The prevalence and associated risk factors of musculoskeletal disorders in students who utilise public transport at a university of technology in South Africa

By

Mayibongwe Thandokuhle Hlongwa

Dissertation submitted in partial fulfilment of the requirements for the

Master's degree of Health Sciences in Chiropractic in the Faculty of Health sciences at the

Durban University of Technology

I, Mayibongwe Thandokuhle Hlongwa, do declare that this dissertation is entirely my own work in both conception and execution (except where acknowledgements indicate to the contrary)

02/11/2025

Mayibongwe Thandokuhle Hlongwa Date

Approved for final examination

02/11/2025

Dr Desiree Varatharajullu Date

M.Tech: Chiropractic

DEDICATION

I dedicate this dissertation to my mother, Nonhlanhla Hlongwa. In a world full of uncertainties, you have been my constant — guiding, grounding, and supporting me through every step of this journey. Your unwavering belief in me and your presence in my life continues to inspire me to strive for more. I am here because of you.

I also dedicate this work to my brother, sister, and all my relatives. Thank you for your constant encouragement and love as it further guides my pursuit for knowledge. May this body of work serve as a stepping stone toward even greater accomplishments for our family.

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to all those who have supported me throughout the course of this research project and the completion of this dissertation.

I am especially thankful to my supervisor, Dr Desiree Varatharajullu, for your invaluable guidance, wisdom, constructive feedback, and unwavering patience throughout this long research process. Despite the many challenges that arose along the way, your expertise and mentorship made them easier to navigate.

To my brother, Mzungulu Hlongwa, and sister, Melisa Hlongwa, thank you for always being present, for motivating me, and for supporting me through the most difficult times.

To Po-ya Tang, Tristan Wellen, Raeesa Bhayat, Farhana Bhayat, Mfundo Mnembe, Anthony Davis, Byron Chandler, Amanda Makhonza, and Siphumelele Ndlovu — you all hold a special place in my heart. Your companionship, support, and banter kept me grounded and uplifted. I have been fortunate to share this journey with you and am grateful to call you friends.

To Gill Hendry, thank you for your dedication and assistance with data analysis. Your meticulous attention to detail was invaluable.

To Helen Bond, I greatly appreciate your time and expertise in proofreading this dissertation. Your contributions have been essential.

To the Department of Chiropractic and the clinic staff at the Durban University of Technology, I have been truly fortunate to learn from and work alongside such passionate lecturers, clinicians, and colleagues.

I also extend my thanks to the Durban University of Technology for providing a research budget, awarding me a scholarship, and granting permission to conduct my study on campus.

I am sincerely grateful to all the individuals who participated in this study, offering their time and insights. I also appreciate the assistance of everyone who helped facilitate access to data and study locations.

This dissertation would not have been possible without the support of everyone mentioned and many others who contributed in countless ways. Thank you all for walking this journey with me.

ABSTRACT

Background

Musculoskeletal disorders are injuries affecting the musculoskeletal system, which includes muscles, bones, tendons, joints, and ligaments. These disorders are experienced from childhood to old age have a higher frequency of complaints by working age individuals to health care practitioners. Musculoskeletal disorders can affect individuals' capacity to work and in more severe cases, can limit their capability to participate in activities of daily living. Transportation is an important part of everyday life within our modern society. In South Africa, public transport comprises the use of minibus taxis, buses and the metro railway system. The national household travel survey of 2020 demonstrated that public transport is the most accessible means of travel, with minibus taxis dominating with 25.7%, followed by buses with 4.5% and lastly the metro railway with 0.7%. In contrast private transport had 25.9%. 41.7% walked as a mode of travel and 1.5% of respondents used other modes of transport. Students have a high travel demand such as Rhodes University recording an estimated 11660 trips in 2014. A large number of students at the Durban University of Technology, South Africa, commute to and from campus using public transport. These students are placed at risk for further exacerbation of current musculoskeletal disorders or the onset of them. A gap in the literature with respect to musculoskeletal disorders among university students who travel using public transport exists and, therefore, this study aimed to fill the gap in that literature.

Aim

The aim of this study was to determine the point prevalence and risk factors of musculoskeletal disorders among students who utilise public transportation at a university of technology.

Methodology

This study was designed as a quantitative, descriptive, cross-sectional survey, and was conducted online with registered students at the Durban University of Technology who commute using public transport. The online questionnaire was administered via a link to QuestionPro to the university students in order to determine the point prevalence and associated risk factors of musculoskeletal

disorders. The questionnaire included demographic information, transport routine factors, factors of musculoskeletal disorder and the impacts of musculoskeletal disorders. The captured data were sent to a statistician for statistical analysis.

Results

A total of 382 completed online questionnaires were analysed, giving a response rate of 72.8%. The results showed a moderately high prevalence (62.3%) of musculoskeletal disorders among the students. The most affected areas of pain were the lower back (39.95%), neck (27.8%), shoulder (27.8%) and upper back (27.4%), while the least prevalent region was the elbow (5.0%).

Factors that were considered statistically significant among the students included stress, excessive alcohol consumption, and previous history of trauma. Transport related factors such as the duration of transport (time) were also statistically significant.

Conclusions and Recommendations

This study highlights the point prevalence and risk factors of musculoskeletal disorders among university students using public transportation. To mitigate these risks, future research should adopt longitudinal design, incorporate objective clinical assessments, and compare different transport modes. Preventative strategies, including student awareness programmes on posture and physical activity, reduced carrying loads through digital learning and ergonomic improvements in public transport seating and suspension, are recommended. Collaboration among educational institutions, transportation authorities, and healthcare professionals is essential to reduce musculoskeletal disorders, ultimately enhance students' well-being, academic performance, and quality of life.

Keywords: Musculoskeletal disorders in students, public transportation, musculoskeletal pain, prevalence, risk factors

DECLARATION

I, Mayibongwe Thandokuhle Hlongwa, declare that the work presented in this dissertation is my own original research. This dissertation is a representative of my own work in both concept and execution.

All sources used or quoted have been appropriately referenced following the required academic conventions. Any assistance received in the completion of this research has been fully acknowledged.

I understand that plagiarism constitutes a serious academic offense and confirm that this dissertation complies with the academic integrity policies of the Durban University of Technology (DUT).

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Signature Date

Mayibongwe Thandokuhle Hlongwa

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Signature Date

Dr D. Varatharajullu

PhD: Health Sciences

M.Tech: Chiropractic

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF SYMBOLS AND ABBREVIATIONS

%	Percentage
>	Refers to a value greater than
<	Refers to a value that is less than
=	A sign that indicates equals to
±	Standard devastation
N	Number of participants (total sample)
kg	Kilograms
m	Metres
m^2	Square metre
n	Number of participants (sample sub-group)
p	p-value showing statistical significance
Hz	Hertz
pH	Potential of hydrogen
SPSS	Statistical package for social science
MSK	Musculoskeletal
BMI	Body mass index
IVD	Intervertebral disk
MSD	Musculoskeletal disorders
REBA	Rapid entire body assessment

WMSD	Work related musculoskeletal disorder
DUT	Durban University of Technology
IREC	Institutional Research Ethics Committee
ICD	International classification of disease
LBP	Low back pain
et al.	And others
NSAID	Non-steroidal anti-inflammatory drugs
WHO	World Health Organization

DEFINITIONS OF TERMS

Musculoskeletal: A subsection in anatomy that pertains to the muscular and skeletal systems of the body. This includes bones, joints, tendons and ligaments. The system in its entirety provides shape, support, stabilisation and movement to the human body (Moore, Agur and Dalley 2018).

Musculoskeletal disorders: Refers to any dysfunction or injury on the body's musculoskeletal system which comprises connective tissue, muscles, bones, cartilage, joints, tendons and ligaments (World Health Organization 2023).

Prevalence: A portion of individuals in a population who have a specific disease or condition at a particular time. Prevalence provides an estimate of how widespread a disease/condition is within a given population.

Point prevalence: The proportion of individuals in a population who have a specific disease or condition at a single point in time. For example, assessing how many individuals have low back pain on a specific day.

Period prevalence: The proportion of individuals in a population who have a specific disease or condition over a specified period, such as a month or year. It accounts for all cases, both new and pre-existing, during that timeframe.

Medical history: A comprehensive account of an individual's past and present health conditions, surgeries, medications, allergies, and family health issues. It serves as a foundational tool for healthcare professionals to diagnose and manage medical conditions effectively.

Travel history: A record of an individual's past travel, detailing destinations, durations, and purposes. Travel history is crucial in medical assessments to identify potential exposures to infectious diseases or environmental risks associated with specific locations.

Risk factor: A risk factor is defined as an attribute, habit or exposure to a hazard that increases the likelihood of developing a disease or an injury. Some examples of risk factors include age, sex, genetic predisposition, diet, occupation.

Demographic: This is statistical information that relates to the characteristics of populations. These characteristics include age, gender, ethnicity, BMI etc.).

Psychosocial: Psychosocial risk factors encompass both psychological and social elements encountered in the workplace, Healthcare settings, educational institutions, community and familial relationships. Factors such as job dissatisfaction, work-related stress, and social pressure contribute to the development of musculoskeletal disorders (Arias *et al.* 2023: 261).

Personal: Relating to an individual's unique characteristics, experiences, and behaviours. Personal factors, such as lifestyle choices and habits, can significantly impact one's health outcomes (Adetiba 2017: 21–23).

Biomechanical: Biomechanical work-related factors are factors that encompass the work environment, work procedures, working equipment and ergonomics that result in biomechanical stress in the musculoskeletal system (Lamprecht and Padayachy 2019).

CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

Chapter One introduces and describes of the study, adding a significant layer of context. The aims, objectives, and the chronological order of the chapters are presented.

1.2 BACKGROUND TO THE STUDY

Musculoskeletal disorders (MSDs) are injuries affecting the musculoskeletal (MSK) system which includes muscles, bones, tendons, joints, and ligaments (World Health Organization 2023). These disorders are experienced from childhood to old age and have a higher frequency of complaints by working age individuals to health care workers (Atia *et al* 2023). Furthermore, MSDs can affect individuals' capacity to work and in more severe cases, can limit their capability to participate in activities of daily living. Transportation is an important part of everyday life within our modern society. In South Africa, public transport comprises the use of minibus taxis, buses, and the metro railway system. The national household travel survey of 2020 demonstrated that public transport is the most accessible means of travel, with minibus taxis dominating by 25.7%, followed by buses with 4.5% and lastly the metro railway with 0.7%. In contrast, private transport accounted for 14.9% of car/truck drivers and car/truck passenger with 11.0%. walking was the mode of travel for 41.7% and 1.5% of respondents used other means of transport. students, have a high travel demand, with the example of Rhodes University having an estimated 11660 trips recorded in 2014. Numerous students commute to and from Durban University of Technology (DUT) campuses using public transport.

Musculoskeletal disorders are globally prevalent in individuals, and they have a significant effect on the global population's social care and health (Atia *et al.* 2023). The most common MSK conditions include osteoarthritis, psoriatic arthritis, rheumatoid arthritis, lumbar spine pain, gout and osteoporosis (Lewis *et al.* 2019: 164). The management of these MSK issues requires a multidisciplinary approach, such as physiotherapy, occupational therapy, rheumatology, osteopathy and chiropractic. These disciplines in the healthcare sector have their own unique approach to assess, treat and manage MSDs to improve patient function.

1.3 RESEARCH PROBLEM, AIM AND OBJECTIVES

1.3.1 Research Problem

A significant number of individuals within the South African population utilise public transport, namely minibus taxis and buses, as a means of commuting from place to place. Many university students travel to and from university using public transport and, as such, these students are placed at risk for further exacerbation of current MSDs or the onset of MSDs. There is a gap in the literature with respect to MSDs in university students who travel using public transport; therefore, this study aimed to fill the gap in that literature.

1.3.2 Aim

The main aim of this study was to determine the point-prevalence and risk factors of MSDs in students who utilise using public transportation at a university of technology.

1.3.3 Objectives

1. Determine the prevalence (point and period) of MSDs in students who utilise public transportation at a university of technology.
2. Determine the selected risk factors (previous history of injury, repetitive activity, improper seating posture, contact pressures and physical fatigue) for MSDs among students who utilise public transportation at a university of technology.
3. Determine the impact of MSDs among students who utilise public transportation at a university of technology.

1.4 RATIONALE

Globally, there are more than 150 MSDs, and these disorders are highly prevalent and affect an estimated 1.7 billion individuals (de Luca *et al.* 2022: 22). Individuals who suffer from MSDs usually report pain and loss of range of motion and some individuals report disability (Parker and Jelsma 2010: 2). When considering developing countries, the literature on MSDs is limited, which provides a challenge on making prevalence estimates, rehabilitation and preventative strategies. A multitude of reasons may be behind this, ranging from limitations in funding going

into cultural and health system barriers (Reis *et al*. 2022:4). Researchers in the past have overlooked MSD studies due to the greater urgencies of investigating infectious diseases. Despite MSK pain and disorders seeming to have a clinical high priority in developed countries, research efforts and funding in African countries are often invested in other diseases such as tuberculosis, human immunodeficiency virus or, more recently the COVID-19 pandemic (Martinez-Calderon *et al.* 2024). In other cases, cultural factors, traditional beliefs, informal care, catastrophising of symptoms and fear avoidance practices can complicate more standardised methods of data collection and hinder systematic studies which leads to compromised data (Reis *et al.* 2022: 4).

South Africa is considered a developing country and, hence, the literature on MSDs is limited. Additionally, the information available is relatively old in comparison to other studies (Parker and Jelsma 2010: 2). A fairly recent systematic review conducted by Morris *et al.* (2018), highlighted that South Africa is the second most researched country with respect to MSDs. This may be a positive sign, although it still has its own setbacks, which include general population-level data still being underrepresented, studies being methodologically weak, studies having a high urban focus, and a low priority in MSK based research. This calls for high epidemiological research across the African continent, including in South Africa.

A cross-sectional study in the Marmara University Faculty of Fine Arts, Turkey, was conducted to assess the prevalence and probable risk factors of performance related MSDs in the visual artists. It revealed an overall high prevalence of 88.8% of the 197 participants (Sur Unal and Cifcili 2020: 128). Another study by Kapitán *et al.* (2021: 5) on undergraduate dentistry students assessing the development of MSDs revealed that the overall occurrence of these disorders increases significantly from the first year (30.1%) to the fifth year (45.2%) of study. Similarly, Calik *et al.* (2014: 1364) found an overall prevalence of 51.8% in 871 students of Pamukkale University, Turkey, when investigating MSDs of the spine and upper extremities in university students who use computers. These recent studies show that university students are prone to acquiring MSDs, especially with risk factors such as gender, weight, height, and educational status. In addition to academic-related MSDs, the supplementary need to travel via public transportation can further exacerbate MSDs.

Public transport is transportation that is available to the general population, with set fares and on fixed routes. In South Africa, the socioeconomic landscape was shaped by inequality, which resulted in many individuals not having access to formal financial institutions and general financial literacy. More recently, the COVID-19 pandemic contributed to further financial hardship and, as a result, the average student has little choice regarding transport, namely having to take public minibus taxis and buses to commute from one location to the next (Mashigo 2006; Arndt *et al.* 2020: 100410).

Literature relating to MSDs, public transportation, and public transport ergonomics in the South African context is lacking. The closest comparison to South African minibuses which has been investigated in the past is “tro tro” vehicles, a type of shared public transit vehicle mainly used in Ghana and Nigeria that has some similarities to the minibus taxis of South Africa (Tetteh, Bowen-Dodoo and Kwofie 2017: 167). According to Tetteh, Bowen-Dodoo and Kwofie (2017: 167) the cabin design of public transit vehicle was standardized, thereby not accommodating for the unique kinathropometrical characteristics of its individual patrons, which was cited as a predisposing risk of MSD. Due to the paucity of epidemiological information relating to this area of study and the ever-increasing population, there is a possible correlation with MSDs and constant public transport use (Mokwena and Zuidgeest 2020: 1995). This study aimed to gather epidemiological data on MSDs in relation to university students since they have a high travel demand, so the main focus was on university students who utilised public transport.

