnostic Radiographer.

Exclusion criteria
- Student Radiographers
- Nuclear Medicine Radiographers, Ultrasonographers and Radiotherapists
- Questionnaires that are less than 70% completed
- The two Radiographers who participated in the expert group and pilot study

Outline of the procedures:
Participants of the study will be approached directly by the researcher. A letter of information and informed consent will be signed before participation in the study can commence. The participant will then be required to complete a once-off questionnaire which will take approximately twenty (20) minutes. The questionnaire is an adaptation of the Dutch Musculoskeletal Questionnaire (Hildebrandt *et al.*, 2001) and consists of a series of questions and statements regarding LBP experienced by the radiographer. The results of this study will provide key information about the demographics, risk factors, incidence, prevalence and clinical presentation of LBP in diagnostic radiographers.

Risks or discomforts to the participant:
This research study is a questionnaire-based study and therefore poses no anticipated risks or discomfort to the participant of any kind. Questionnaires will be anonymous. No names will appear on the questionnaire.

Benefits:
You will contribute to the establishment of radiographer specific sociodemographic, environmental, occupational and psychological risk factors to LBP. The nature, severity and clinical presentation of work-related LBP will also be established. Lastly, the incidence and prevalence of LBP in radiographers will be established from this research study. By identifying common work-related risk factors for LBP in radiographers, information can be obtained regarding which activities should be addressed by the radiographer in order to lower their risk for developing LBP. Benefits for the researchers may include a publication and/ or presentation of the results at a seminar/ congress/ academic journal.

Withdrawal from the study:
You may withdraw from the research study at any given time without penalty/ consequence.

Remuneration:
You will not receive any form of remuneration for your participation in this research study.

Costs of the study:
You will not be liable for any financial contribution/s towards this research study.

Confidentiality:
The information provided by you will be treated as highly confidential and will remain anonymous at all times. You will not be required to include your name or any identifiable details when completing the questionnaire. Data records may be inspected for data analysis by relevant Ethics Committees.

Persons to contact in the event of any problems or queries:
You may contact the researcher, Mr. M. Erasmus (0824463043) or the study supervisors, Prof J.D Pillay (031-373 2396) and Dr. F. Ally (031- 373 2389/082 703 0006). You may also contact the Institutional Research Ethics administrator on 031-373 2900.

Complaints can be reported to the DVC: TIP, Prof F. Otieno on 031- 373 2382 or dvctip@dut.ac.za.

Yours faithfully,
Mr. M. Erasmus
Principal researcher

The epidemiology of low back pain in radiographers working in the eThekwini Municipality

INFORMED CONSENT

INSTITUTIONAL RESEARCH ETHICS COMMITTEE (IREC) – CONSENT LETTER

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Mr. Mynhardt Erasmus, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: IREC 130/16.
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth and initials will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

* 1. I give full consent to be part of the research study.

- ◯ Yes
- ◯ No

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Section A

***Please select a response for each question by clicking on available options.**
***Also please specify where required.**

1. Age in years:

2. Height in meter:

3. Weight in kg:

4. Gender:

- ◯ Female
- ◯ Male

5. Race:

- ◯ Indian
- ◯ Colored
- ◯ African
- ◯ Caucasian
- ◯ Asian
- ◯ Other (please specify)

6. Marital status:

- ◯ Single
- ◯ Married
- ◯ Divorced/Separated
- ◯ Other (please specify)

7. Number of dependents:

8. Highest level of education:

- ◯ National Diploma in Radiography
- ◯ Bachelors Degree in Radiography
- ◯ Masters Degree in Radiography
- ◯ PhD/DTech
- ◯ Other (please specify)

9. Sector of employment:

- ◯ Public
- ◯ Private

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Section B

*Please select a response for each question by clicking on the options available.
*You may select more than one option where applicable.
*Please specify where required.

* 1. How would you rate your health, at the moment?

- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor

* 2. Do you have medical health insurance? If yes, which option:

- ☐ No
- ☐ Yes
- ☐ Comprehensive medical aid
- ☐ Hospital Scheme

* 3. Do you wear anything that supports your back? (back brace, taping)

- ◯ No
- ◯ Yes (please specify)

* 4. Have you had any back surgery?

- ◯ Yes
- ◯ No

* 5. Have you had any lower limb surgery?

- ◯ Yes
- ◯ No

* 6. Have you ever been pregnant?

- ◯ Yes
- ◯ No
- ◯ N/A

* 7. If “yes” did you experience any low back pain while pregnant?

- ◯ Yes
- ◯ No
- ◯ N/A

* 8. Do you suffer from any clinical condition? (specify)

- ◯ No
- ◯ Yes (please specify)

* 9. Do you suffer with any condition within the following systems ↓ : If yes, please specify:

- ☐ Cardiovascular/Circulatory
- ☐ Digestive system/Excretory
- ☐ Endocrine
- ☐ Integumentary (Skin)
- ☐ Lymphatic/Immune
- ☐ Muscular/Skeletal
- ☐ Nervous
- ☐ Renal/Urinary
- ☐ Reproductive
- ☐ Respiratory
- ☐ Sensory (eyes, nose, ears, etc.)
- ☐ None
- ☐ Yes (please specify)

* 10. Do you take any medication for the above clinical conditions, please specify:

- ◯ No
- ◯ N/A
- ◯ Yes (please specify)

* 11. What is your smoking status?

- ◯ Current smoker
- ◯ Ex-smoker
- ◯ Non-smoker

* 12. If you answered yes for current or ex-smoker, how many cigarettes do you/ did you smoke per day?

0 100

* 13. If you answered yes for current or ex-smoker, how many years have you/ did you smoke?

0 50

* 14. On average, how many hours do you sleep per night?

0 24

* 15. Do you have a routine sleeping pattern?

- ◯ Yes
- ◯ No

* 16. What is your predominant sleeping position?

- ◯ On your side
- ◯ On your back
- ◯ On your stomach

* 17. Outside of work, are you exposed to any of the following?