Multiple groups will benefit from a study that investigates the prevalence of MSDs among students who utilise public transport. These groups include university students, educational institutions, healthcare professionals, researchers, and academics. Such a study can help raise awareness about potential MSK health, understand challenges faced by students who utilise public transport, provide data to healthcare professionals, and contribute to researchers by providing specific data that can be further explored with other studies

1.5 ASSUMPTIONS AND DELIMITATIONS

Prior to stating assumptions, limitations and the delimitations of the study, it is important to define these concepts. Assumptions are factors the researcher believes

are true but cannot be verified. Delimitations are the governable restrictions set by the researcher to shape the direction of the study. The restrictions are generally based on practical factors such as time and budget restrictions. Limitations within research are a set of factors that the researcher has no control over and these are closely related to the chosen research design, funding constraints and/or statistical model (Terrell 2022: 50-52).

1.5.1 Assumptions

It is assumed that all the responses the participants submitted in the survey were open and honest and that they were thoughtful and reflect the authenticity at the time of questionnaire completion. When considering this assumption, the effort was made by the researcher in the data collection process to declare that their responses would be kept anonymous to foster a comfortable environment so the participants could answer honestly. Using a questionnaire as the primary data collection tool opens the possibility of participant recall bias. This may occur when respondents are required to remember and report past events, exposures, or experiences, which can lead to inaccuracies or misrepresentation of information due to imperfect memory or selective recall.

1.5.2 Delimitations

The following factors were considered delimitations of the study:

- Participants for the study were limited to full-time DUT students (undergraduate and postgraduate) and the study was conducted online. This limitation was to minimise cost within the budget, time constraints imposed on the study, and to maximise the DUT resources that are readily available to all students within each campus.
- To determine the prevalence and identify any associations between risk factors, specific variables were examined. It is acknowledged that other variables exist, which were not explored and could have potentially influenced the participants' responses.
- A quantitative, descriptive cross-section design was chosen as opposed to other designs due to it being best suited to achieving the objectives and the aim of the study. The sampling strategy that was chosen was a convenient

sampling technique as it was suitable for the target population of DUT students, it provided accessibility for the researcher, and it was cost effective for the study budget.

1.6 STRUCTURE OF DISSERTATION

Chapter One

This chapter introduced and contextualised the study by providing clear and concise background on the research surrounding the topic. The chapter outlined the research problem, aims, objectives and rationale of the study.

Chapter Two

This chapter reviews and critically examines the existing literature on MSDs, its associated risk factors, and its association with transportation with the purpose of identifying trends and gaps, further contextualising the research, producing information, and evaluating the sources. Most of the research that is the primary focus in this chapter has been published in the past five to 10 years to ensure that the review is current and up to date.

Chapter Three

This chapter documents the study's methodology. It states the study design, population, location, method of sampling, and the sample characteristics. This chapter explains the data collection tool, development of the questionnaire, the process of testing the validity and the face validity of the measurement tool, the study procedure, and the ethical principles that were used to ensure that the study was ethically sound.

Chapter Four

The results from the study are presented in this chapter. The data collected is represented in a range of ways, including text, tables, and graphs. Significant associations and correlations in data are displayed.

Chapter Five

The results from the previous study are explored and interpreted in this chapter through a detailed analysis and discussion. The process of analysis is in accordance

with the objectives of the study, highlighting noteworthy and statistically significant associations. The findings are discussed and related to the relevant literature that was reviewed in Chapter Two.

Chapter Six

This chapter concludes the research and summarises the findings. This chapter will assess the study by revising each objective and demonstrating the contribution the study has made to the limited literature that was noted. A review of the research process and recommendations for future research is provided.

1.7 CONCLUSION

Musculoskeletal disorders encompass a diverse array of conditions that are prevalent worldwide, affecting individuals across various age groups and socioeconomic backgrounds. Given the significant reliance on public transportation among many students' daily routines, it is crucial to consider the distinct risk factors they encounter. Despite this, there is limited reporting, particularly from developing countries such as South Africa. Consequently, there remains a lack of established data regarding the prevalence and specific risk factors for MSDs among students who commute to campus daily.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

There may numerous studies that have covered the concept of MSDs, but there is a paucity of studies that assess the relationship between MSDs and public transportation use (Sur Unal and Cifcili 2020; Kapitán *et al.* 2021; Pereira *et al.* 2021; de Luca *et al.* 2022). Although some studies have investigated the relationship between MSDs and transportation, a lot of variances in the types of vehicles, working hours and geographical location of the investigation is evident. Studies that investigated this include Ghazal *et al.* (2014); Maduagwu *et al.* (2022) and Ngatcha Tchounga *et al.* (2022). The literature on this topic is notably limited within the South African context.

Studies that investigate MSDs are very significant because they help to better understanding the aetiology, impact, and possible draft preventative measures to manage such disorders. This chapter will closely analyse and review the literature and studies available that were conducted on the topic and other topics that are related should there be a lack in the available literature.

The literature that was used to write this review was sourced through the databases of MEDLINE, EBSCOhost, ProQuest, Science direct, Pubmed. Additional sources were obtained through the Durban University of Technology library summon search and Google Scholar.

2.2. DEFINITIONS

2.2.1 The Musculoskeletal System

The MSK system is a collection of sub-systems within the body that mainly comprise and focus on the following (Moore, Agur and Dalley 2018):

- The skeletal system which comprises bones and cartilage. This is a rigid structure that provides shape and support for the body. Protection of vital organs (that is the heart, lungs, and pelvic structures) is another important function of this system.
- Muscular system which is made up of structures that contract and relax to provide movement of structures and control the flow of fluids in certain

structures. This sub-system works in tandem with the skeletal system to move and position certain parts of the body. This comprises different categories of muscle types.

- Articular system, which is the interconnection of skeletal structures, muscle structures and skeletal-muscular structures. It provides sites on the body where movement can occur.

2.2.2 Musculoskeletal Disorders

Musculoskeletal disorders are defined as any form of injury or disorder that is of muscular, skeletal, and articular origin (World health Organization 2023). There is a wide variety of risk factors associated with MSDs; these include physical hazards (e.g. heavy lifting, repetitive movements, awkward sitting and standing positions, previous history of injury and hours of sleep), psychosocial factors and workplace factors (e.g. work demand, social support, stress and anxiety) (Haahr, Frost and Andersen 2007). A study by Pereira *et al.* (2021: 4) criticised the classification of MSDs, mentioning that the classes do not consider disorders in the occupational context. The study continued by developing a tool to help categorise work-related MSDs. Studies by Ngatcha Tchounga *et al.* (2022: 1018); Atia *et al.* (2023: 1465) and Mohamed (2021: 4251) reveal that MSDs occur in daily life and have a high occurrence.

2.2.3 Pain

As of January 2020, the International Association for the Study of Pain revised the definition of pain as follows: “Pain is an unpleasant sensory and emotional experience associated with or resembling that associated with actual or potential tissue damage” (Malik 2020: 481-483). Pain can be acute (fewer than three months) or chronic (more than three months). Acute pain is usually temporary, associated with a known cause, and is generally easy to treat. In contrast, chronic pain is associated with a long-term condition/disease that is difficult to treat and the cause is sometimes difficult to diagnose (Vasu, Balasubramanian and Kodivalasa 2020).

2.2.4 Risk Factor

A risk factor is defined as an attribute, habit or exposure to a hazard that increases the likelihood of developing a disease or an injury. There is a wide variety of risk factors associated with MSDs which include physical hazards (e.g. heavy lifting,

repetitive movements, awkward sitting and standing positions, previous history of injury, hours of sleep) and psychosocial factors (such as work demand, social support, stress and anxiety) (Haahr, Frost and Andersen 2007). Work related factors significantly associated with work-related MSDs include static posture, prolonged computer use, lack of physical activity, smoking, older age, and alcohol consumption (Demissie, Bayih and Demmelash 2024).

2.2.5 Young Adults and University Students

According to the literature, young adulthood is a period that is approximately between the ages of 18 to 26 years old. This is a time where individuals are expected to develop financially, socially, and assume roles in their respective communities to become functional members of society (Committee on Improving the Health *et al.* 2015). Certain individuals in their young adulthood seek to further their education in higher learning institutions such as universities. In these institutions, they are also referred to as students, and they are studying to enter a particular profession.

2.3 MUSCULOSKELETAL DISORDER

The definition of a musculoskeletal disorder (MSD) was briefly touched on in the definitions section. This section of the literature review aims to elaborate further on its definition.

According to the World Health Organization (2023), a MSD is any condition that is related to the MSK system. It has been noted that there are more than 150 different diseases/conditions that affect the MSK system. The World Health Organization in 1948 assumed responsibility of the international classification of diseases (ICD) classification system that categorises and tracks diseases within the population according to the disease's origin, course, anatomical location and clinical presentation (Hirch *et al.* 2016). This categorisation system is displayed in an orderly manner expressed in the form of codes, referred to as ICD 10 codes (10 standing for the tenth revision) and MSDs are included in the ICD.

Musculoskeletal disorders affect motor organs, muscles, tendons, bones, cartilage, and ligaments (Yu *et al.* 2023). They manifest themselves in a wide variety of symptoms that have a significant effect on individuals. Musculoskeletal disorder consequences can be as minor as inconvenient to as extreme as affecting an

individual's activities of daily living. Musculoskeletal disorders can affect any individual within the world from children to adults, workers/labourers to housewives. Given how an individual's MSK system is in constant use for living, it is no surprise that this sub-category is very prevalent in the world.

2.3.1 The Most Common Musculoskeletal Disorders

There are a wide range of MSDs that have been noted in the ICD classification system but in many countries (developing and developed), the following have been considered to be the most common MSDs: osteoarthritis (OA), rheumatoid arthritis (RA), low back pain (LBP), neck pain and gout (Yu *et al.* 2023)

2.3.1.1 Osteoarthritis

Osteoarthritis is also referred to as degenerative joint disease. It is the most common form of arthritis, characterised by the progressive loss of joint cartilage from mechanical stress, resulting in damage to the underlying bone and the formation of new bone over the lost cartilage margins (Bickley, Szilagyi and Bates 2017: 696-697). This condition is most common (but not limited to) in weight bearing joints such as the hip, knees, proximal and distal interphalangeal joints and the lumbar spine.

The cause of OA is insidious, often genetically associated; it can be caused by injury, obesity, and old age. The symptoms include pain (localised to the affected joint), stiffness, crepitus on movement, limited range of motion, swelling, and a perceived lack of power due to the manifestation of pain (Wilkinson 2017: 544). On radiographic examination, this is characterised by asymmetric distribution of the symptoms, non-uniform loss of joint space, formation of subchondral cysts, loss of cortical bone tissue, formation of bony spurs and general deformation of the joint in extreme cases.

Management for this condition can be approached in a multidisciplinary manner since there is no definitive form of treatment. Management comprises exercise that will improve local muscular strength and function, weight loss for individuals who are obese, and manual therapies such as joint mobilisation and manipulation, which have been shown to be quite effective (Reichardt *et al.* 2022: 1075). The pharmacological approach includes the use of topical non-steroidal anti-inflammatory drugs (NSAID) for pain.

2.3.1.2 Rheumatoid Arthritis

Rheumatoid arthritis is a chronic systemic autoimmune inflammatory arthritis characterised by inflammation of the synovial membrane, erosion of the cortical bone cartilage, and significant damage to the surrounding tendons and ligaments (Guo *et al.* 2018). This condition is characterised by its symmetrical deformation of associated joints. Rheumatoid arthritis is usually insidious. The clinical presentation of this condition includes swelling of the associated joints or tendon sheaths, tenderness, and warmth of the joint, stiffness that is at its most prominent in the mornings and after prolonged inactivity, limited range of motion, joint contracture, subluxation, weakness, fatigue, and weight loss (Bickley, Szilagyi and Bates 2017: 696-697). Management for of RA usually requires a rheumatologist as soon as it is suspected to avoid irreversible destruction of the joints. Manual therapy can be implemented alongside pharmacological treatment. Manipulation of the affected joints is contraindicated and may lead to further damage to the affected area. Steroids rapidly reduce the symptoms and the inflammation. Surgical intervention may provide significant pain relief, improve joint function, and prevent joint (Wilkinson 2017: 546).

2.3.1.3 Low Back Pain

Low back pain is pain that is experienced in the lumbar region or the lumbosacral region of the spine. This pain can vary in its presentation from dull or achy to sharp shooting sensations (Bickley, Szilagyi and Bates 2017: 699). In the absence of abnormal tissue formation, inflammatory disease or infections, the pain is usually acute and commonly work related. A possible cause for this pain is usually muscular or ligamentous injury. In some cases, the cause can be intervertebral disk (IVD) disease, herniation of the IVD, spinal stenosis (central or lateral) or facet disease. The general clinical presentation of LBP includes paraspinal muscle or facet tenderness, reduced curvature of the lumbar spine and, reduced range of motion as a result of pain.

2.3.1.4 Neck Pain

Neck pain is pain that is experienced in the cervical region of the spine. The pain varies from aching, burning to sharp electric-like pain. Neck pain can be accompanied with weakness, headaches or the sensation of pins and needles. A

wide variety of causes are evident, including excessive muscle contraction as a result of poor sleep, posture, and stress. Other causes are forced hyperflexion (whiplash), nerve root compression, or compression of the spinal cord. Symptomatic presentation varies based on cause: mechanical based neck pain, aching pain presentation that is localised, muscle tenderness, muscle spasm, pain on movement, and abnormal head posture (Bickley, Szilagyi and Bates 2017: 698).

2.3.1.5 Gout

Gout is an acute type of arthritis that is characterised by inflammation resulting from the deposition of crystallised urate crystals into nearby joints. The joint that is mostly affected is usually the first metatarsophalangeal joint of the big toe, but other joints can be affected, including the ankle, foot, joints of the hand, wrist joints and knee (Wilkinson 2017: 548). In acute cases, there is only one joint involvement (big toe); but, in chronic cases, there could be multiple joint involvement (wrist, hand, ankle and feet). The joint involvement is not symmetrical. The clinical presentation of someone who presents with gout includes swelling (in and around the affected joint), limited motion, fever, and stiffness (only in chronic cases) (Bickley, Szilagyi and Bates 2017: 697). Treatment in acute cases usually involves a high dose of NSAIDs but the treatment and management is dependent on the stage of the gout (Wilkinson 2017: 548).

2.4 TRANSPORTATION AND DIFFERENT THE TYPES OF TRANSPORTATION IN SOUTH AFRICA

Transportation is a system for the carrying of people and/or goods from one place to another by means of a vehicle. There are two types of transportation systems – private and public transportation.

2.4.1 Private Transportation

Private transportation is a mode of transportation that is personal or individual. It is a mode of transportation that is not for use by the public. This mode of transportation provides the individual with freedom in terms of time and the route of transit. An individual who is in full control of the mode of transportation is the driver. Another form of private transportation comes from privately-hired transport services such as taxi cabs or more modern iterations of that such as ride sharing services (such as

Uber, Bolt, or Lyft). This is also regarded as a form of private transportation because this service is not available to anyone else in the public; there is a private agreement between the driver and the passenger, a form of renting a chauffeured car. This service has been reported to have been making a significant growth as shown by Dong (2020: 231), in which their study revealed that in a developed country such as the United States of America, participants in their survey preferred ride sharing services. This further emphasises the vastness of this type of service; Carson (2018) reported an increase in number of rides (375.5 million) within the year of 2017. In the context of South Africa, an approximate 6.2 million individuals use their own privately owned vehicles (that is car) as a form of travel as shown in the report of South Africa, Department of Statistics (2020:1). Specific statistical metrics still need to be obtained but ride hailing services also have an influence on the methods of commute for South Africans as shown by a study conducted in Cape Town by Carmody and Fortuin (2019: 199)

2.4.2 Public Transportation

Public transportation is a mode of transportation that is available and used by the public. This mode of transportation is made up of many forms, charges a set fee which is subject to change based on the economy, and run on fixed routes. The forms of public transport include, but are not limited to, buses, taxis, and trains. Public transportation is a pivotal mode of transit for many South Africans. It provides a mode of travel for different individuals, from different economic backgrounds, especially individuals who cannot afford their own form of private transportation. In a study by Chakwizira, Bikam and Adeboyejo (2018: 62), in which they investigated the transport constraints faced by public transport commuters in the Gauteng province, South Africa, it was shown that 64.8% of the participants did not own any car. The majority of the participants were from high density areas in Gauteng (such as Mamelodi, Tembisa, Mabopane, and Hamanskraal). Public transport in South Africa predominantly comprises public buses, the metro railway system, and the extensive taxi industry.

2.4.2.1 Buses

Buses constitute a major mode of public transportation, capable of transporting significantly more passengers than standard private vehicles such as cars or vans.

South Africa's Department of Transportation primarily distributes the MAN Lion's explorer bus to the public. This bus has an approximate carrying capacity of 65 seated passengers.

2.4.2.2 Train

South Africa's metro railway system is used to transport many passengers but due to the accessibility buses, taxis, and private transport, according to the Statistics South Africa (2021), trains are the least used form of transportation. Specific values were not detailed within the results of the survey, but it was noted that only 1.5% in Gauteng and 1.6% in the Western Cape of the public utilised this form of transportation.

2.4.2.3 Taxi Industry

The taxi industry makes up the most extensive portion of the public transportation sector. This form of privately-run transportation came about in the late 1970s to service the many South Africans who did not have their own form of private transportation (Lucas 2011: 1320). Since the late 1970s, the South African household travel survey has shown that this is the most dominant form of transportation. According to the latest figures shown in the report of Statistics South Africa (2021: 1), 10.7 million individuals utilise minibus taxis as their main form of transportation.

2.4.3 Transportation from a Statistical Point of View in South Africa

According to the report of Statistics South Africa (2021: 1), a total of 18.5 million students were identified throughout South Africa irrespective of their learning institution. This number would certainly have increased since these statistics were captured. When considering the statistics of school-going individuals, at least 72.4% of those were reported to use taxis, 26% used buses and 1% used trains.

2.4.4 Cost and Efficiency of Public Transportation in South Africa

All the previously mentioned systems of public transport work to serve South Africa's commuters. Unfortunately, within South Africa's metropolitan areas, these systems are far from being adequate. The system does not operate at maximal output, and the communities/citizens struggle to cope with the public transport's shortcomings.

The systems are costly and inconsistent, and, at times, extremely disjointed, uncoordinated, and racially segregated (Mitchell 2020: 22).

The taxi industry is largely dominant in passenger transportation and due to government and police authorities being unable to enforce compliance, the industry rapidly grew since its beginnings in the late 1970s. This resulted in a significantly reduced train use by the public; territory wars between the taxi industry and public buses; land transport levies being dictated by semi-formal taxi associations; and heavy monopolising of the transportation sector. Considering the dominance of the taxi industry and its resistance to change, the increase in the efficiency of public transports may never be realised.

Lucas (2011: 1333-1334) and Thomas (2016: 356) stated that many individuals within lesser affluent regions of South Africa are exposed to the following problems in transportation: 1) lack of access to private vehicles, 2) high dependency to minibus taxis (that is the taxi industry), and 3) lack of efficiency and choice. The initial public transport planning was short-sighted caused by a past system of apartheid of institutionalised racial segregation and discrimination in South Africa. The previous legacy of apartheid's spatial injustice and transit captivity resulted in communities being heavily dependent on the taxi industry.

2.5 THE PREVALENCE OF MUSCULOSKELETAL DISORDERS

Musculoskeletal disorders are prevalent and have the capability of causing long-term pain and physical disability. According to a global burden of disease study by Storheim and Zwart (2014), disability due to MSDs was estimated to have increased by 45% globally between the years 1990 to 2010 (Storheim and Zwart 2014: 949-950). Examples of this can be seen in different regions around the world. A study conducted in Northwest Ethiopia by Tegenu *et al.* (2021) investigated work-related MSDs in restaurant workers. The study revealed that there was a high prevalence of MSDs within 12 months, with LBP with the highest percentage (53.8%). In Asia, there was an increased prevalence in MSDs in the country of India, specifically on the Karnataka region (Pradeepkumar, Sakthivel and Shankar 2020). This study investigating work-related MSDs in full-time occupational bus drivers revealed that 55.8% of the study population had experienced MSDs and significant factors such

as age, body mass index, prolonged sitting, and stress contributed to the work-related MSDs in the drivers who were participants of the study.

2.6 RISK FACTORS

As mentioned under the definitions, a risk factor is a variable that increases the chance of developing a disease or an infection. General health risk factors can be categorised into two major categories, that is intrinsic and extrinsic factors. Intrinsic factors are influences that act within an individual, such as their personality, cognition and mood, while extrinsic factors, are more external influences, and these include weather, physical environment and social rules. Extrinsic factors are regarded as modifiable, due to them being identified as external influences, while intrinsic factors are regarded as non-modifiable or potentially modifiable due to them being a characteristic nature that makes someone more likely to develop a disease, disorder or injury (Orejel Bustos *et al.* 2021). Some examples of intrinsic risk factors include age, sex, genetic predisposition and general state of a person's health, while extrinsic factors include diet, smoking, physical activity, any environmental hazards and occupation.

Research regarding risk factors for MSDs is up to date and is still being investigated by different authors (Coetzee 2018: 6; Lamprecht 2018). Most of the literature categorises risk factors that are associated with MSDs into factors of psychosocial, personal and biomechanical work-related risk.

2.6.1 Psychosocial Risk Factors

According to Arias *et al.* (2023: 261), psychosocial risk factors are a combination of mental and social components that are experienced in a work environment. Things such as job discontent, work-related stress, and social work pressure are all factors that contribute to the formation of MSDs. These factors can manifest in various ways that contribute to MSK pain, including disruptions in systems such as the circulatory and endocrine systems (Ikenna *et al.* 2022: 4). In addition to these factors, increase work demand, social support from work peers, monotony of work, employment risk, and sudden change in workplace environment, are important factors that contribute to work-related MSDs (Arias *et al.* 2023: 260). An accumulation of all these factors will result in the individual developing an injury or a disease and further interaction

of these factors will eventually result in the deterioration of an individual's health and work productivity (Baek *et al.* 2018: 217; Bensusan 2019: 7)

2.6.2 Personal Risk Factors

Personal risk factors are factors are from an individual's demographics (that is age, gender and weight) and the individual's habits/lifestyle practices (exercise, alcohol and use of recreational drugs) (Adetiba 2017: 21-22; Lamprecht and Padayachy 2019: 7; Rathod, Meshram and Meshram 2024: 4). This section will analyse past literature that has noted the association and effect that an individual's demographics and lifestyle have on the development of MSDs.

2.6.2.1 Age

According to Davis *et al.* (2014: 608), many physiological changes occur with ageing, including a reduction in muscular strength, decreased joint mobility, and a reduction in tissue elasticity because of cumulative exposure to external forces. This physiological deterioration could potentially result in an adverse response leading to MSDs. Malik, Beckerly and Imani (2018: 7) noted that age is a significant intrinsic factor for the development of MSDs. They further emphasised this by making an example of how OA is a cause of pain and disability, citing age as one of the predisposing factors for the development of this specific MSD. A statistical example of this was shown by Kapitán *et al.* (2021: 14), in which their study showed a significant increase in the occurrence of self-reported MSDs among dentistry students at the beginning of the first year to the end of their fifth year, the increase moving from 30.1% to 45.2%.

2.6.2.2 Gender

Gender is a significant contributor to MSDs, and could be associated with hormonal changes, difference in strength, and lower muscle volume noted in women when compared to men. Women are reported to display symptoms associated to MSDs at a higher rate than men (Rafie *et al.* 2015: 4). In the Kasr Alainy School of Medicine in Egypt, among the 370 medical students who were selected in a stratified random sample, it was noted that MSDs were significantly higher among women than men (Mohamed 2021: 4251), which correlates with other studies. It was concluded that the higher prevalence may be related to smaller body size and reduced muscle tone in women compared to men. Tembo *et al.* (2023) investigated the prevalence of

work-related MSDs, sampling 108 non-academic staff at the university of Zimbabwe. It was found that women had higher odds of experiencing work-related MSDs, with almost all female participants reporting on LBP within the period of 12 months of work. A 15-year cohort study conducted by Peng *et al.* (2021) highlighted the heightened risk of MSDs among female food and beverage industry workers in Taiwan.

2.6.2.3 Body Mass Index

Body mass index is an approximate measurement of an adult individual's Body mass; this measurement is calculated by dividing Body mass (kgs) by the square of the height (m^2). A normal BMI is defined by the World Health Organization (2024) as being between the ranges of 18 and 25, with individuals falling below 18 being classed as underweight and those with a greater or equal to 25 BMI being regarded as overweight.

The assessed the relation between BMI and MSK symptoms showed that obese individuals within the working population had a higher risk of developing MSK symptoms, especially symptoms of the lower extremity. The association of MSK symptoms was further modified by physical workload (Viester *et al.* 2013: 6). A study by Hooper *et al.* (2007: 116-117) measured MSK changes before and after bariatric surgery for weight loss. In this study, it was noted from previous literature that obese individuals have more MSK pain and physical dysfunction compared to people of normal weight. The results showed great improvements within the cervical spine, lumbar spine, and the foot after substantial weight loss, and it was noted that weight loss significantly reduces MSK symptoms, showing consistency with prior literature.

2.6.2.4 Smoking and Alcohol Consumption

Smoking is a lifestyle habit that has an influence in the impairment and damage of musculoskeletal structures. Its effects are attributed to chronic airway inflammation and tissue destruction (Kohler *et al.* 2023; Adetiba 2017: 22). It may favour the onset or even aggravate the development of MSDs. Multiple explanations as to why the development of MSDs occur have been given, the first being that smoking provokes disk herniation through coughing. The second is pathological changes to the IVD in its nutrition and pH (the acidic or alkaline nature of a solution). Lastly, smoking could have a pharmacological effect on pain perception (Palmer *et al.* 2003: 33). One

systematic review further shows that smoking is a significant risk factor for disc herniation and contributes to biological changes in the IVDs (Huang *et al.* 2016: 173-174). The literature clearly illustrates that smoking contributes to the development and progression of musculoskeletal disorders by inducing tissue ischaemia through vascular constriction, endothelial dysfunction, and reduced oxygen delivery. These changes impair nutrient and oxygen supply to muscles, tendons, and intervertebral discs, thereby accelerating tissue degeneration, delaying healing, and increasing susceptibility to pain and dysfunction(Al-Bashaireh *et al.* 2018: 2).

Excessive alcohol consumption has been shown to adversely affect musculoskeletal health by contributing to osteoporosis, skeletal muscle myopathy, reduced tissue repair capacity, and the aggravation of joint diseases through disrupted metabolic regulation and increased inflammation. Furthermore, alcohol consumption impairs motor and cognitive function, thereby increasing the risk of injuries to the MSK system (Chen *et al.* 2022).

2.6.2.5 Physical Activity

Physical exercise is generally beneficial for the body and mind. It provides MSK aptness, reduces coronary risk factors, improves glucose tolerance, increases MSK strength and flexibility, and renders an individual more eager to complete activities of daily living (Lee *et al.* 2023: 2). Lee *et al.* (2023: 3) conducted a study on Korean middle-aged and elderly individuals with the aim of suggesting an appropriate level of physical activity by confirming the association between physical activity and a higher health-related quality of life. Results from Lee's study show consistency with previous literature such as Wu *et al.* (2017), that individuals of all ages who are engaged in moderate physical activity get better results in their MSK health and psychological well-being and an improved quality of life than those with an inactive lifestyle.

2.6.3 Biomechanical Work Risk Factors

Biomechanical work-related factors are factors that encompass the work environment, work procedures, working equipment and ergonomics that result in biomechanical stress in the MSK system (muscle, joints, tendons, IVDs and nerves). Biomechanical risk factors such as previous injury, injury severity, high initial pain intensity, impaired motor control, and reduced pre-injury physical function have been

associated with an increased risk of developing persistent MSK pain (Alkassabi *et al.* 2022). Kumar (2001: 18) estimated that around 50% of the working population are exposed to physically hazardous work environments that require a significant amount of physical exertion, substantial repetition, and substantial amount of time spent in static positions. Although Kumar's study is rather old, it does yield true because, in more recent years, another study by Jeong and Lee (2024: 6) supported this argument when investigating work-related MSDs in construction workers who had worked over three months. It was noted that 53.9% of the subjects had work-related MSDs with the most common site of pain being the low back. In the corporate side of the workforce, Chinedu *et al.* (2020: 716) noted that office workers from various working organisations show an overall general high work-related MSD prevalence with rates higher than 51% in countries such as Turkey, Brazil, Iran and Kuwait.

Risk factors associated with MSDs and public transport include prolonged sitting posture, awkward sitting positions, and whole-body vibration (Kasemsan *et al.* 2021: 1264). These specific factors have been identified previous studies that investigated the prevalence of MSK pain. In addition to the aforementioned factors, long working hours were identified as a risk factor (Wei *et al.* 2017: 767-768).

This study considers the previously mentioned factors of psychosocial, personal and biomechanical-work-related factors, as well student's lifestyles, how young adults are at risk of these factors and relates them to the public transportation.

2.6.4 Risk Factors Associated with Transport Use

This study primarily focuses on public transport use and MSDs, the significant risk factors in close association with MSDs were noted as the number of working years and hours, vehicle ergonomics and whole-body vibration. Pickard *et al.* (2022: 18) stated that working years and hours are significant factors that influence occupational drivers, since there is a dose-response relationship whereby the number of years worked is directly proportional to the risk of MSDs. Regarding vehicle ergonomics, the incompatibility in seat/body position within public transport vehicles (taxis and buses) is shown to have a close association with MSK disorders. Pickard's study noted that previous studies identified back support and gearbox position contributing greatly to the factor of ergonomics. Burgel and Elshatarat

(2017) also acknowledged similar risk factors associated with transport, in which prolonged sitting, whole body vibration, manual luggage handling and long hours contribute to the development of LBP.

According to Guruguntla *et al.* (2023: 1), whole body vibration is when rapid oscillatory motion is passed to the entire human body or to specific segments of the body through a supporting structure such as a car seat, tractor or ship. When the vibration in a vehicle exceeds a specific vibration threshold, the occupants experience discomfort. Persistent vibration in the frequency range of five to 10 Hertz between four to eight hours results in discomfort for seated occupants, and in order to avoid ride discomfort, a human being should not be exposed to more than eight hours of persistent vibration (Guruguntla *et al.* 2023: 11)

2.7 THE IMPACT OF MUSCULOSKELETAL DISORDERS IN STUDENTS AND WORKERS

Regarding the correlation of students suffering MSDs, an epidemiological study done Sur Unal and Cifcili (2020: 128) in the Marmara University Faculty of Fine Arts Acibadem campus, Turkey, investigated the prevalence and probable risk factors of performance related MSDs in fine art students. This study showed a significant prevalence in MSK pain, with participants having a significant rapid entire body assessment score (REBA) of 5.2. However, regarding their sampling, the study did focus more on one population group since 71.1% of the 197 participants consisted of women. The study further emphasises that university students are prone to MSDs, especially when considering student life, academic stressors, and non-ergonomic environments, all of which can be major contributors to MSDs (Harithasan *et al.* 2022: 1453). In recent times, online learning and the use of smart devices also perpetuates MSDs, mainly manifesting in the cervical, lumbar and shoulder regions (Obembe *et al.* 2013: 389).

In a multi-year cross sectional survey conducted in Canadian university students, it was noted that there was a high prevalence in self-reported MSDs, with the most prevalent regions being the neck (61.8% to 68.4%) and low back (46.6% to 59.7%) over the period of 2018 to 2021 (Parto, Wong and Macedo 2023). Furthermore, Parto, Wong and Macedo (2023) noted that academic stress, lack of sleep, anxiety, and stress have a positive association. A noticeable decline was evident in the

prevalence of MSDs in the 2020 and 2021 year period. One possible explanation for this could be due to the COVID-19 pandemic, resulting in less sport activities and altered study habits.

Tantawy, Rahman and Ameer (2017) conducted a cross-sectional study investigating the relationship between the development of MSDs, BMI, and academic stress among students from Ahlia University in Manama, Bahrain. The study reported a high prevalence of MSDs (77.6%), with the neck, upper back, and low back being the most affected areas. The findings suggest the existence of a cycle in which academic demands contribute to stress, leading to physical tension and discomfort, which may ultimately reduce academic performance and engagement. Although the study did not extensively explore the broader impact of MSDs on students' well-being and lifestyle, it implied that MSDs may contribute to fatigue, reduced physical activity, and increased mental and emotional distress, all of which can hinder overall functioning (Tantawy, Rahman and Ameer 2017).