- ☐ Sitting for long periods
- ☐ Lifting heavy objects
- ☐ Turning your body (twisting)
- ☐ Working at a computer
- ☐ Working with your arms overhead
- ☐ Bending
- ☐ Continuous pulling/ pushing
- ☐ Forward positioned arms
- ☐ None

* 18. Do you exercise regularly (3 times a week)?

- ◯ Yes
- ◯ No

* 19. If no, do you feel it is due to your demanding/ physical job?

- ◯ Yes
- ◯ No

* 20. Do you perform any of the following exercise activities?

- [ ] Running
- [ ] Walking
- [ ] Swimming
- [ ] Cycling
- [ ] Yoga
- [ ] Pilates
- [ ] Weight training
- [ ] Aerobics
- [ ] Other (please specify)

* 21. How do you get to work each day?

- ( ) Drive yourself
- ( ) Bus
- ( ) Get a lift in a car
- ( ) Taxi
- ( ) Walk
- ( ) Other (please specify)

* 22. How many minutes do you spend seated per day whilst traveling?

0 240

* 23. Distance from residence to place of work (km's)

0 300

* 24. Are you currently experiencing any stress? If yes, what do you feel is the cause?

- [ ] Finances
- [ ] Family
- [ ] Work
- [ ] Health
- [ ] Marriage
- [ ] No
- [ ] Other (please specify)

* 25. Please rate the stress you are experiencing above:

- ( ) N/A
- ( ) Low
- ( ) Moderate
- ( ) High

* 26. Have you ever been booked of work for stress?

- ( ) Yes
- ( ) No

* 27. Do you currently take any medication for stress?

- ( ) Yes
- ( ) No

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Section C

*Please select a response for each question by clicking on the options available.
*You may select more than one option where applicable.
*Please specify where required.

* 1. What is your current work status?

- [ ] Community Service Radiographer
- [ ] Junior Radiographer
- [ ] Senior Radiographer
- [ ] Chief Radiographer
- [ ] Assistant Director Radiographer
- [ ] Manager
- [ ] Locum Radiographer
- [ ] Other (please specify)

* 2. What is your present work status?

- ( ) Full-time
- ( ) Part-time
- ( ) Night shift only
- ( ) Unemployed

* 3. How many years (in total) have you been in clinical practice?

0 50

* 4. How many years have you been working for this current hospital/practice?

0 50

* 5. Which modality/ies would you classify yourself mainly?

- [ ] General Radiography (inclusive of Mobile Radiography)
- [ ] Computed Tomography (CT)
- [ ] Theatre Radiography
- [ ] Magnetic Resonance Imaging (MRI)
- [ ] Mammography
- [ ] Other (please specify)

* 6. In the general x-ray department, which of the following do you work on.

- [ ] Conventional radiography with wet processing (Dark room)
- [ ] Computed radiography (CR)
- [ ] Digital radiography (DR)
- [ ] N/A

* 7. How old is the x-ray unit you work with?

- [ ] 0-3 years
- [ ] 4-6 years
- [ ] 7-9 years
- [ ] More than 10 years

* 8. How old is the mobile x-ray unit/ c-arm you work with?

- [ ] 0-3 years
- [ ] 4-6 years
- [ ] 7-9 years
- [ ] More than 10 years
- [ ] N/A

* 9. How old is the lead jacket you are currently wearing?

- ◯ 0-3 years
- ◯ 4-6 years
- ◯ 7-9 years
- ◯ More than 10 years
- ◯ N/A

* 10. How many hours do you work per week?

0 60

* 11. How many days do you work per week?

0 7

* 12. Does your job involve any of the following for majority of the day?

- ☐ Sitting for long periods
- ☐ Lifting heavy objects
- ☐ Turning your body (twisting)
- ☐ Working at a computer
- ☐ Working with your arms overhead
- ☐ Bending
- ☐ Continuous pulling/ pushing
- ☐ Forward positioned arms
- ☐ No

* 13. Are you required to do any of the following on a daily basis?

- [ ] Push around mobile X-ray unit
- [ ] Wear a lead apron
- [ ] Lift patients
- [ ] Transfer patients to a chair/bed
- [ ] Position the overhead X-ray tube
- [ ] Sit for more than 3 hours
- [ ] Stand for more than 3 hours a day
- [ ] Push hospital bed-patients
- [ ] Carry imaging cassettes
- [ ] Work fast due to radiation exposure
- [ ] No

* 14. Have you ever injured your lower back by doing any of the activities mentioned above? If yes, which activities?

- [ ] No
- [ ] Yes (please specify)

15. If your job involves lifting of heavy objects, how much weight (kg) on average do you lift?

- [ ] 1-10kg
- [ ] 11-20kg
- [ ] 21-30kg
- [ ] 31-40kg
- [ ] 41-50kg
- [ ] 51-60kg
- [ ] 61-70kg
- [ ] 71-80kg
- [ ] 81-90kg
- [ ] More than 90kgs
- [ ] N/A

16. If your job involves lifting of heavy objects, what is it that you are lifting?

* 17. On average, how many times a day do you repeat the lifting tasks required of you?

- 0-10times
- 11-20times
- 21-30times
- Continuous
- N/A

* 18. How many hours per day are you seated?

0 24

* 19. How many hours per day do you wear a lead apron?

0 24

* 20. Do you ever experience low back pain from wearing the lead apron?

- Yes
- No

* 21. How many days per month are you required to wear a lead apron?

0 31

* 22. Please select the weight (kg) of the lead apron you are wearing at work.

0 10

* 23. How many patients do you lift per day?

0 100

* 24. Have you ever experienced low back pain from transferring or lifting a patient?

- Yes
- No

* 25. How many days per month are you working with a mobile x-ray unit?

0 31

* 26. Are you satisfied with the physical demands currently expected from you at work?