Masondo (2022) investigated the prevalence and associated risk factors of MSDs among undergraduate radiography students during work integrated learning at the DUT. A high prevalence of 86.1% was noted in the findings of the study. Bending forward was noted as a causative factor, along with stress being another. Regions that were mainly affected were the low back and neck, while the elbow and thigh regions were the least affected. Studies such as these further emphasise that there is a lot of knowledge that still needs to be explored regarding MSDs. It also highlights the lack of literature within this field of research, specifically in South Africa.

2.8 THE IMPACT OF USING TRANSPORT AND MUSCULOSKELETAL DISORDERS

The continuous use of vehicles is seen in many places around the world. A recent systematic review by Pickard *et al.* (2022) noted that the use of transportation is pivotal in many places (Canada, Hong Kong and Korea to name a few). These countries show a high prevalence of work-related MSDs. For LBP, it was found that prolonged sitting and constant sedentary positions while driving without any short breaks can lead to muscle fatigue, which strains the lumbar region (Pickard *et al.* 2022: 20). Fixed and/or awkward sitting postures exacerbate negative bodily outcomes. It begins with continual overloading of the joints, leading to gradual

repeated trauma affecting connective tissue, all of which accumulates and produces pain. An extended period of sitting in a vehicle leads to poor circulation, static muscle contractions, and degenerative changes and, if left untreated, may go as far as annular tears and disc herniation for the lumbar spine discs (Pickard *et al.* 2022: 20-21).

According to Maduagwu *et al.* (2022: 577), the neck and shoulder muscles of drivers get fatigued due to occupational drivers actively engaging these muscles to maintain a steady driving posture. Other postures such as one-sided leaning or slumping create further problems leading to MSK pain and dysfunction of the neck and upper back. These assumed postures are coping strategies that are ignorantly implemented by occupational drivers to manage the MSK pain (Maduagwu *et al.* 2022: 577).

2.9 MUSCULOSKELETAL DISORDERS AND THE USE OF PUBLIC TRANSPORTATION

In a study by Ghazal *et al.* (2014: 25) investigating daily travel and LBP in university students of Rawalpindi and Islamabad, Pakistan, 85.1% of the 315 participants reported LBP and 48.6% of the students travelled by bus. The primary position assumed while traveling was the seated position, while 14.9% of the participants travelled while standing. Furthermore, when participants were questioned regarding the timing of the LBP, the highest percentages were “during travel” (31.1%) and at the end of the day (38.1%). Demographically, most of the participants were women (68.9%), although this value is distorted, due to the sample having 217 women and 98 men. The study revealed that daily commuting in a seated position increased the prevalence of LBP, specifically in students. This shows that perpetual use of public transportation has some effect on the MSK system. The study also proposed that whole body vibration has a link to MSK complaints (Ghazal *et al.* 2014: 25).

The South African household travel survey statistics show that there is a large population that uses public transportation (Statistics South Africa 2021). This survey showed that 10.7 million individuals use minibus taxis and of that large number, there is a higher percentage of higher learning students who travel by taxi (31.5%) compared to students who drive themselves by car or truck (24.1%). These statistics show how dependent the public and especially the youth of South Africa are on

minibus taxis. Considering these high values, it must be noted that there is a paucity of studies done to assess MSDs within the South African context and among university students who commute via public transport. Accounting for the confines of minibuses and buses that the large population using public transport are at risk of developing MSDs.

2.10 SUMMARY

The MSK system is a complex organisation of different sub-systems that work in bringing about protection and locomotion to the human body. Continuous use and lack of care may bring about MSDs. Musculoskeletal disorders have been emphasised as highly prevalent globally. It has been noted that there is a significant impact that perpetual transportation (be it driver or passenger) has on the development of MSDs. A wide variety of transport types operate within South Africa; the taxi industry has been noted as the most used by the population. Lower back, neck, and shoulder pain have been noted as the most prevalent MSDs within this sub-group of transport users. The risk factors of psychosocial, personal, and biomechanical work-related risk factors have been identified as having an association with the prevalence of MSDs. Contrary to these factors, factors specific to transport use have been identified as time spent in the vehicle, seat ergonomics and whole-body vibration. The extent of transport related factors and the relationship among university student is not yet fully understood. With the transport services offered in South Africa, the limited literature has been noted; this warrants the further investigation into the phenomena of MSDs and their prevalence in the population of university students.

CHAPTER THREE: METHODOLOGY

3.1 INTRODUCTION

This chapter provides detailed account of the methodology of the study. It describes the outline of the study by stating the research paradigm, study design, development and the validation of the questionnaire, procedures followed for the data collection, and the statistical examination of the data.

3.2 RESEARCH PARADIGM

According to Dieronitou (2014: 3), a research paradigm is a set of common beliefs, values, techniques, and agreements shared amongst members of the scientific community about how problems should be understood and addressed. Research paradigms are theoretical frameworks that intended to study the reality of the world. Each of the designs different study designs (that is quantitative, qualitative and mixed research methods) use different research method models and have different research problems. This is a philosophical concept that influences what should be studied, how studies are done, and how the results of the study should be interpreted (Bibi, Khan and Shabir 2022: 7322).

The following are essential elements of a research paradigm.

3.2.1 Ontology

Ontology refers to the concept of “being and existence”. Ontology studies the perception of reality about the world’s entities. This philosophical outlook is concerned with the subsistence of man, society and the world, and how all these three components form objective participants. According to Bibi, Khan and Shabir (2022: 7323), they acknowledge that certain scholars adopt a subjectivist or an objectivist point of view. Objectivists believe in objective reality while subjectivists explore reality and judge from the participant’s point of view.

3.2.2 Epistemology

This describes the relationship between the researcher and their version of reality by answering the question “what is the relationship between the researcher and the researched?”. Epistemology deals with the fundamental nature, forms, acquisition, and communication of knowledge. In this study, the researcher gained information

based on the students' experience with MSDs. The use of the closed-ended questionnaire was utilised to gather information about this reality.

3.2.3 Methodology

Methodology refers to how the study is conducted; in other words, the "study of methods". This is a generic approach used by investigators which includes data collection and data analysis of the investigator's research. Research methodology comprises the selection and use of qualitative, quantitative, and mixed method approaches to the research in order to collect data, interpret data, deduce the results, and finally generate theories and possible approaches to future research.

This study used a positivistic paradigm of quantitative research approach. This approach maintains the certainty that reality is to be studied, captured, and realised.

3.3 STUDY DESIGN

This study was designed as a quantitative, descriptive, cross-sectional survey, and was conducted online with registered students at the DUT to determine the prevalence and associated risk factors of MSDs in students who commute using public transport.

Quantitative research is a method of research in which the researcher collects and analyses numerical data. The data are collected through close ended questions and the statistics generated give the researcher objective and unbiased information. Cross sectional surveys are studies that analyse data population at a single point in time. This type of study is useful in gaining information on the prevalence of health conditions of a population.

This research design was chosen for the purpose of using descriptive information that was generated for statistical analysis which allowed for an understanding of the relationships between variables (Mitchell and Jolley 2010). The chosen research design was effective for this study to determine the prevalence and risk factors of MSDs of the chosen population. Additionally, the study design was cost-effective, and its online nature made it efficient.

3.4 STUDY LOCATION

The study locations comprised of four DUT campuses (Steve Biko, ML Sultan, Ritson, and City Campus) in the eThekwini Municipality. Permission was sought from the Research Director (Appendix A) at DUT to conduct the study on students at all four campuses.

3.5 STUDY POPULATION

A study population refers to a group of individuals selected from a larger population for the purpose of conducting research. This group is defined using specific inclusion and exclusion criteria relevant to the study's aims, objectives, and research question (Eldredge, Weagel and Kroth 2014). Data were collected and analysed from this group. In this study, the chosen population consisted of registered students attending the DUT.

3.6 SAMPLING

Sampling is the process of selecting the group that will be a representative portion of a larger population for the purpose of determining the characteristics and reaching conclusions on the basis of evidence and reasoning (Greenfield and Greener 2016: 245). It is necessary to sample because it provides a practical, accessible, and cost-effective method of studying the desired population. A random stratified sampling method was used to ensure that all four sectors of the DUT eThekwini Municipality campuses were represented. Stratified sampling is a sampling method in which the researcher divides the population into smaller sub-groups which is referred to as strata (Greenfield and Greener 2016: 249). The chosen random stratified sampling method was the best approach to ensure that the student population selected was equally represented and it limited sample bias providing equal probability of representation. Students were provided a QuestionPro link to access, where they could answer the provided questionnaire at their own leisure.

Regarding the total number of students within the Durban campuses, assuming a population of 24 823, with a margin of error and alpha value of .05, the sample required from each campus is shown in the **Table 3.1**.

Table 3.1: The total number of students in each campus and their sample sizes

Campus	Population Size	Sample
City Campus	677	8
ML Sultan	8029	96
Ritson	9861	118
Steve Biko	6256	75
Total	**24823**	**379**

3.7 SAMPLE CHARACTERISTICS

3.7.1 Inclusion Criteria

- Registered DUT students who utilise public transportation (that is minibus taxis, buses, or taxicabs).
- Students between the ages of 19 and 30 years to ensure accurate representation of the study population.

3.7.2 Exclusion Criteria

- DUT staff.
- Participants who have not signed the informed consent forms.
- Participants who have not voluntarily read the letter of information.
- Students not willing to participate.
- Students who participated in the focus group and pilot study.

3.8 MEASUREMENT TOOL

Quantitative studies use numeric based measurement methods; the one chosen for this study was a survey. This instrument was chosen based on its validity and reliability and it was noted as the most suitable for achieving the study objectives. The measurement tool was a-questionnaire that was adapted from Pendock (2018: 94-101) (Appendix B). Permission to use and alter the questionnaire was requested

and granted (Appendix C). After the questionnaire was developed and approval (Appendix D) of the study was obtained from the Institutional Research Ethics Committee (IREC), a focus group and a pilot study were conducted to test the validity of the questionnaire. Potential factors found in the review of literature for this study were used for the development of the research questions. Factors that contribute to the development and perpetuation of MSDs were asked in this questionnaire.

The questionnaire (Appendix B) developed/adapted using the following references:

Table 3.2: Questionnaire development

Sections	References
Section A • Demographics • Social history (sleep, exercise, stress, smoking, alcohol consumption etc.) • Medical history	(Pasero and McCaffery 2010) (Rufa'i *et al.* 2015: 252) (Pendock 2018)
Section B • Travel distance • Posture during travel • Vehicle type • Duration of travel	(Ghazal *et al.* 2014) (Rufa'i *et al.* 2015: 252)
Section C • Musculoskeletal pain characteristics (location, intensity, character if pain, aggravating factors, relieving factors, and effects of pain)	(Yap Zhi *et al.* 2022: 2636- 2641) (Pasero and McCaffery 2010)

3.9 RESEARCH TOOL

3.9.1 Focus Group

A focus group is a collective of people participating in an interactive discussion, focusing on a specific set of issues with the aim of gaining a broad range of views (Hennink 2014: 1). The focus group was formed to critique the questionnaire. The constructive criticism was for the purpose of testing validity regarding construct, content, and face validity, making sure that the questions asked in the questionnaire are addressing the objectives of the study.

3.9.2 Procedure for the Focus Group

The focus group critique was conducted online using MS Teams. A total of six individuals represented in at least one of the criteria presented for the focus group;

the group comprised of individuals with diverse linguistic backgrounds to help with streamlining terminology for the questionnaire. The members were welcomed and informed of their role within the expert group. They were informed that the group discussion was being recorded, and confidentiality would be maintained. A request was made for the participants to not divulge any information/discussion to anyone outside the focus group.

Confidentiality statements (Appendix E), information letters (appendix F) were presented for the individuals to sign before the meeting took place. After signing, the prefocus group questionnaire (Appendix B) was presented to each individual, and on the day of the meeting its critique was conducted. Each question was analysed and stand out questions were critiqued accordingly.

Inclusion criteria for the focus group:

- The researcher.
- The research supervisor.
- At least one individual with experience with survey research.
- At least two students who use public transportation.
- One chiropractic student that is currently completing their master's degree at the Durban university of Technology.

Suggestions, recommendations and modifications were recorded. Unanimous agreement was required to make any modifications to each question. Following the focus group meeting, the questionnaire was modified to form the pre-piloted questionnaire (Appendix G)

3.9.3 Pilot Study

A pilot study is an investigation carried out using the study population to test or estimate statistical parameters. This is done to optimise the design of the main trial of that study and/or determine the feasibility of the study (Sim 2021: 658).

Once the focus group was completed and amendments were made to the questionnaire, the pilot study was conducted to ensure the adaptability of the questionnaire. A further five registered DUT students were requested to be involved in the pilot testing of the questionnaire. Upon completing the questionnaire, the chosen five also participated in a pilot study evaluation (Appendix H). Feedback

from the pilot study evaluation was used to make editorial amendments to the questionnaire.

3.9.4 Final Questionnaire

The main study and data collection was conducted with an online copy of the questionnaire (Appendix I). The questionnaire content was manually transferred by the researcher to the online survey platform QuestionPro. The online version of the survey was subject to three different tests by the researcher to make sure that there were no issues with the platform, the survey and the process of data collection, and the final testing of the online version of the questionnaire was tested by four different individuals:

- The research statistician.
- The research supervisor.
- one student that uses public transport.
- One student that is completing their master's degree in chiropractic at the Durban university of technology.

3.10 RESEARCH PROCEDURE

The study's data collection procedure is outlined in the following points, from the provisional ethical clearance that was granted to the data interpretation period.

3.10.1 Ethical Clearance Procedure

The study was approved by the IREC. The study was granted full ethical clearance by IREC (Appendix J) and the researcher was assigned the following ethical clearance number: IREC 071/24

3.10.2 Data Collection

The data collection process involved approaching DUT-registered students from various eThekwini campuses and informing them about the study. The researcher explained the aims, objectives, and motivation for the study to each student. It was emphasised that participation in the study was voluntary; participants would remain anonymous, and their responses would remain confidential. Prospective participants were provided with a digital letter of information (Appendix K), which included a link to the questionnaire. Before completing the questionnaire,

participants were required to fill out an informed consent field (Appendix L). Throughout the data collection process, the researcher was available to answer and clarify any questions. If participants chose to complete the questionnaire later, they could contact the researcher using the details provided in the letter of information. However, no assistance was requested with answering the questionnaire.

3.10.3. Data Capturing and Analysis

Data capture is the process of collecting information from a source and transferring it into a format that computers can understand (Malak 2024). Data analysis is the process of organising and examining data to uncover patterns, relationships or insights that address research questions or objectives.

The study's collected data were automatically extracted with QuestionPro and captured in MS Excel format. The analysis was carried out using the Statistical Package for Social Science (SPSS), specifically SPSS version 29. Descriptive statistics, including means and standard deviations, in the form of tables and graphs, were used to describe the data graphically. Tests used for the analysis of the data included the chi-square goodness-of-fit-test, Chi-square test of independence, Fisher's exact test, Binomial test and independent samples t-test.

3.11 ETHICAL CONSIDERATIONS

The following ethical principles were consistently upheld: beneficence, non-maleficence, autonomy, justice, confidentiality and informed consent (Hosseini, Jackson and Bahramnezhad 2022: 610). Definitions of each principle are provided in the following section.

Beneficence: Acting for the Benefit of Others

Beneficence is the act of charity, kindness, and mercy with a strong sense of good towards others. With this study, MSDs within the student population was investigated and statistical data were collected to help contribute to predicting future outcomes within this population group.

Non-Maleficence: Avoid Causing Harm to Others

Non-maleficence is the obligation not to inflict harm on others. No participant was harmed during the course of this study. Acquired data were analysed and reported

on objectively. The researcher, statistician, and supervisor had access to the data. Any electronic data would be deleted, and hardcopy data will be shredded after five years.

Autonomy: The Freedom from External Control or Influence

Participants participated in this study voluntarily. Participants had the freedom to refuse or withdraw from this study at any time and for any reason without the need of an explanation.

Justice: Fairness Towards Others

Ethical approval was obtained from the Institutional Research Ethics Committee. No participant was excluded based on their race, religion, colour, creed or sexual orientation.