- Yes
- No

27. If you answered “no” to the previous question, why not?

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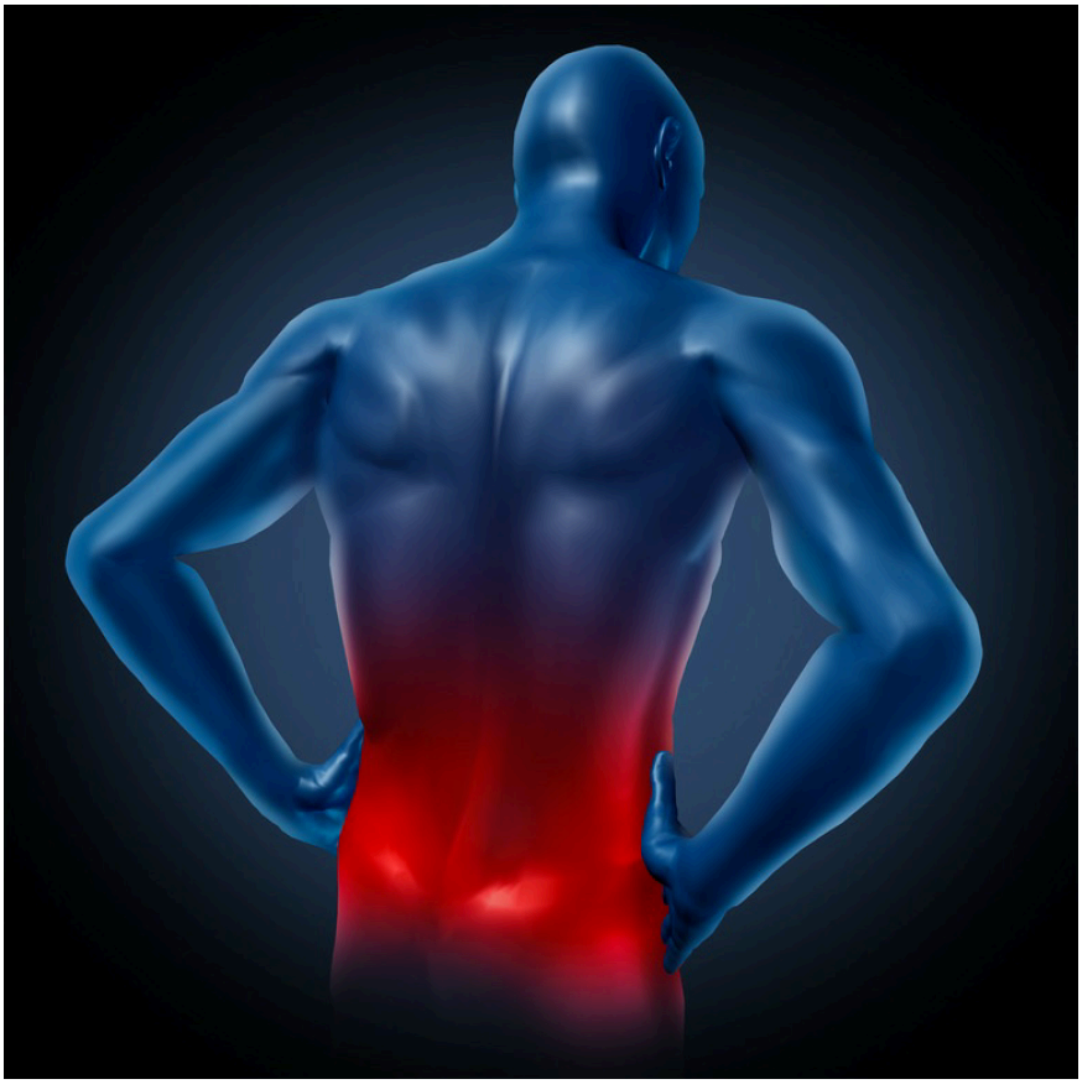
Section D

*Please select a response for each question by clicking on the options available.
*You may select more than one option where applicable.
*Please specify where required.

Questions 1-2 is applicable to this image with regards to the area in red.



* 1. Have you ever had low back pain? (area in red)

- ◯ Yes
- ◯ No

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D1: Questions and statements pertaining to current low back pain.

* 1. At any time during the past 1 month, have you had low back pain in the area shown on the image (red area)? If yes, indicate the time frame.

- ☐ No
- ☐ Yes 0-<3 months
- ☐ Yes 3-<6 months
- ☐ Yes 6-<9 months
- ☐ Yes 9-<12 months

* 2. Do you currently have low back pain? (today)

- ◯ Yes
- ◯ No

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D1.1: Questions and statements pertaining to current low back pain.

* 1. How would you score your low back pain? (0 being no pain, 10 being the worst pain)

0 10

* 2. Describe the pain?

- [ ] Sharp
- [ ] Shooting
- [ ] Dull ache
- [ ] Stabbing
- [ ] Stiffness
- [ ] Catching
- [ ] Poking
- [ ] Other (please specify)

* 3. Is the location of the low back pain one side or both sides?

- ( ) One side-left
- ( ) One side-right
- ( ) Both sides

* 4. Do you ever get the feeling of pins and needles in your legs when the low back pain presents?

- ( ) Yes
- ( ) No

* 5. If you indicated yes to the previous question, did the pain spread down your legs to below your knees?

- ◯ Yes
- ◯ No
- ◯ N/A

* 6. Do you ever get a numb feeling in your legs and feet when the low back pain presents?

- ◯ Yes
- ◯ No

* 7. Are there any other associated signs and symptoms you experience when you have the low back pain? (i.e weakness, giving way, etc.) Please specify.

* 8. Approximately how many days of current low back pain have you experienced to date?

0 365

* 9. Is the low back pain constant or intermittent?

- ◯ Constant
- ◯ Intermittend

* 10. I can only sit in my work chair for "x" amount of time before experiencing low back pain.

- ◯ 10 mins
- ◯ 30 mins
- ◯ 60 mins
- ◯ 120 mins
- ◯ 180 mins
- ◯ No low back pain while seated for long periods in work chair

* 11. I can only sit in a car seat for "x" amount of time before experiencing low back pain.

- ◯ 10 mins
- ◯ 30 mins
- ◯ 60 mins
- ◯ 120 mins
- ◯ 180 mins
- ◯ No low back pain while seated for long periods in a car seat

* 12. I can only sit in my favorite armchair for "x" amount of time before experiencing low back pain.

- ◯ 10 mins
- ◯ 30 mins
- ◯ 60 mins
- ◯ 120 mins
- ◯ 180 mins
- ◯ No low back pain while seated for long periods in my favorite arm chair

* 13. Does the current low back pain make it difficult to perform activities of daily living? (i.e. tie your show laces/put socks on, etc.)

- ◯ Yes
- ◯ No

* 14. Does the current low back pain affect your leisure activities?

- ◯ Yes
- ◯ No

* 15. Have you ever needed bed rest for your current low back pain?

- ◯ Yes
- ◯ No

* 16. How did your current low back pain begin?

- ◯ Gradually over time
- ◯ Suddenly
- ◯ Not sure

* 17. Do you have current low back pain only at work?

- ◯ Yes
- ◯ No

* 18. Do you have current low back pain only at home?

- ◯ Yes
- ◯ No

* 19. Does the low back pain get better over weekends/days off from work?

- ◯ Yes
- ◯ No

* 20. Do you think your low back pain is related to your work?

- ◯ Yes
- ◯ No

* 21. What do you think has caused or aggravates your low back pain?

- [ ] Bending
- [ ] Twisting
- [ ] Lifting heavy objects
- [ ] Posture
- [ ] Driving
- [ ] Sitting
- [ ] Standing
- [ ] Overhead movements
- [ ] Other (please specify)

* 22. Do you feel your work activities aggravate your low back pain?

- [ ] Yes
- [ ] No

* 23. Have you ever received treatment for your current low back pain?

- [ ] Yes
- [ ] No

* 24. If yes to the previous question, please specify the treatment/s received.

- [ ] Surgeon
- [ ] Pharmacy
- [ ] Traditional healer
- [ ] Biokinetikists
- [ ] Physiotherapy
- [ ] Homeopathy
- [ ] General practitioner (GP)
- [ ] Chiropractic
- [ ] Clinic
- [ ] Other (please specify)

* 25. Do you ever do stretches to relieve your low back pain?

- [ ] Yes
- [ ] No

26. If yes to the previous question, how many minutes do you stretch for?

0 60

* 27. Are you taking any medication for the current low back pain? (i.e pain killers, muscle relaxants, etc.)

- ◯ Yes
- ◯ No

* 28. If yes to the previous question, what medication are you taking for the low back pain?

- ◯ Pain killers
- ◯ Anti-inflammatory
- ◯ Rubs
- ◯ Patches
- ◯ Traditional medicine
- ◯ I dont know

* 29. Does the medication help reduce the pain?

- ◯ Yes
- ◯ No
- ◯ N/A

* 30. Have you had low back pain in the past?

- ◯ Yes
- ◯ No

The epidemiology of low back pain in radiographers working in the eThekwini Municipality

D2: Questions and statements pertaining to past low back pain.

* 1. How would you score the low back pain? (0 being no pain, 10 being the worst pain)

0 10

* 2. Please describe the pain.

- [ ] Sharp
- [ ] Shooting
- [ ] Dull ache
- [ ] Stabbing
- [ ] Stiffness
- [ ] Catching
- [ ] Poking
- [ ] Other (please specify)

* 3. Was the location of the low back pain one side or both sides?

- ( ) One side-left
- ( ) One side-right
- ( ) Both sides

* 4. Did you ever get the feeling of pins and needles in your legs when the low back pain presented?

- ( ) Yes
- ( ) No

* 5. If you answered yes to the previous question, did the pain spread down your legs to below your knees?

- ◯ Yes
- ◯ No
- ◯ N/A

* 6. Did you ever get a numb feeling in your legs and feet when the low back pain presented?

- ◯ Yes
- ◯ No

* 7. Were there any other associated signs and symptoms you experienced when you had the low back pain? (i.e weakness, giving way, etc.) Please specify.

* 8. Approximately how many days of low back pain have you experienced in the past?

0 365

* 9. Was the low back pain constant or intermittent?

- ◯ Constant
- ◯ Intermittend

* 10. I could only sit in my work chair for "x" amount of time before experiencing low back pain.

- ◯ 10 mins
- ◯ 30 mins
- ◯ 60 mins
- ◯ 120 mins
- ◯ 180 mins
- ◯ No low back pain while seated for long periods in work chair

* 11. I could only sit in a car seat for "x" amount of time before experiencing low back pain.

- ◯ 10 mins
- ◯ 30 mins
- ◯ 60 mins
- ◯ 120 mins
- ◯ 180 mins
- ◯ No low back pain while seated for long periods in a car seat

* 12. I could only sit in my favorite armchair for "x" amount of time before experiencing low back pain.

- ◯ 10 mins
- ◯ 30 mins
- ◯ 60 mins
- ◯ 120 mins
- ◯ 180 mins
- ◯ No low back pain while seated for long periods in my favorite arm chair

* 13. Did the past low back pain make it difficult to perform activities of daily living? (i.e. tie your show laces/put socks on, etc.)

- ◯ Yes
- ◯ No

* 14. Did the past low back pain affect your leisure activities?

- ◯ Yes
- ◯ No

* 15. Did you ever need bed rest for your low back pain?

- ◯ Yes
- ◯ No

* 16. How did your low back pain begin?

- ◯ Gradually over time
- ◯ Suddenly
- ◯ Not sure

* 17. Did you have low back pain only at work?

- ◯ Yes
- ◯ No

* 18. Did you have low back pain only at home?

- ◯ Yes
- ◯ No

* 19. Did the low back pain get better over weekends/days off from work?

- ◯ Yes
- ◯ No

* 20. Do you think your past low back pain was related to your work?

- ◯ Yes
- ◯ No

* 21. What do you think caused or aggravated your past low back pain?

- [ ] Bending
- [ ] Twisting
- [ ] Lifting heavy objects
- [ ] Posture
- [ ] Driving
- [ ] Sitting
- [ ] Standing
- [ ] Overhead movements
- [ ] Other (please specify)

* 22. Do you feel your work activities aggravated your low back pain?

- [ ] Yes
- [ ] No

* 23. Did you ever receive treatment for your low back pain?

- [ ] Yes
- [ ] No

* 24. If yes to the previous question, please specify the treatment/s received.