Confidentiality: The Protection of Participant's Information

Confidentiality means the obligation of researchers to protect research participants' personal information from being disclosed without their consent. No identifying details were disclosed and all information obtained was kept confidential.

Informed Consent: Providing the Necessary Information to Prospective Participants

All the necessary information about the study, including its purpose, procedures and benefits were provided in the form of an information letter to potential participants so they could make a voluntary and informed decision about participating.

3.12 CONCLUSION

This chapter expressed all elements of the methodology of the study. A quantitative descriptive cross-sectional survey was conducted. Students of the DUT campuses were sampled from the selected DUT campuses. Ethics approval was obtained from the DUT's IREC. Data were collected using QuestionPro and the statistical analysis of the obtained data was used using the SPSS. The resulting information from that analysis is presented and discussed in the following Chapter Four.

CHAPTER FOUR: RESULTS

4.1 INTRODUCTION

This chapter presents the results of the data gathered and the outcomes obtained on the prevalence and the associated risk factors of MSDs in students who utilise public transportation. The data provided has been reported under the objectives of the study. The questionnaire was administered online to DUT students and was the primary means of collecting data. This chapter presents the descriptive and interferential statistics. The descriptive statistics are presented in a combination of numerical values (that is mean and standard deviation) and visual representations (tables and graphs). Interferential data techniques include Pearson chi square tests, which are interpreted using *p*-values. The results are presented in the form of mean percentages per variable. Significant relationships between variables are highlighted.

4.2 RESPONSE RATE

The total number of 24 823 registered students at the Durban University of Technology campuses (City campus, ML Sultan, Ritson and Steve Biko) was obtained from the DUT MI Data Department via the Chiropractic Department. A final sample of 379 (n=379) was determined by the statistician and a total of 382 students consented, participated, and completed the questionnaire.

A total of 525 responses were recorded and, of these, 382 were completed which was above the minimum requirement of 379 required responses. A final response rate of 100.79% was achieved. Individuals who did not meet the requirements of the inclusion criteria were excluded, as well as the individuals who participated in the pilot study. Reasons for non-participation were a lack of interest and time to complete the questionnaire. Other individuals who did not consent to answering the questionnaire were excluded.

4.3. DEMOGRAPHICS: AGE, GENDER, RACE AND YEAR OF STUDY

From the information shown in **Figure 4.1**, of the total sample size (*n*=382), majority of the participants were first years (27.2%), black (85.3%), women (62.8%), and within the ages 18–22 years old (57.3%).

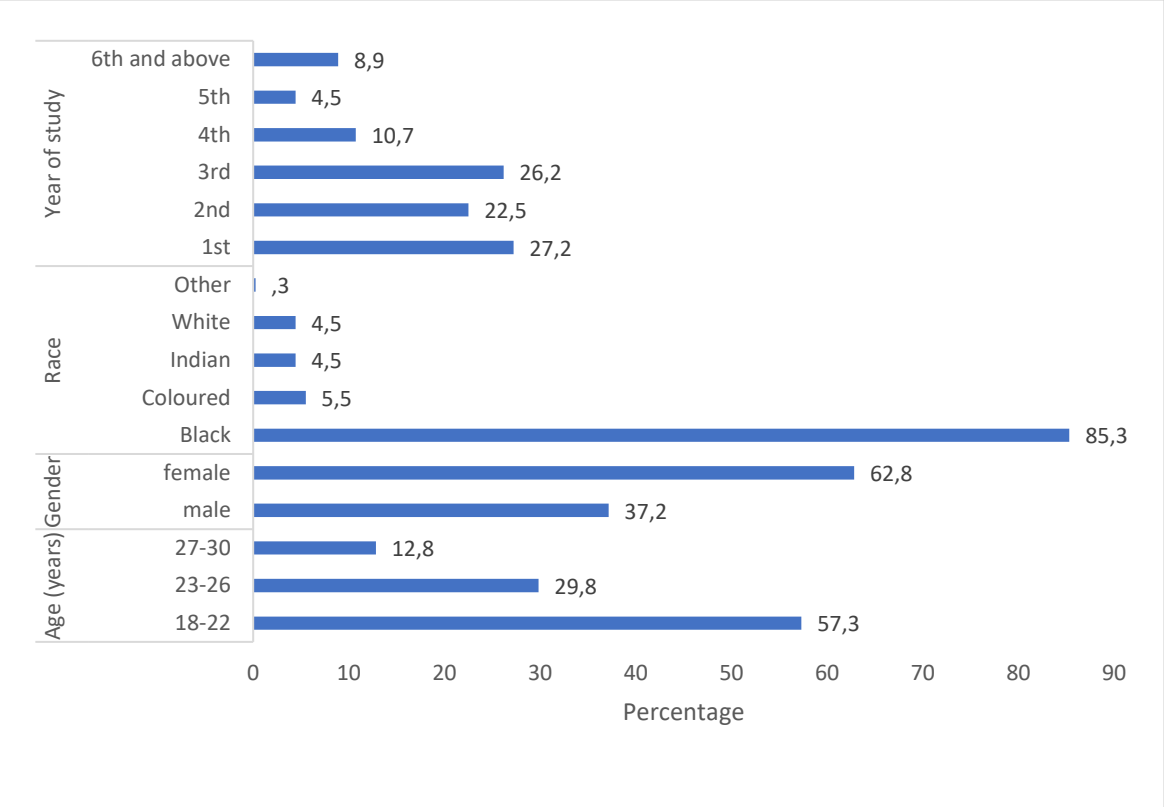

Figure 4.1: Age gender, race and year of study of the participants

4.4 TRAVEL HISTORY

Participants were asked about their travel history (**Table 4.1**). Of the 382 participants, 281 (73.6%) reported using public transport, while 101 (26.4%) participants did not use public transport. The main analysis and data interpretation of this chapter primarily revolves around those 281 participants; there is specification in this chapter when another group is referenced or focused on.

Table 4.1: Total use of transport

Use of public transport	Frequency (n)	Percentage (%)
Yes	281	73.6
No	101	26.4
Total	382	100

Of the 281 participants, 148 (38.7%) used a bus, 132 (34.6%) used minibus taxis, and 1 (0.3%) reported using a train (**Table 4.2**). When participants were asked to indicate if they take more than one mode of transport in their daily travels (**Table 4.3**), most (*n*= 209, 74.4%) of the participants said “no”.

Table 4.2: Modes of transport used often by participants

Mode of transport	Frequency (n)	Percentage (%)
Bus	148	52.7
Minibus Taxi	132	47.0
Train	1	0.4
Total	281	100

Table 4.3: Number of participants who use more than one mode of transport in their daily travels

Use of more than one mode of transport	Frequency (n)	Percentage (%)
Yes	72	25.6
No	209	74.4
Total	382	100

The participants were asked to state the general posture, assumed during travels, and majority of the participants (*n*=274, 95%) reported that they assume a sitting position, as shown in **Table 4.4**.

Table 4.4: Assumed sitting position within participants' public transport

Position assumed when travelling	Frequency (n)	Percentage (%)
Sitting	274	97.5
Standing	7	2.5
Total	281	100

The participants were asked about the average distance they travelled on public transport each day. A majority (*n*=153, 54.4%) reported traveling less than 10 kilometres daily. When asked whether they needed to walk to reach their public transportation, most participants (*n*=195, 69.4%) stated that they did. Among these, the highest frequency (*n*=136) reported walking less than 1 kilometre. Additionally, participants were asked about the average total duration of their public transport travel. The most common response (*n*=96) was a travel time of 10 to 15 minutes (**Table 4.5**).

Table 4.5: Average distance travelled, if the participants walk to their transport, total duration of travel

	Category	Frequency (*n*)	Percentage (%)
Average distance travelled on public transport a day	<10km	153	54.4
	10-20km	107	38.1
	>20km	21	7.5
Do participants walk to reach their public transport	Yes	195	69.4
	No	86	30.6
Distance walked	<1km	136	48.4
	1-2Km	47	16.7
	>2km	12	4.3
Total		195	100
Total duration of travel on public transport	<10 min	76	27.0
	10-15min	96	34.2
	15-30 min	74	26.3
	>30 min	35	12.5
	Total	281	100

Overcrowding and proper seating was significant as it showed a total 63.7% participants who experienced overcrowding ‘occasionally’ or ‘often’; while a significant 69% indicated that they have proper seating ‘occasionally’ or ‘often’ (**Table 4.6**).

Table 4.6: Overcrowding and proper seating values of the participants

How often do you…	Responses as Frequency (%)					X^2	df	p-value
	never	rarely	occasionally	often	always			
Experience overcrowding during your commutes?	1 (1.4)	14 (20.3)	***19 (27.5)***	***25 (36.2)***	10 (14.5)	23.971	4	<.001
Have proper seating during your commutes on public transport?	2 (2.9)	14 (20.3)	***25 (36.2)***	***23 (33.3)***	5 (7.2)			

4.5 MUSCULOSKELETAL DISORDER

This section shows the findings regarding MSDs among the participants. It is presented in the form of the objectives of the study.

4.5.1 Objective One: The Prevalence (Point and Period) of Musculoskeletal Disorders in Students Who Utilise Public Transportation at a University of Technology

The first objective of this study was to determine the prevalence of MSDs among students who utilise public transport. This was determined by asking if the students were diagnosed with any MSK conditions and asking the level of MSK pain they experienced. Regarding the participants who use public transport (*n*=281), an analysis from a binomial test shows that a significant 91.8% of those who use public transport have never been diagnosed with any MSD ($p<.001$) (**Figure 4.2**). A significant 88.1% of those who do not use public transport have never been diagnosed with any MSK disorder ($p<.001$) (**Figure 4.2**).

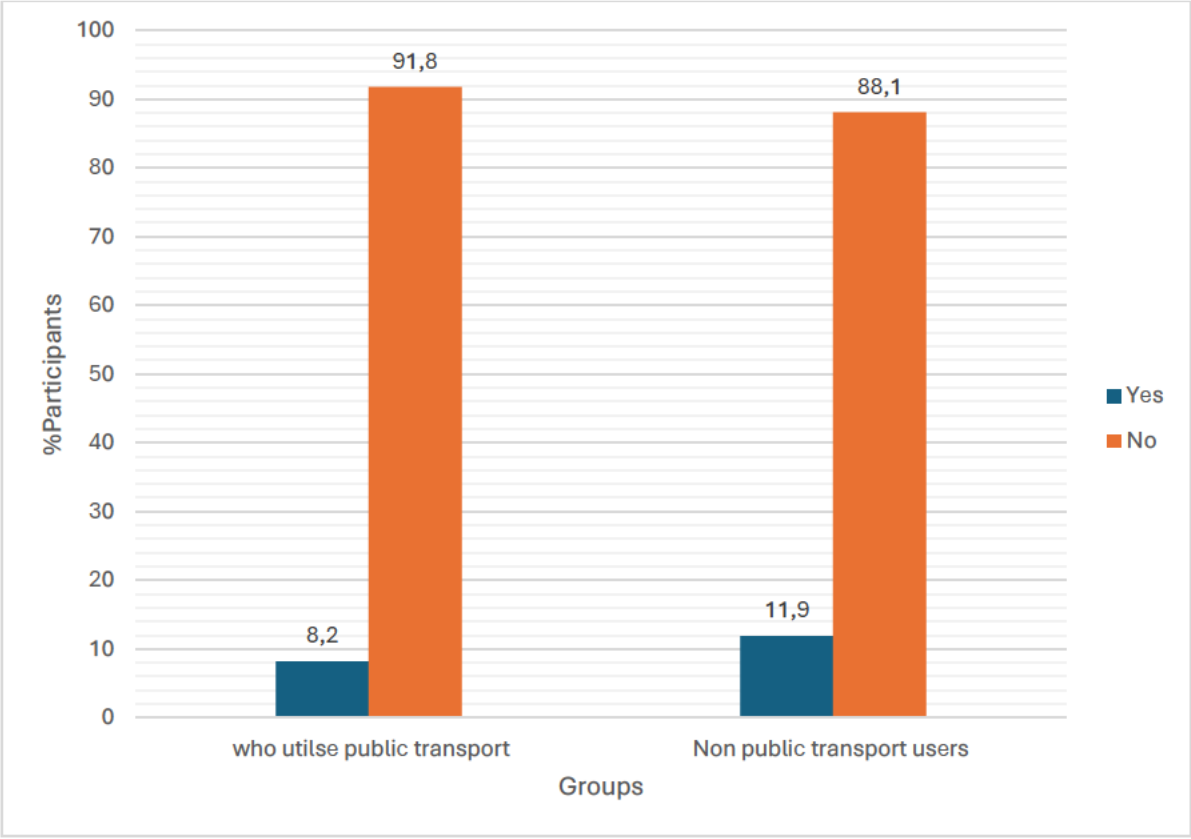

Figure 4.2: Response of two different groups and the diagnosis of musculoskeletal disorders

To determine the point prevalence, participants were asked to indicate from zero to 10 the level of pain they were experiencing at the time of answering the questionnaire. The average pain levels of the participants are shown in **Figure 4.3**. Of those that use public transport, 37.7% of the participants had no MSK pain, while there is an accumulative 62.3% of individuals who reported experiencing MSK pain**.** Results from the independent sample t-test analysis show that the average pain level for those who use public transport (1.98) is significantly higher than for those who do not use public transport (1.42), t (205.109) = 2.379, *p*=.018.

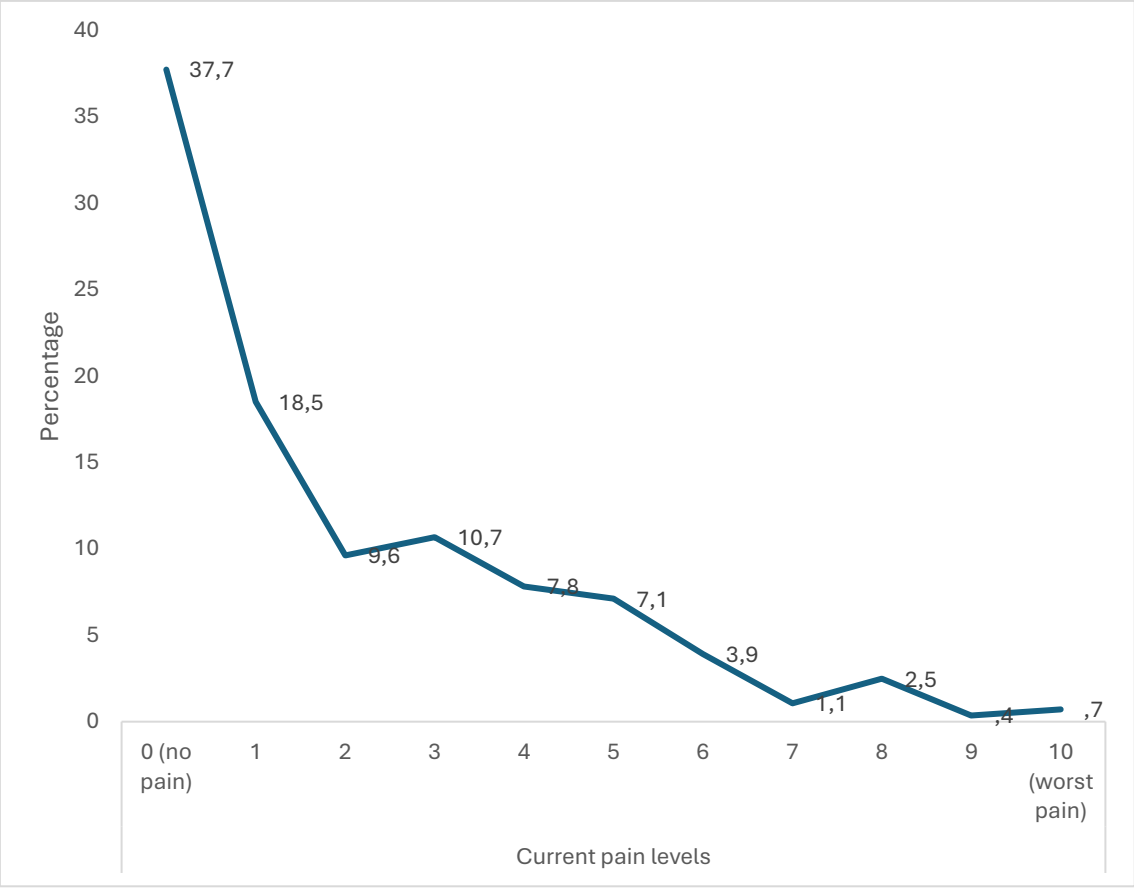

Figure 4.3: Different pain levels from participants

When asking public transport users about the prevalence of the MSK pain per body region, many participants reported the low back being the region with the highest prevalence within the past week of answering the questionnaire. **Figure 4.4** depicts the percentage of participants who reported experiencing pain in different regions currently (point), and two different periods (in the past week and in the past six months).