- [ ] Surgeon
- [ ] Pharmacy
- [ ] Traditional healer
- [ ] Biokinetikists
- [ ] Physiotherapy
- [ ] Homeopathy
- [ ] General practitioner (GP)
- [ ] Chiropractic
- [ ] Clinic
- [ ] Other (please specify)

* 25. Did you ever do stretches to relieve your low back pain?

- [ ] Yes
- [ ] No

26. If yes to the previous question, how many minutes did you stretch for?

0 60

* 27. Were you taking any medication for the low back pain? (i.e pain killers, muscle relaxants, etc.)

- ◯ Yes
- ◯ No

* 28. If yes to the previous question, what medication were you taking for the low back pain?

- ◯ Pain killers
- ◯ Anti-inflammatory
- ◯ Rubs
- ◯ Patches
- ◯ Traditional medicine
- ◯ I dont know

* 29. Did the medication help reduce the pain?

- ◯ Yes
- ◯ No
- ◯ N/A

The epidemiology of low back pain in radiographers working in the eThekwini Municipality

Section E:

* 1. Have you ever injured your low back at work?

- [ ] Yes
- [ ] No

* 2. Have you ever been absent from work due to your low back pain?

- ( ) Yes
- ( ) No

3. If yes to the previous question, how many days in total?

0 100

4. Have you ever lost your job due to low back pain?

- ( ) Yes
- ( ) No

5. On average, how much money have you spent on treatment for your low back pain? (in rand)

0 100000

6. Please list those things that you would change in your work area in order to decrease the chances of you experiencing low back pain:

Appendix G:

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

The Manager
_____ Hospital Radiography Department
Durban
4001

Dear Sir/Madam,

Permission to Conduct Research within the Radiography Department:

I am currently a registered MTech: Chiropractic student at the Durban University of Technology. One of the requirements for this qualification is to conduct a research study. I would like to therefore request your permission to conduct the following study, entitled: "The epidemiology of low back pain in radiographers working in the eThekwini Municipality."

The details of my intended study are briefly outlined below:

The aim of this study is to:

- Establish the point, period and lifetime prevalence of LBP amongst diagnostic radiographers employed in eThekwini Municipality.
- Determine the nature, severity and clinical presentation of LBP in diagnostic radiographers in the eThekwini Municipality
- Identify possible sociodemographic, environmental, occupational and psycholsocial risk factors that may contribute to LBP in diagnostic radiographers in the eThekwini Municipality.
- To establish the association, if any, between work history and risk factors for LBP in diagnostic radiographers.

The study will attempt to determine the prevalence of LBP in diagnostic radiographers and to identify possible sociodemographic, environmental, occupational and psychosocial risk factors for developing LBP that diagnostic radiographers are exposed to.
Permission is, therefore requested, in order to conduct this study among diagnostic radiographers within the radiography department. Participation in this study will be voluntary and participants will only be required to complete a questionnaire adapted from the Dutch Musculoskeletal Questionnaire (Hildebrandt *et al*., 2001), in their personal time (lunch/tea time) so as not to disturb the work-flow within the various departments. The information will remain confidential, and will be available in the form of a dissertation in the Durban University of Technology Library after the data has been captured and analysed, and a conclusion drawn.
Attached please also find copies of letters of information and informed consent to be provided to the targeted diagnostic radiographers.
Please contact me should you have any queries.

_____

Researcher: **Mynhardt Erasmus (0824463043)**

Supervisors: **Dr JD Pillay (PhD: Physiology) (0313732398)**

Dr F Ally (PhD: Anatomy) (0313732389)

APPENDIX H: PERMISSION FROM LAKE, SMIT AND PARTNERS:

LAKE, SMIT PARTNERS Inc.
www.lakesmit.co.za
SPECIALISTS IN DIAGNOSTIC RADIOLOGY
PR. No. 3805948 Reg. No. 2003/031449/21 VAT No. 4100209818

CROMPTON HOSPITAL Tel: 087 310 4981 Fax: 087 236 0681
ENTABENI HOSPITAL Tel: 087 310 4983 Fax: 087 236 0683
GATEWAY PRIVATE HOSPITAL Tel: 087 310 4985 Fax: 087 236 0685
DIGITAL MAMMOGRAPHY CENTRE Tel: 087 310 4990 Fax: 087 236 0690
KINGSWAY HOSPITAL Tel: 087 310 4980 Fax: 087 236 0680
ONCOLOGY CENTRE Tel: 087 310 4989 Fax: 087 236 0689
PARKLANDS HOSPITAL Tel: 087 310 4986 Fax: 087 236 0686
SHIFA HOSPITAL Tel: 087 310 4988 Fax: 087 236 0688
ST. AUGUSTINE'S HOSPITAL Tel: 087 310 4984 Fax: 087 236 0684
WESTVILLE HOSPITAL Tel: 087 310 4982 Fax: 087 236 0682

ACCOUNTS: Tel: 087 310 4987 • Fax: 087 236 0687 • Email: info@lakesmit.co.za

10 January 2017

Durban University of Technology (DUT)
Institutional Research Ethics Committee

Attention: Mynhardt Erasmus

"The epidemiology of low Back pain in radiographers working in the Ethekwini Muncipality."

Approval to conduct research

Upon review of your letter from your institution and further discussion and review of the questionnaire, I will be glad to offer you the opportunity to conduct your research with the diagnostic radiographers in our organization.

As discussed, no information will be required from our organisation and you will conduct on-line surveys via the radiographer's personal emails upon approval. Should they complete the survey they will do so of their own choice and in their own time.

All information is to be strictly confidential.

I wish you all the best with your studies.

Yours sincerely,

[redacted]

Naomi Muir
Radiographic Manager
Lake, Smit & Partners
naomi.muir@lakesmit.co.za

0873104987

APPENDIX I: PERMISSION FROM JACKPERSAD AND PARTNERS:

Yogi Thanthony
To: Mynhardt Cc: Kd Daji

New contact info found in this email: Yogi Thanthony yogi@jrp.co.za

Yogie writes

Dear Mynhart

Please take note that you have permission to conduct research with our Radiographers.
Please bear in mind that all research done, is confidential.

Kind regards

Yogavelli Thanthony
Radiographic Manager
Jackpersad and Partners Incorporated
Direct line: 031- 365 2167
Cell:0833067472
Email:yogi@jrp.co.za

JACKPERSAD & PARTNERS INC.
SPECIALIST DIAGNOSTIC RADIOLOGISTS

EXCELLENCE IN MEDICAL IMAGING

APPENDIX J: PERMISSION FROM MAXWELL, WEDDERBURN AND PARTNERS:

Umhlanga CT Dept
To: Mynhardt

3:00 PM
Details

UD

Thanks for the mail

Yes that will be fine

Kind Regards

Nalene Herbst (Nat Dip Rad 1996)
Chief Radiographer-CT Specialist
Tel: 031560 5593
(w) 031 5605593
(fax)031 5605603

----- Original Message -----
From: Mynhardt Erasmus
To: ct
Sent: Wednesday, December 21, 2016 1:38 PM
Subject: Permission letter

Good day,

Hope this email finds you well.

I am currently doing my Masters degree and my topic is: *The epidemiology of low back pain in radiographers working in the eThekwini Municipality.*
My research in covering the entire eThekwini Municipality area and includes both private and public sectors.
I would like to request permission to conduct research on the radiographers employed by the practice. My research involves a one-time questionnaire that i will email to all participants to be completed online if they wish to participate. I will email the link to radiographers willing to participate in a private capacity and not in work hours or work emails. This permission letter is imperative for me to continue my research as the IREC at DUT requires a permission letter from private and public institutions in the eThekwini municipality in order for me to start my data collection. The questionnaire is anonymous, does not require the name, surname, employer details etc. The participant only selects Private or Public at the start of the questionnaire and the rest is anonymous questions about back pain.
I am happy to share the research findings with participants once it is completed.

Please find attached the application for permission letter.

APPENDIX K: PERMISSION FROM ADDINGTON HOSPITAL:

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

ADDINGTON HOSPITAL

P.O. BOX 977
DURBAN
4000
Tel: 031-327-2970 Email: reshma.boodhai@kznhealth.gov.za
www.kznhealth.gov.za

OFFICE OF THE CHIEF EXECUTIVE OFFICER

Reference: *9/2/3/R*

Date: 23rd January 2017

Principal Investigator:
- **Mr M Erasmus**

PERMISSION TO CONDUCT RESEARCH AT ADDINGTON HOSPITAL: "THE EPIDEMIOLOGY OF LOW BACK PAIN IN RADIOGRAPHERS WORKING IN THE ETHEKWINI MUNICIPALITY "

I have pleasure in informing you that permission has been granted to you by Addington Hospital Management to conduct the above research.

Please note the following:

1. Please ensure that you adhere to all the policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
2. This research will only commence once this office has received confirmation from the Provincial Health Research Committee in the KZN Department of Health.
3. Please ensure this office is informed before you commence your research.
4. Addington Hospital will not provide any resources for this research.
5. You will be expected to provide feedback on your findings to Addington Hospital.

[redacted]

DR M NDLANGISA
HOSPITAL MANAGER
ADDINGTON HOSPITAL

APPENDIX L: PERMISSION FROM KING EDWARD VIII HOSPITAL

OFFICE OF THE HOSPITAL CEO
KING EDWARD VIII HOSPITAL

Private Bag X02, CONGELLA, 4013
Corner of Rick Turner (Francois Road) & Sydney Road
Tel: 031-3603853, Fax:031-2061457, Email: jessica.khuzwayo@kznhealth.gov.za
www.kznhealth.gov.za

Ref.: KE 2/7/1/(04/2017
Enq.: Mrs. R. Sibiya
Research Programming

18 January 2017

Mr. M. Erasmus
33 Silverdale
47 Madeline Road
Morningside
DURBAN

Dear Mr. Erasmus

Protocol: "The epidemiology of low back pain in Radiographers working in the eThekwini Municipality"- IREC NO. 130/16

Permission to conduct research at King Edward VIII Hospital is provisionally granted, pending receipt of ethical clearance and approval by the Provincial Health Research Committee, KZN Department of Health.

Kindly note the following:-

- The research will only commence once confirmation from the Provincial Health Research Committee in the KZN Department of Health has been received.
- Signing of an indemnity form at Room 8, CEO Complex before commencement with your study.
- King Edward VIII Hospital received full acknowledgment in the study on all Publications and reports and also kindly present a copy of the publication or report on completion.

The Management of King Edward VIII Hospital reserves the right to terminate the permission for the study should circumstances so dictate.

Yours faithfully

[redacted]

SUPPORTED/NOT SUPPORTED ✓ 23.01.2017
DATE

MRS. P NZAMA
ASSISTANT DIRECTOR: RADIOGRAPHY

[redacted]

SUPPORTED/NOT SUPPORTED 25/1/2017
DATE

DR. S. RAMJI
ACTING SENIOR MEDICAL MANAGER

Fighting Disease, Fighting Poverty, Giving Hope

APPENDIX M: PERMISSION FROM R.K KHAN HOSPITAL

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

R.K KHAN HOSPITAL

Postal Address: Private Bag X004, Chatsworth, 4030
Physical Address: 336 R. K. Khan Circle, Croftdene,
Chatsworth, 4030
Tel.: 031-459 6001
Fax: 031-401 1247
Email: reena.ramcharan@kznhealth.gov.za

OFFICE OF THE CEO

ENQUIRIES: DR P.S. SUBBAN

16 JANUARY 2017

Dr JD Pillay
Cc: Dr F Ally
School of Health Sciences
Durban University of Technology

Dear Madam/Sir

RE: PERMISSION TO CONDUCT RESEARCH: THE EPIDEMIOLOGY OF LOW BACK PAIN IN RADIOGRAPHERS WORKING IN THE ETHEKWINI MUNICIPALITY

Permission is granted to conduct the study at this institution.