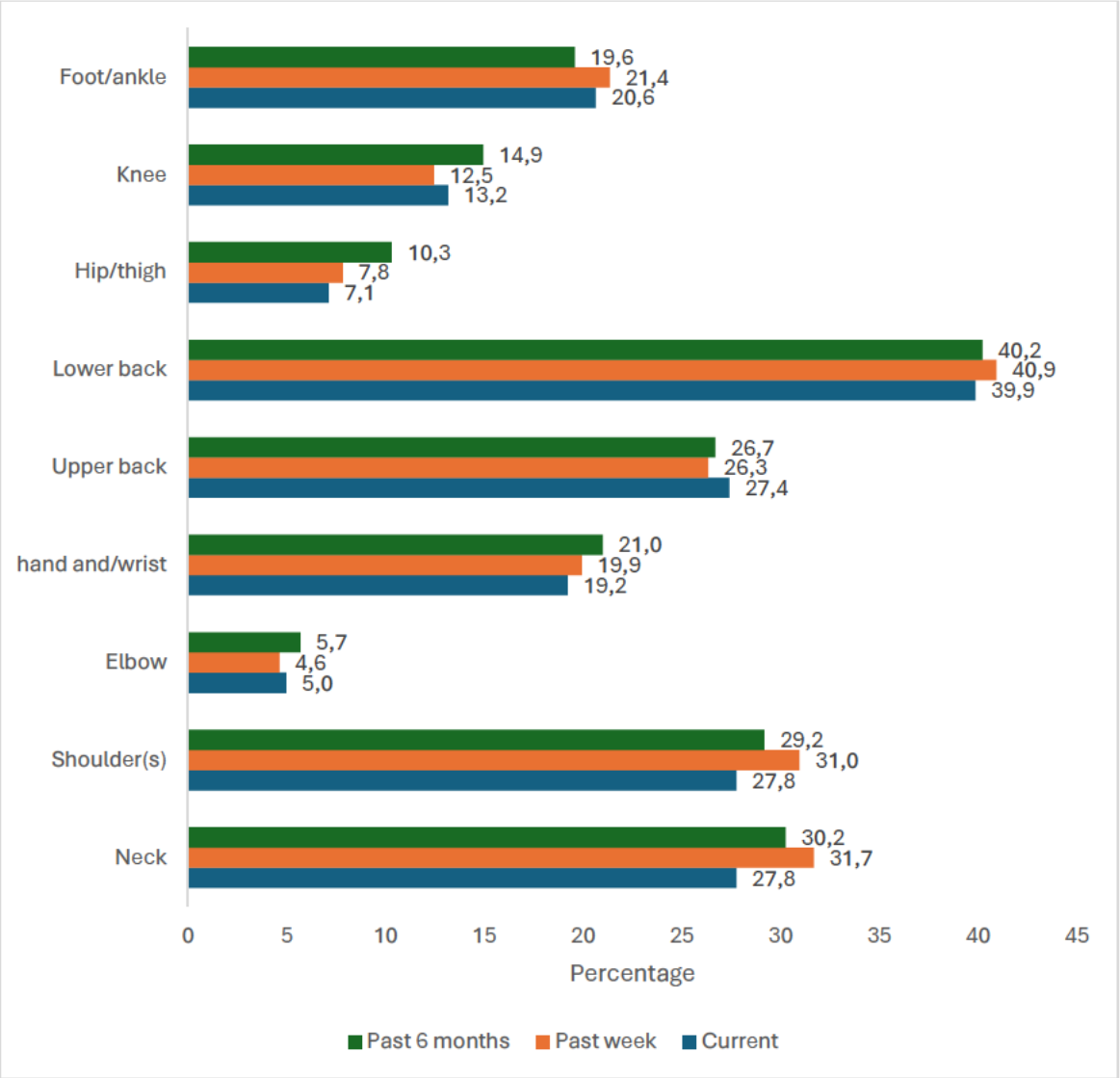

Figure 4.4: Prevalence of musculoskeletal pain by region

Participants that used public transport reported on the most common pain type experienced as well as the frequency of the pain. across all mentioned pain types, the highest percentage of participants reported “not at all”, while the “intermittent” pain frequency having some variation (**Figure 4.5**).

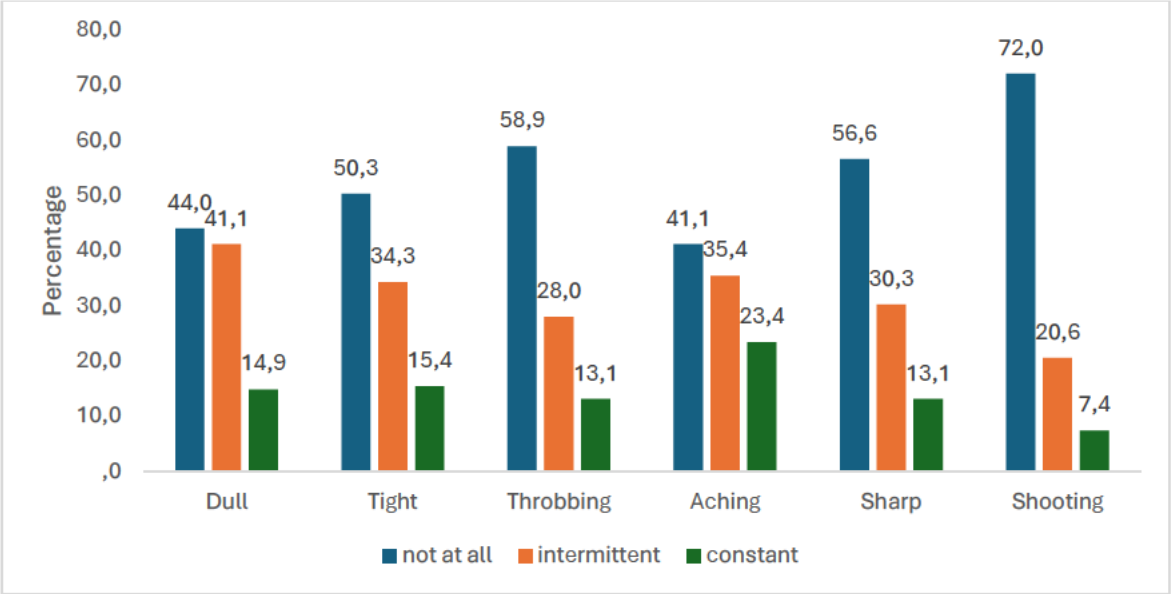

Figure 4.5: Frequency and each pain adjective

Participants were asked to indicate the general action that exacerbates MSK pain, most of the participants who utilised public transport (*n*=110,62.9%) reported stress to be a factor. **Figure 4.6** shows the results from a binomial test that a significant 62.9% reported that their pain is aggravated by stress (*p*=.001).

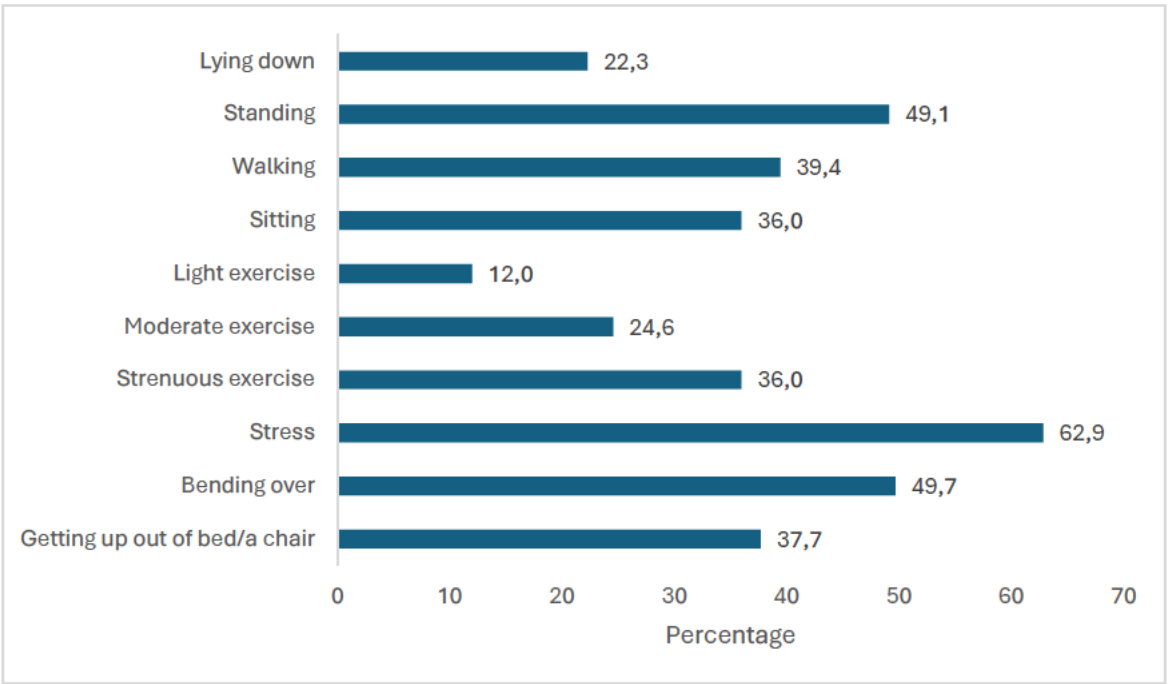

Figure 4.6: Actions that exacerbate musculoskeletal pain

4.5.2 Objective Two: Determine the Selected Risk Factors for Musculoskeletal Disorders in Students Who Utilise Public Transportation at a University of Technology

The second objective focused on identifying selected variables or conditions that are associated with an increased possibility of developing MSDs. The factors were put into different sub-categories: sociodemographic, psychological personal medical history and transport related factors.

4.5.2.1 Sociodemographic

Age, gender and year of study were sociodemographic factors that were used to measure the relationship with reported MSDs with participants.

4.5.2.1.1 Age

When analysing the relationship between age and MSK disorder, the 27-to-30-year age group (*n*=9, 18.4%) responded “yes” (*p*=0.052). This shows that there is some significant relationship when considering age and MSDs (**Table 4.7**). When examining gender, women had a higher frequency percentage (62.8%), The relationship with gender and MSK disorder also showed no significance (*p*=0.465).

Table 4.7: The relationship between age and MSDs

Musculoskeletal condition	Responses as Frequency (%)			χ^2	df	p-value
	18–22	23–26	27–30			
YES	16(7.3)	10(8.8)	9(18.4)	5.916	2	0.052
NO	203(92.7)	104(91.2)	40(81.6)			
Total	219(100)	114(100	49(100)			

4.5.2.1.2 Year of Study

Upon assessment of the year of study in relation to the having had MSDs, **Table 4.8** shows a significant proportion of sixth years responded “yes” (*p*=0.001).

Table 4.8: Year of study in relation to MSDs

Musculoskeletal condition	Response as Frequency (%)						χ^2	df	p-value
	1st	2nd	3rd	4th	5th	6th			
YES	5(4.8)	5(5.8)	8(8.0)	4 (9.8)	2(11.8)	11(32.4)	25.816	5	0.001
NO	99(95.2)	81(94.2)	92(92.0)	37(90.2)	15(88.2)	23(67.6)			
Total	104(100)	86(100)	100(100)	41(100)	17(100)	34(100)			

4.5.2.2 Psychological Factors

A significant 91.1% (*n*=256) of participants reported that they are not receiving any treatment for anxiety, stress or depression (*p*<.001). Stress showed no significant relationship with MSD.

4.5.2.3 Personal Factors

4.5.2.3.1 Smoking and Recreational Drug Use

Most participants do not smoke cigarettes (*n*=262, 93.2%). The mean number of cigarettes smoked per day was 3.8 (±SD 3.7) (**Table 4.9**). Moreover, a total of 238 (92.2%) participants do not take recreational drugs (**Table 4.10**). The report of smoking had no significant relationship to MSDs (*p*=0.771 Fisher’s exact test) and no significant relationship with recreational drug use (*p*=0.698 Fisher’s exact test)

Table 4.9: Cigarette smoking related to MSDs

Musculoskeletal condition	Responses as Frequency (%)		χ^2	df	p-value
	Smokes cigarettes	Does not smoke cigarettes			
YES	1(4.3)	22(95.7)	.085	1	.771
NO	15(5.8)	243(94.2)			
Total	16(5.7)	265(94.3)			

Table 4.10: Recreational drug use related to MSDs

Musculoskeletal condition	Responses as Frequency (%)		χ^2	df	p-value
YES	2(8.7)	21(91.3)	.026	1	.872
NO	20(7.8)	238(92.2)			
Total	22(7.8)	259(92.2)			

4.5.2.3.2 Exercise and Sleep

Most of the participants' exercise (*n*=187, 66.5%); they participated in an average of 3.75 number of days exercise a week (±SD1.41) and had an average of 40.63 minutes per exercise session (±SD 1.34). Exercise participation was not found to be significant in relation to MSDs (*p*=0.435).

The majority of participants (*n*=166, 59.1%) reported "yes, sometimes" when asked if they have difficulty sleeping. With the average number of hours being 6.76 within a 24-hour period (±SD 1.50) ranging from one to 12 hours per night. No significant relationship with hours of sleep and MSDs was evident.

4.5.2.3.3 Alcohol Consumption

Many of the participants (*n*=213, 75.8%) said "no" when they were asked if they consumed alcohol. Of those that did consume it, it was noted that there is a significant relationship between having had a MSK condition and alcohol consumption, $\chi^2(1) = 5.076$, *p*=.024. A significant proportion of those who consume alcohol have had a condition (**Table 4.11**).

Table 4.11: Alcohol consumption in relation to MSDs

Musculoskeletal condition	**Responses as Frequency (%)**		**χ^2**	**df**	**p-value**
	Drinks alcohol	**Does not drink**			
YES	10(43.5)	13(56.5)	5.076[a]	1	0.24
NO	58(22.5)	200977.5)			
Total	68(24.2)	213(75.8)			

4.5.2.4 Medical History

4.5.2.4.1 Previous History of Trauma

Most of the participants (*n*=248,88.3%) answered “no” when asked if they had a previous history of trauma that resulted in prolonged pain. From the participants who did have a previous history of trauma (*n*=33,11.7%), 10 of them reported having a MSK condition. From these responses, there is a significant relationship between having had a MSK condition and previous history of trauma (Fisher’s exact test: *p*=.024). A significant proportion of those who have had a history of trauma have had a condition (**Table 4.12**).

Table 4.12: Previous history of trauma in relation to MSDs

Musculoskeletal condition	Responses as Frequency (%)		χ^2	df	p-value
	Previous history of trauma	No history of trauma			
YES	10(43.5)	13(56.5%	24.34	1	.000
NO	23(8.9)	235(91.1)			
Total	33(11.7)	(248(88.3)			

4.5.2.4 Transport Related Factors

4.5.2.5.1 Transport Type, Condition of Transport and Posture in Transport Versus Musculoskeletal Disorders

As mentioned in travel history, the majority (*n*=148, 52.7%) reported using buses followed by participants (*n*=132, 47%) using minibus taxis. When examining the relationship between the type of public transport and MSDs, it is noted that no significant relationship exists (*p*= 0.370). When examining the condition of the public transportation, many of the participants (*n*=53, 76.8%) rated the condition of the vehicles as ‘average’ (*p*<.001). No significant relationship was reported when looking at the vehicle condition and its association with MSDs.

A majority (*n*=274, 97.5%) of participants assume the sitting posture when using public transport; however, the chi-square *p* value suggested that there was no significant relationship between MSDs and assumed posture in transportation (*p*=0.551).