Please note the following:

1. Please ensure that you adhere to all the policies, procedures, protocols and guidelines of the Institution with regards to this research.
2. Please ensure this office is informed before you commence your research.
3. You will be expected to provide feedback on your findings to this institution.
4. You will be liaising with : Mr Selvam Pillay
   Tel.: 031 459 6130

Yours faithfully

[redacted]

DR P.S. SUBBAN
HOSPITAL CEO

HOSPITAL C.E.O.
R.K. KHAN HOSPITAL
16 -01- 2017
PRIVATE BAG X004
CHATSWORTH 4030

Fighting Disease, Fighting Poverty, Giving Hope

APPENDIX N: PERMISSION LETTER FROM WENTWORTH HOSPITAL

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

1 Boston Road, Jacobs 4025
Private Bag, Jacobs 4025
Tel: 031-460 5000 Fax: 031-4689654
www.kznhealth.gov.za

DIRECTORATE:
WENTWORTH HOSPITAL
PRIVATE BAG
JACOBS 4026

Reference : Research Protocol
Your Ref : Research
Enquiries : Dr. S.B. Kader
Telephone : 031-460 5001
E Mail : Suriya.kader@kznhealth.gov.za
Date 28th DECEMBER 2016

MR. M. ERASMUS
33 SILVERDALE,
47 MADELINE ROAD,
MORNINGSIDE, DURBAN 4001
mynhardterasmus@yahoo.com

Dear Mr. Erasmus

RE: **PERMISSION TO CONDUCT RESEARCH QUESTIONNAIRE AT WENTWORTH HOSPITAL**
THE EPIDEMIOLOGY OF LOW BACK PAIN IN RADIOGRAPHERS WORKING IN THE ETHEKWINI MUNICIPALITY

Your e mail correspondence has reference.

I have a pleasure in informing you that permission has been granted to you to conduct research (questionnaire) on THE EPIDEMIOLOGY OF LOW BACK PAIN IN RADIOGRAPHERS WORKING IN THE ETHEKWINI MUNICIPALITY

Kindly take note of the following information before you continue:-

1. Please adhere to all the policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
2. This research will only commence once this office has received confirmation from the Provincial Health Research Committee in the Kwa-Zulu Natal Department of Health.
3. Kindly ensure that this office is informed before you commence your research.
4. The hospital will not provide any resources for this research.
5. You will be expected to provide feedback once your research is complete to the Chief Executive Officer.

Yours faithfully

[redacted]

DR. S.B. KADER
HOSPITAL MANAGER

Fighting Disease, Fighting Poverty, Giving Hope

APPENDIX O: PERMISSION LETTER FROM OSINDISWENI HOSPITAL

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

Osindisweni Hospital/EThekwini District
Oakford Rd, Verulam,4340
Tel: 032 541 9202 Fax: 032 5333 922 Email: Sibusiso.matibela@kznhealth.gov.za
www.kznhealth.gov.za

Office of the Manager
Nursing Services

To	Ms. M Erasmus
	Researcher – Durban University of Technology (DUT)
From	F.S. Matibela
	Deputy Manager Nursing (Acting CEO)
Date	30 January 2017
Re	Permission to conduct Research within Radiology Department

This letter has as reference.

Kindly be informed that permission to conduct such research is granted with the following conditions:

- All ethical research principles should be adhered to.
- Participants will agree on their own to participate to such study.
- Institution to be informed of the report (results) of the study.
- No hospital property to be utilized or damaged during the process of the study.

Wishing you all the best in your studies.

[redacted]

F.S. Matibela
CEO - Acting

OSINDISWENI HOSPITAL
KZN DEPT OF HEALTH
30 JAN 2017
NURSING MANAGEMENT
P/BAG VERULAM 4340 TEL: (032) 541 9202

Fighting Disease, Fighting Poverty, Giving Hope

APPENDIX P: PERMISSION LETTER FROM PRINCE MSHIYENI HOSPITAL

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

DIRECTORATE: Senior Medical Manager

Mangosuthu Highway, Private Bag X 07
MOBENI
Tel: 031 907 8317/8304 Fax: 031 906 1044 Email:myint.aung@kznhealth.gov.za
www.kznhealth.gov.za

Prince Mshiyeni Memorial Hospital

Enquiry: Dr M AUNG
Ref No: 06/RESH/2107
Date: 10/02/2017

TO: Mynhardt Erasmus

RE: LETTER OF SUPPORT TO CONDUCT RESEARCH AT PMMH

Dear researcher;

I have pleasure to inform you that PMMH has considered your application to conduct research on **"The epidemiology of low back pain in radiographers working in the eThekwini Municipality."** in our institution.

Please note the following:

1. Please ensure that you adhere to all the policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
2. This research will only commence once this office has received confirmation from the Provincial Health Research Committee in the KZN Department of Health.
3. Please ensure this office is informed before you commence your research.
4. The institution will not provide any resources for this research.
5. You will be expected to provide feedback on you finding to the institution.

Should the following requirements be fulfilled, a Permission/ Approval letter will follow.

- Full research protocol, including questionnaires and consent forms if applicable.
- Ethical approval from a recognized Ethic committee in South Africa

Thank you.

[redacted]

Dr. M Aung
Senior Manager: Medical & Consultant in Family Medicine
MBBS(Rgn), PGDip in HIV (Natal), DO(SA)
M.Med.Fam.Med (Natal)

_____

APPENDIX Q: PERMISSION LETTER FROM MAHATMA GHANDI HOSPITAL

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

MAHATMA GANDHI MEMORIAL HOSPITAL

Physical Address: 100 Phoenix Highway, Phoenix
Postal Address: Private Bag X13, Mount Edgecombe, 4300
Tel: 0315021719 ext 2012 Fax: 086 5757 6612 Email: nancy.bridgemohun@kznhealth.gov.za
www.kznhealth.gov.za

Reference: Research

9 February 2017

MR M ERASMUS
C/O DUT

RE: PERMISSION TO CONDUCT RESEARCH: THE EPIDEMIOLOGY OF LOW BACK PAIN IN RADIOGRAPHERS WORKING IN THE ETHEKWINI MUNICIPALITY

I wish to inform you that permission is hereby granted for you to conduct the above mentioned research at Mahatma Gandhi Memorial Hospital provided:

1. Authority is obtained from the Department of Health: Kwazulu-Natal
2. Full ethics approval is obtained.

Kindly forward the above documents to my office. You may not commence your study until these documents have been forwarded.

Yours faithfully,

[redacted]

DR C. PERSAD
MEDICAL MANAGER
MAHATMA GANDHI MEMORIAL HOSPITAL

Fighting Disease, Fighting Poverty, Giving Hope

APPENDIX R: PERMISSION LETTER FROM CLAIRWOOD HOSPITAL

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

Physical Address: 1 Higginson Highway, Mobeni, 4060
Postal Address: Private Bag X04, Mobeni, 4060
Tel: 031 451 5181 Fax: 031 462 2882 Email: buyisiwe.mabaso2@kznhealth.gov.za
www.kznhealth.gov.za

DIRECTORATE:
CLAIRWOOD HOSPITAL
MEDICAL DEPARTMENT

Enquiries: Dr B Mabaso
16 February 2017

Mr M Erasmus
33 Silverdale
47 Madeline Road, Morningside,
Durban
4001

Re: Permission to conduct research at Clairwood hospital

Dear Mr M Erasmus

Clairwood hospital is hereby granting you authority to conduct research with a title **"The Epidemiology of low back pain in Radiographers working in the EThekwini Municipality".**

This permission is subject to approval by ethics committee prior to commencement of your study.

Kind Regards

[redacted]

Dr B Mabaso
Manager: Medical Services
Clairwood Hospital

APPENDIX S: PERMISSION LETTER FROM KING DINUZULU HOSPITAL

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

Physical Address :75 R.D. Naidu road, Sydenham
Physical Address:PO Domerton ,4015
Tel: 031 242 6000 Fax: 031 2099586
www.kznhealth.gov.za

DIRECTORATE:
King Dinuzulu Hospital Complex

Enquiries: Dr S.B. Maharaj

31/01/2017

Dear Mr M. Erasmus

RE: PERMISSION TO CONDUCT RESEARCH AT KING DINUZULU HOSPITAL COMPLEX - (THE EPIDEMIOLOGY OF FLOW BACK PAIN IN RADIOGRAPHERS WORKING IN THE ETHEKWINI MUNICIPALITY.

I have pleasure in informing you that permission has been granted to you by King Dinuzulu Hospital Complex.

Please note the following:

1. Please ensure that you adhere to all policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
2. This research will only commence once this office has received confirmation from the Provincial Health Research Committee in the KZN Department of Health.
3. Please ensure that this office is informed before you commence your research.
4. Neither the District Office nor KDHC will provide any resources for this research.
5. You will be expected to provide feedback on your findings to KDHC.

Yours sincerely

[redacted]

DR S.B. MAHARAJ
MEDICAL MANAGER

APPENDIX T: STATISTICIAN INVOICE AND AGREEMENT

DEEPAK SINGH

Database and Statistical Analysis

P. O. Box 24002
Hillary
4024

(cell): 083-775-9239
singhd@telkomsa.net

QUOTATION

8 February 2017

Mr Mynhardt Erasmus
Durban University of Technology

Dear Mr Erasmus

Statistical Analysis for M. Tech in Chiropractic

The following services will be rendered to you:

1. Coding of data.
2. Analysis
3. Output in Word format.

The statistical aspect of the research will encompass the following:

- Descriptive statistics using frequency and cross-tabulation tables and various types of graphs
- Inferential statistics using correlations
- Testing of hypotheses using multivariate tests
  (Additional methods may be used as the need arises.)

The total cost for the project will be two thousand seven hundred rand only (R2 700).

If you have any queries, please feel free to contact me.

Sincerely

Deepak Singh

APPENDIX U: PERMISSION FROM PRIMIAL PICTURES

PRIMAL PICTURES

Order Confirmation Form

Account Manager: N/a

LICENSEE DETAILS: Durban University of Technology (Mynhardt Erasmus)

Name: Mynhardt Erasmus
Job Title: Masters Student, Chiropractor Researcher
Company: **Durban University of Technology**

Direct Dial: +27824463043
Email: mynhardterasmus@yahoo.com
Postal Address: Durban University of Technology
47 Madeline Road, 33 Silverdale, Morningside, Durban, 4001, South Africa
Postcode Durban 4001
Country: South Africa
Industry Classification: Educational

INVOICE DETAILS (IF DIFFERENT) **Not Applicable**

Name of Agent: n/a
Direct Dial: n/a
Email: n/a
Billing Address: n/a Country: n/a
P/O Number: n/a

LICENSE SERVICE & LICENSE PERIOD

MANAGED RIGHTS

No of images 8

Image Size/s (px) 600 x 600.

Image title/s (list) Figure 2.1: The osseus structures of the lumbo-pelvic region
Figure 2.2: Lateral view of the lumbar vertebra
Figure 2.3: Posterior view of the lumbar vertebra
Figure 2.4: Anterior view of the sacrum
Figure 2.5: The functional spinal unit and ligaments
Figure 2.6: The musculature involved in lumbar spine movement
Figure 2.7: The musculature involved in lumbar spine movement
Figure 2.8: The innervation of the lumbar spine

Permitted Use PhD Thesis The epidemiology of low back pain in radiographers working in the eThekwini Municipality. Mynhardt Erasmus, February 2018, Durban University of Technology Academic Library in print andn online at Durban University of Technology online library which is only accessible to DUT students- not for resale, educational purposes only and online . ***English Language only***

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SIGNED ON BEHALF OF LICENSEE

Signature: [redacted]

Position & Company Name: Masters student Date: 08-07-2017

TOTAL: GRATIS

APPENDIX V: ETHICS APPROVAL LETTER

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

23 February 2017

IREC Reference Number: **REC 142/16**

Mr M Erasmus
33 Silverdale
47 Madeline Road
Morningside
Durban
4001

Dear Mr Erasmus

The epidemiology of low back pain in radiographers working in the eThekwini Municipality

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

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

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

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

Yours Sincerely,

[redacted]

Professor J K Adam
Chairperson: IREC

DUT DURBAN UNIVERSITY OF TECHNOLOGY
2017 -02- 23
INSITUTUTIONAL RESEARCH ETHICS COMMITTEE
P O BOX 1334 DURBAN 4000 SOUTH AFRICA