4.5.2.5.2 Distance of Commutes and Total Duration of Commutes

No significant relationship was found between distance travelled with public transport and the risk of MSD (*p*=0.254). When the participants were questioned regarding the duration of their journey and seeing its association with having a MSK condition, a significant relationship exists between having had a MSK condition and the length of time on public transport, $\chi 2(3) = 7.844$, *p*=.049. A significant proportion of those whose journey exceeds 30 minutes have had a condition (**Table4.13**).

Table 4.13: The relationship between MSDs and length of time

Musculoskeletal condition	Responses as Frequency (%)				χ^2	df	p-value
	<10min	10-<15min	15-30min	>30min			
YES	4 (17.4)	6 (26.1)	6 (26.1)	***7 (30.4)***	7.844	3	.049
NO	72 (27.9)	90 (34.9)	68 (26.4)	28 (10.9)			
Total	76 (27.0)	96 (34.2)	74 (26.3)	35 (12.5)			

4.5.3 Objective 3: Determine the Impact of Musculoskeletal Disorders in Students Who Utilise Public Transportation at a University of Technology

Key highlights that have been noted with the responses is that MSDs do not have a significant impact on the participants' social lives (82%) and their academic performance (70.35). The participants also showed that MSDs have a moderate impact on physical activities (46.3%), movement (42.3%), and work performance (42.3%) (**Table 4.14**).

Table 4.14: Shows the impact of MSDs

Impact of MSD		Yes		No	
	N	n	%	n	%
Does the pain affect your physical activities?	175	81	46.3	94	53.7
Does the pain affect your relationship with others?	175	31	17.7	144	82.3
Does the pain affect your mental health	175	51	29.1	124	70.9
Does the pain prevent you from doing your work properly?	175	74	42.3	101	57.7
Does the pain affect your movement/moving around?	175	74	42.3	101	57.7
Does the pain affect your academic performance?	175	52	29.7	123	70.3

4.6 CONCLUSION

This chapter provided an in-depth illustration and text-based data of the prevalence and associated risk factors of MSDs among students who use public transport at a university of technology. The descriptive data revealed that most participants were female, aged between 18 and 22 years, were of African descent, and in their first year of study. Most of the participants who used public transportation, primarily used buses and minibus taxis and typically travelled in a seated position for durations ranging from 10 to 15 minutes. Many participants reported only occasionally having access to proper seating and they frequently experienced overcrowded conditions during their commutes.

In terms of lifestyle habits, more than half of the participants did not smoke, consumed little to no alcohol, engaged in physical exercise, and did not use recreational drugs. However, slightly more than half of the students reported experiencing difficulties with sleep.

Regarding MSDs, most participants had not been formally diagnosed with an MSD (91.8%). However, point prevalence data showed that 63.2% had experienced MSK pain. The most affected areas included the low back, neck, shoulders, and upper back. Statistical analysis indicated significant associations between MSDs and factors such as stress, alcohol consumption, previous injury history, and duration of public transport travel.

CHAPTER FIVE: DISCUSSION

5.1 INTRODUCTION

This chapter will discuss the findings from Chapter Four and asses them relative to the available literature. The response rate will be discussed followed by a discussion on each of the research objectives.

5.2 RESPONSE RATE

In prevalence studies is important to assess the response rate to help measure the study validity, comparability, and representativeness. Although the definitions of response rates may vary, they are usually based on the number of questionnaires returned, divided by the number given to the intended participants, multiplied by 100, to represent the result in the form of a percentage (Terry, Minseo and Ian 2024: 64). Low response rates highlight a potential risk in a study's validity. Adam *et al.* (2024: 20) stated that survey response rates are often dependant on the population and a variety of factors including study designs, survey structure, and country specific factors. Furthermore, according to Adam *et al.* (2024: 20), higher response rates among student populations are affected by factors such as incentives, access to technology, time availability, influence from peers, social educational responsibility, relevance of survey topic, and established communication channels for dissemination of surveys.

In this study, a final response rate of 72.8% was obtained. This response rate is lower when compared to previous studies that were conducted on university students with a similar aim. This study's response rate was lower than that of Sur Unal and Cifcili (2020: 128), who achieved a response rate of 97% when assessing the prevalence and probable risk factors of performance related MSDs in fine art students. It should be noted that the study by Sur Unal and Cifcili (2020: 128) was specifically on fine art students, while the current study focused on university students in general. When looking at the South African context, this study had a significantly higher response rate than the 50.8% that was achieved by Bensusan (2019: 24), therefore it is possible that the findings of this study are generalisable to the total population from which the sample was extracted.

5.3 OBJECTIVE 1: TO DETERMINE THE PREVALENCE OF MUSCULOSKELETAL DISORDERS IN STUDENTS WHO UTILISE PUBLIC TRANSPORTATION AT A UNIVERSITY OF TECHNOLOGY

The first objective of this study was to determine the prevalence of MSDs among students who utilise public transportation at a university of technology. The findings from this provide insight into the proportion of students affected by MSDs, showing the most reported pain regions and the frequency of the population.

Previous studies that have investigated MSDs have generally shown a high prevalence (Parto, Wong and Macedo 2023). In this study, the self-reported prevalence of MSDs was found to be 62.3% among students who use public transport. This prevalence is high but, when comparing it to other studies, it is lower than the other findings seen in past literature. Sur Unal and Cifcili (2020: 130) reported a higher overall prevalence of 88.8% among fine art students. A study by Mohamed (2021: 4251) reported a high prevalence of 82.97% among Egyptian medical students who suffered from MSDs. When considering a similar study conducted at the DUT, Masondo (2022: 100) had a much higher prevalence of 86.1% in a study that investigated the prevalence and associated risk factors of MSK among radiography students.

The results from this study showed that the regions which were reported to be most affected were the low back (39.95%), followed by the neck (27.8), shoulder (27.8%) and upper back (27.4%), with the least prevalent region being the elbow (5.0%) in those suffering with current and period MSDs. This is similar to the study by Sur Unal and Cifcili (2020: 129), in which they found the most affected regions being the low back, followed by upper back and the neck. Mohamed (2021: 4251) also showed similar findings when students reported the low back being the most affected region when looking at medical students.

Given the nature of the activities students engage in, the current study's findings correlate with previous studies and show that the low back region is the most affected by MSDs. Physical stresses such as awkward posture, long lecture times, repetitive bending, lifting and twisting motions, and psychological stress results in LBP (Ghazal *et al.* 2014: 25)

In this study, the neck was the second most prevalent region for MSDs, followed by the shoulder, although a lot of variation in neck and shoulder MSD prevalence was evident. The findings of current study correlate with those of Sur Unal and Cifcili (2020: 129), Mohamed (2021: 4249) and Parto, Wong and Macedo (2023: 5). This high prevalence in students has been attributed to multiple factors such as poor posture, a previous history of neck and shoulder trauma, sedentary lifestyle and prolonged use of electronic devices in class and at home (Gao *et al.* 2023: 4).

5.4 OBJECTIVE 2: DETERMINE THE SELECTED RISK FACTORS FOR MUSCULOSKELETAL DISORDERS IN STUDENTS WHO UTILISE PUBLIC TRANSPORTATION AT A UNIVERSITY OF TECHNOLOGY

The second objective was to identify the selected risk factors that contribute to MSDs among the participants. The risk factors were divided into sociodemographic, personal, biomechanical, and transport-related factors. This provides some insight into potential contributors to the development of MSDs within the population.

5.4.1 Sociodemographic

5.4.1.1 Age and Year of Study

In this study, participants aged 27 to 30 years exhibited the highest prevalence of MSDs, followed by participants aged 23 to 26 years. Previous literature such as Davis *et al.* (2014: 608) and Malik, Beckerly and Imani (2018: 7) support and emphasise the notion that aging leads to increasing physiological decline. The physiological decline includes reduced muscular strength, reduced joint mobility, and decreased tissue elasticity due to prolonged exposure to external forces. The physiological changes may contribute to an increased risk of developing MSDs. However, despite this trend, the association between age and MSDs in this study did not yield any significant relationship (p=0.052). Similarly, the year of study relationship with MSDs had no statistical significance (p=0.001), aligning with the age-related findings. These results were consistent with those of Sur Unal and Cifcili (2020: 131) and Parto, Wong and Macedo (2023: 9), in which no significant correlation between age and MSD development was found. Ghazal *et al.* (2014) also reported that age did not serve as a factor for the development of MSDs, and

noted that the age of different students did not matter. In contrast, Kapitán *et al.* (2021) observed a significant effect of age on MSD occurrence, but only among first-year dentistry students, suggesting limited relevance due to the narrow age range of participants. Overall, while age-related physiological decline may theoretically increase MSD risk, its impact within the studied student population appears to be minimal.

5.4.1.2 Gender

In previous studies, women have been found to have a higher prevalence in having MSDs when compared to men. Furthermore women have been shown to report more MSK pain and symptoms in different regions when compared to men (Silva *et al.* 2016: 190). A higher frequency of women is found in this study but, contrary to the previous information, no statistical significance was found when the association of MSDs and gender was compared (p= 0.465). This correlates with other previous studies that have investigated MSDs and considered gender as a factor. Rafie *et al.* (2015: 4) had similar findings where they observed no significant gender differences in relation to MSDs. This differs from Tembo *et al.* (2023) who found that gender was associated with LBP and discomfort at both twelve months (p=<0.05) and three months (p=0.001), being more prevalent in women that were non-academic staff at the University of Zimbabwe's Faculty of Medicine and Health Sciences. Similarly, Peng *et al.* (2021) highlighted that women were approximately 29% more likely to develop MSDs compared to their male counterparts in the Taiwan food and beverage industry, supporting the increasing consensus that women have a higher risk and prevalence of MSDs across various sectors.

5.4.2 Psychosocial Factors

In this study, no significant relationship was found between stress and MSDs in students who use public transport within this study. The findings in this study do not align with that of Bensusan (2019: 105) who found a significance in stress levels over the academic year and its association with MSDs. Baek *et al.* (2018), also found a significant correlation between the various psychosocial factors that workers experienced and MSK pain, noting that MSK symptoms were low in all regions of the body for participants who reported having high levels of job satisfaction. Although the statistical relationship was not significant, it should be noted that in this

study, 91.9% of the participants who use public transport reported that they are not receiving any form of treatment for stress, anxiety or depression.

Moreover, this study found a significant 62.9% of the participants reported that their pain was aggravated by stress. It has been theorised that the cause of MSK manifestations of stress include muscle tension from stress related vasoconstriction, hormonal imbalances that would result in increased pain sensitivity, negligence in one's physical activities, poor posture, and ergonomics (Ikenna *et al.* 2022: 4). Stress may be attributed to the academic and personal pressures placed on the students within their daily lives. Based on the previously mentioned literature and the findings of this study, it is evident that greater investigation is needed into the relationship between MSDs and psychosocial factors to provide a clearer understanding.

5.4.3 Personal Factors

5.4.3.1 Smoking

The literature generally suggests that the use of cigarette smoking is closely associated with adverse health issues including pulmonary disease, cancers, and reproductive outcomes and these can be worsened if there are any pre-existing health conditions (Bedno *et al.* 2017). In the context of MSDs, it has been associated with tissue hypoxia, reduced healing and impaired blood flow (Al-Bashaireh *et al.* 2018: 2). In this study, 5.7% of the participants who use public transport reported that they smoked cigarettes. Smoking has shown that it does not have a significant relationship with the development of MSDs (p= 0.771). The findings in this current study are consistent with Parto, Wong and Macedo (2023: 4) and Mohamed (2021: 4250).

5.4.3.3 Exercise

Moderate exercise is a preventative measure with respect to the development of MSDs as it provides MSK strength and flexibility, enhances posture and reduces strain on the body (Lee *et al.* 2023: 2). Moreover, physical activity yields significant benefits to cardiovascular health and physical fitness. It is very important that the exercise is done in moderation as too much can result in injury (Parto, Wong and Macedo 2023: 2). The results found in this study show that 66.5% of the responded participated in exercise with an average of three days a week, with an average of

40 minutes per exercise session. Surprisingly this study found no significant relationship between participation in exercise and its relation to MSDs

5.4.3.4 Alcohol Consumption

According to Chen *et al.* (2022: 2), alcohol contributes an estimated 4% of the global burden of disease and heavy alcohol consumption has been reported to have a negative effect on the hepatic, cardiovascular, neurological, and gastrointestinal system. In this study, a small portion of the participants (24.2%) who use public transport responded “yes” to consuming alcohol. Although this figure may be small, statistical analysis between MSDs and alcohol consumption were found to be significant, with a *p*-value of (p=0.24).

In a different study, similar findings were noted in nurses, where their level of work burnout led to excessive alcohol use, resulting in the development of chronic pain by increasing the risk of traumatic injury and harmful outcomes to the MSK system (Chen *et al.* 2022: 8). Excessive and persistent alcohol consumption compromises the MSK system, as it reduces the body’s ability to protect against injuries, and cognitively compromises the individual, increasing the risk of injuries and re-injury. Furthermore, excessive alcohol consumption has been shown to contribute to impairment of bone remodelling, muscle weakness, tissue repair impairment and cartilage degeneration (Chen *et al*. 2022).

5.4.4 Biomechanical Factors: Previous History of Trauma

Regarding previous history of trauma (past physical injury to the MSK system), in this study a significant relationship was noted between having had a MSK condition and previous history of trauma (p=0.024). A notable portion of those participants who had a history of trauma, have a MSD condition. This is consistent with a systematic review by Alkassabi *et al.* (2022), in which they found that individuals with past MSK injuries were more likely to experience persistent pain particularly when associated with factors such as high initial pain intensity, fear-avoidance behaviours, and psychological distress.

5.4.5 Transport Related Factors

As previously mentioned in Chapter Two, public transportation is considered a factor within this study. According to the findings of this study, public transportation type,

condition of transport, and assumed posture in commutes were not found statistically significant in relation to MSDs (p=0.370, p<0.001, and p=0.551 respectively). In a systematic review conducted by Pickard *et al.* (2022), similar factors were considered as contributing to the development of MSDs among occupational drivers. Similar to the current study's findings, Burgel and Elshatarat (2017) found no significance in similar factors when investigating Californian taxi drivers and psychosocial work factors (p<0.05).

In this study, the relationship of duration of travel and MSDs was found to be statistically significant (p= 0.049) in those participants whose journey exceeded 30 minutes. This is similar to a finding by Guruguntla *et al.* (2023), where they noted that excessive exposure to a vehicle's vibration (between 5 to10 Hertz) for an extended period resulted in ride discomfort, fatigue, and MSK strain. Within the context of long travel time, static postures and whole-body vibration contribute to a higher risk of developing MSDs, particularly in the low back, neck and shoulder region (Guruguntla *et al.* 2023).

5.5 OBJECTIVE 3: DETERMINE THE IMPACT OF MUSCULOSKELETAL DISORDERS IN STUDENTS WHO UTILISE PUBLIC TRANSPORTATION AT A UNIVERSITY OF TECHNOLOGY

The third objective of this study was to find how MSDs have an impact on the lives of those students who utilise public transportation. This study found that there are three key areas that MSDs have an impact on the participants, namely academic, physical activity and psychosocial.

5.5.1 Academic Impact

Regarding academic impact, 29.7% of the participants in this study reported that pain affects them academically, while 42.3% of the participants reported that pain affects their work/academia from being conducted accordingly. The current study's findings regarding engaging in academic activity correspond with previous literature where a positive relationship was noted with academic stress with various areas being affected, namely the neck, shoulder, low back and hip (Tantawy, Rahman and Ameer 2017: 131). Contrary to the current study's findings, in the aforementioned study in which university students were assessed, Tantawy, Rahman and Ameer

(2017: 131) noted that the student's academic performance was negatively affected. It is very important to note that such widespread discomfort that students are experiencing can interfere with their ability to be fully engaged in academic activities. Musculoskeletal disorders can also affect a student's academic performance and activity due to absenteeism. It has been suggested in previous studies that prolonged pain and discomfort can increase the number of times an individual is absent from their place of work or school (Moodley and Naidoo 2015). This can be applied in a university setting, where the pain results in absenteeism, leading to gaps in learning and decreased academic achievement. Another consequence of MSDs in students regarding their academia is concentration. Persistent pain can lead to distractions and a decrease in concentration due to a reduction in cognitive function, which will lead to the student's learning outcome being adversely affected.

5.5.2 Physical Impact

Regarding physical impact, 46.3% of the participants noted that their physical activity was impacted negatively by MSK pain. This study's findings are somewhat consistent with previous studies done in the past, such as the finding of Tantawy, Rahman and Ameer (2017: 130) who noted that 44.68% of their participants reported that the MSK pain interfered with their activities of daily living. Activities of daily living are everyday routines that comprise of personal care and functional mobility and are fundamental parts of everyday life (Owen 2023).

Another piece of literature consistent with this current study's findings is an investigation by Hendi *et al.* (2019) on MSDs and how they correlate with physical activity. In that study, it was noted that low level of physical activity alongside other factors (that is psychosocial stress) are a result and contributing factors for MSDs among the medical students. They concluded that physical activity may be a factor that affects students and stress is a factor that they found to be a greater threat in a student's MSK health.

5.5.3 Psychosocial Impact

Regarding psychosocial impact, 29.1% of the participants reported that the MSK pain influences their mental health. Although the values are low, it is something that should not be disregarded as previous literature has shown that this is a serious contributing factor.

Psychosocial stress may be as contributing factor MSDs (Baek *et al.* 2018). One plausible explanation for this is that the psychosocial demands placed on individuals (be it in work or school settings) aggravate task-related biomechanical strain or even may affect the awareness and reporting of MSK symptoms (Ng, Hayes and Polster 2016). Other literature that further suggests an association between mental health and MSDs includes Parto, Wong and Macedo (2023: 9). It was noted in that study that the quantity and quality of sleep was influenced by other factors and had a significant influence in students' pain sensitivity. The study further noted other previous literature that shows a positive association between academic stress in college students and how MSDs increased during the exam period (Tantawy, Rahman and Ameer 2017; Parto, Wong and Macedo 2023).

5.6 CONCLUSION

A high prevalence of MSDs is found among students who utilise public transportation at a university of technology. The most affected areas include the low back, neck, shoulder, and upper back regions. Contrary to this, the least affected region that was reported was the elbow.

In accordance with the literature available and the findings of this study, several selected factors were found to be closely associated with MSDs. These factors include stress, excessive alcohol consumption, the extremes of exercises (excessive or lack of training), and previous history of trauma. Regarding the transport specific factors, it was noted that duration of travel (time) was a factor that contributed to the development of MSDs.

Musculoskeletal disorders impacted three categories of the participants' life, including the academic field (activity and results), physical activity (student's activity of daily living), and psychosocial elements (stress, sleep and academic demand).

CHAPTER SIX: CONCLUSION

6.1 INTRODUCTION

This chapter summarises the key findings in each of the objectives of the study, highlights the limitations of the study, and makes recommendations stemming from the study.

6.2 RE-EVALUATION OF KEY FINDINGS

6.2.1 Aim

The aim of this study was to determine the prevalence and risk factors of MSDs among students who utilise public transportation at a university of technology in KwaZulu-Natal, South Africa. The prevalence of MSDs among the participants of the study was 62.3%. Although this prevalence is moderately high, it is not as high when compared to previous studies. The identified biomechanical risk factor is a previous history of trauma. The identified personal risk factor was alcohol consumption, and, lastly, the transport related risk factor was duration of travel on public transport.

6.2.2 Objectives

Objective one was to determine the prevalence (point and period) of MSDs in students who utilise public transport at a university of technology. After analysis of the data obtained from the questionnaire provided to the students at the DUT, this study found that the prevalence of MSDs was moderate compared to previous literature. Further analysis of the questionnaire indicated that there was a higher seven-day prevalence compared to a six-month prevalence. The main regions that were affected were in descending order were the low back, neck, shoulder and upper back regions.

Objective two of the study was to determine selected risk factors for students who utilise public transportation at a university of technology. Identified risk factors that were noted include a previous history of trauma, alcohol consumption, and the duration of travel. Surprisingly, stress was not found statistically significant in relation to MSDs for this study. It was noted that many of the participants highlighted that stress exacerbated their MSK pain, and previous literature supports a psychological

risk factor to influence the development of MSDs. With these findings, and accounting for the previous literature, it clearly highlights the complexity of MSDs, and that they require a multidisciplinary approach.

Objective three within this study was to determine the impact of MSDs in students who utilise public transportation. It was noted that the MSDs influenced academic participation, academic achievement, general physical activity, and students' mental health.

6.3 LIMITATIONS

This study provides valuable insights and information into the prevalence and risk factors of MSDs among students who utilise public transportation at a university of technology. However, the study's limitations should be acknowledged.

The quantitative, descriptive, cross-sectional method utilised in the study allowed the statistical models to identify correlations between the selected risk factors and MSDs. However, the identified risk factors are associated with MSDs rather than being interpreted as direct causes of the MSK symptoms.

This study has a quantitative, descriptive cross-sectional study design that was conducted via an online survey with registered students at the DUT. Since it was cross sectional, it captured a quick glimpse of MSD prevalence and associated risk factors at a single point in time. Causation cannot be established so, although the study identifies the associations, it cannot prove that public transport directly causes MSDs.

The study was conducted on the four main Durban campuses (that is Steve Biko, Ritson, M. L. Sultan and City), due to their proximity to one another. Other campuses were excluded due to their greater distance and not being located in the eThekwini Municipality.

The questionnaire was only administered with a letter of information that contained a link to QuestionPro. Therefore, it was required that the students had full, uninterrupted internet access to answer and submit the questionnaire. Some of the participants may have had issues with their internet connection and, in some rare cases, questionnaires may have been inaccessible.

To avoid participants' fatigue bias, many of the questions were kept closed ended. The questions were kept as short as possible. As convenient as this approach is, it does limit the participants' answers.

The online questionnaire was quite long. This was to gain extensive information regarding students and their use of transportation. A more concise detailed data collection tool would perhaps have garnered better participation.

The study relied on a self-reported questionnaire so the validity of results from the current study depends on the openness of the students. Dishonesty and exaggeration about behaviour or activities may have influenced the results of the study, and some participants may have misinterpreted questions or failed to recall accurate details. Furthermore, the study may lack clinical confirmation as it relies on self-reported information rather than imaging techniques and biomechanical examinations that could provide objective measurements of MSK health.

6.4 RECOMMENDATIONS

Several recommendations are proposed based on the results of the study. These recommendations may serve to enhance the research process further for future research, as well as mitigate MSD risks among students using public transport.

6.4.1 Recommendations for Future Research

As previously mentioned, this study is a cross-sectional epidemiological study. Future research should adopt longitudinal cohort design to establish risk factors of MSDs in students better, as this approach would allow for tracking the development of MSDs over time.

Since there are no objective measurements, research that incorporates clinical examinations, posture analysis, and biomechanical studies would help provide objective validation of self-reported MSDs. Future research could compare different transportation methods (such as bus versus minibus taxis or public transport versus private transport use) to assess which mode of transport poses a greater risk of developing MSDs.

6.4.2 RECOMMENDATIONS FOR PUBLIC TRANSPORT USING STUDENTS

Based on the findings of this study, preventative programmes and day-to-day guidelines are highly recommended to prevent the development of MSDs in students. The recommendations are as follows:

Educational institutions should implement awareness programmes to educate students on proper posture, stretching exercises, and ergonomic adjustments to minimise the risk of MSDs. Regular low-intensity physical activities, such as yoga, stretching, and core exercises, should be encouraged to counteract the negative effects of prolonged sitting.

Furthermore, students should be advised to reduce their carrying load by utilising digital learning materials, such as PDF documents and e-books, as universities already have the necessary platforms to support this transition.

The Department of Transportation can propose improved seating designs for public transportation to manufacturing companies. Ergonomically designed seats with better lumbar support, cushioning to absorb whole-body vibration, and adjustable headrests can help reduce strain on the spine and shoulders. These improvements would benefit not only students but also the public across different demographic groups.

Additionally, manufacturers may enhance public transportation vehicles by improving suspension systems, which would help minimise excessive vibration exposure, further reducing the risk of MSK strain among passengers.

6.5 CONCLUSIONS

This study provided valuable insights into the prevalence and risk factors of MSDs among students who utilise public transportation. Addressing the highlighted issues through collaborated efforts between educational institutions, public transportation authorities and healthcare professionals could significantly reduce the occurrence and the burden of MSDs among students. Ultimately supporting their academic performance, general well-being, mental health, and quality of life.

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APPENDICES

Appendix A: Permission letter from research director

Directorate for Research and Postgraduate Support

3rd Floor, Open House, Steve Biko Campus
Durban University of Technology
P O Box 1334, Durban, 4000

T +27 373 2577
E Gatekeeper@dut.ac.za
W https://www.dut.ac.za/research-ps/

21 June 2024

Mr M T Hlongwa
c/o Department of Chiropractic
Faculty of Health Sciences
Durban University of Technology

Dear Mr Hlongwa

PERMISSION TO CONDUCT RESEARCH AT THE DUT

Your email correspondence in respect of the above refers. I am pleased to inform you that the Institutional Research and Innovation Committee (IRIC) has granted **Gatekeeper Permission** for you to conduct your research "The prevalence and associated risk factors of musculoskeletal disorders in students who utilise public transport at a university of technology in South Africa" at the Durban University of Technology. **Kindly note that this letter must be issued to the IREC for approval before you commence data collection**.

The DUT may impose any other condition it deems appropriate in the circumstances having regard to nature and extent of access to and use of information requested.

Upon completion of your research project, you are requested to share the summary of your key research findings.

Yours sincerely

_____
Dr F Akpa-Inyang
(for) Dr V Govender
Director (acting)
Research and Postgraduate Support

Appendix B: First adaptation of questionnaire

For each question, select the ONE response option that best applies to you.

Section A: Demographics

1 Your age in years

19 - 22	23 - 26	27 - 30

2 What gender were you assigned at birth?

male	female

3 Your Race

Black	Coloured	Indian	White	Other

If you selected 'other' specify your race: _____

4 Year of study

1st	2nd	3rd	4th	5th	6th

Section B: Travel History

1 What form of public transport do you use most often?

Minibus Taxi	Bus	Train	Other (please specify) _____	None of these (if so, the process should automatically go to section C)

2 On average, what distance (in km) do you travel on public transport in total each day? _____km

3 On average, what is the total duration (in minutes) of your travel on public transport _____minutes

4 What posture do you assume when travelling?

sitting	standing	Other (please specify) _____

5 Do you experience any pain because of your travels?

yes	no

5.1 **If you responded YES to q5**, rate on a scale from 0= no pain to 10 = the worst pain you have ever experienced, the pain you are currently experiencing _____

6 Respond yes or no to each of the following questions:

	YES	NO
6.1 Do you think the pain you experience is associated with your use of public transport?		
6.2 Do you carry heavy bags regularly on your commutes?		
6.3 Do you engage in a lot of repetitive movements on your commutes?		
6.4 Do you do a lot of overhead movements on your commutes?		
6.5 Do you experience significant vibration from the vehicle when commuting?		
6.6 Have you ever experienced any accidents or injuries during your commutes with public transport (e.g. slips, falls, whiplash, etc.)?		

7.

HOW OFTEN DO YOU…	never	rarely	occasionally	often	always
7.1 Experience overcrowding during your commutes?					
7.2 Have proper seating during your commutes on public transport?					

8 How would you rate the general physical condition of the public transport vehicles you use regularly?

bad	average	good

Section C: Associated Risk Factors

1 Exercise

1.1 Do you exercise (e.g. walking, jogging cycling, gym etc.)?

yes	no

If you responded YES to q1.1:

1.1.1 On how many days a week do you exercise for at least 15 minutes? _____days per week

1.1.2 For how long do you exercise on average in each exercise session? _____ minutes per exercise session

2 Sleeping habits

2.1 How many hours of sleep do you have on average within a 24-hour period? _____Hours

2.2 Do you have difficulty sleeping?

Yes, often	Yes, sometimes	No, never

2.3 When you sleep, is your sleep interrupted?

Yes, often	Yes, sometimes	No, never

If you responded YES to q2.3:

	Rarely/never	Occasionally	Often
2.3.1 How often is your sleep interrupted?			
2.3.2 How often do you battle to fall asleep again			
2.3.3 How often is your interruption of sleep due to some form of body pain that wakes you up?			

3 Stress

3.1 Are you receiving any form of treatment for anxiety, stress, or depression?

yes	no

If you responded YES to q3.1:

3.1.1 Rate your level of stress (physical or mental) in the last 3 months (from 0= no stress to 10= extreme stress) _____

3.1.2 What treatment are you receiving for your stress? _____

4 Smoking

4.1 Do you smoke cigarettes?

yes	no

4.1.1 If you responded YES to q4.1, how many cigarettes do you smoke in a day, on average? _____

4.2 Were you a smoker in the past but have given up?

yes	no

If you responded YES to q4.2:

4.2.1 How many years ago did you stop smoking? _____ years

4.2.2 How many cigarettes did you smoke on average per day? _____

5 Alcohol consumption

5.1 How many units of alcohol do you consume on average per week (2 units = an average beer)? _____

6 Recreational drugs

6.1 Do you partake in any recreational drug use?

If you responded YES to q6.1:

Indicate which of the following drugs you use:

6.1.1 Marijuana	
6.1.2 Cocaine	
6.1.3 Ecstasy	
6.1.4 Other: specify _____ _____	

7 Medical history

7.1 Do you have any significant Medical conditions for which you are being treated?

yes	no

If you responded YES to q7.1:

7.1.1 For what condition(s) are you being treated? _____

7.1.2 Do you take any medication for these conditions?

yes	no

7.2 Do you have any previous history of trauma that resulted in prolonged pain?

yes	no

7.2.1 If you responded YES to q7.2, did you receive any treatment for the injury?

yes	no

Section D: Previous musculoskeletal pain

1 Have you ever been diagnosed with any musculoskeletal (muscle, bone, joint) conditions?

yes	no

If you responded YES to q1:

1.1 What was/were the diagnosis/es?

_____

_____

1.2 Did you ever get treatment for the condition?

yes	no

1.3 Who did you see for your musculoskeletal condition? (e.g. Chiropractor, physiotherapist, pharmacist, general practitioner etc.) _____

1.4 Indicate which of the following symptoms you experienced with the condition:

1.4.1 Nausea	
1.4.2 Vomiting	
1.4.3 Swelling	
1.4.4 Decreased movement of the affected area	
1.4.5 Fatigue	
1.4.6 Muscle twitches	
1.4.7 Joint pain	
1.4.8 Other: specify _____ _____	

Section D: Musculoskeletal characteristics

1 Indicate the worst level of pain you are currently experiencing (0= no pain and 10= the worst pain you have ever experienced) _____

2 Indicate the areas where you are experiencing/have experienced pain within the last 6 months

Location	Pain currently		Pain in past week		Pain in past 6 months	
	yes	no	yes	no	yes	no
2.1 Neck						
2.2 Shoulder(s)						
2.3 Elbow						
2.4 and/wrist						
2.5 Upper back						
2.6 Lower back						
2.7 Hip/thigh						
2.8 Knee						
2.9 Foot/ankle						

3 Describe the type of pain you are currently experiencing using the descriptions in the table below

Pain type	Not at all	Intermittent	constant
3.1 Dull			
3.2 Tight			
3.3 Throbbing			
3.4 Aching			
3.5 Sharp			
3.6 Shooting			

4 Indicate which of the following actions aggravates your pain

4.1 Getting up out of bed /a chair	
4.2 Bending over	
4.3 Stress	
4.4 Strenuous exercise	
4.5 Moderate exercise	
4.6 Light exercise	
4.7 Sitting	
4.8 Walking	
4.9 Standing	
4.10 Lying	

5 Indicate which of the following activities, if any, alleviates the current pain:

5.1Application of something cold to the area	
5.2 Applying pressure to the area of pain	
5.3 Stretching	
5.4 Lying down	
5.5 Massage	
5.6 Being active (walking/moving around)	
5.7 Standing	

6 Respond yes or no to each of the following questions:

	YES	NO
6.1 Does the pain affect your physical activities?		
6.2 Does the pain affect your relationship with others?		
6.3 Does the pain affect your mental health?		
6.4 Does the pain prevent you from doing your work properly?		
6.5 Does the pain affect your movement/moving around?		
6.6 Does the pain affect your academic performance?		

THANK YOU FOR YOUR TIME

Appendix C: Permission for questionnaire

Gmail — Marshall H <hmayibongwe@gmail.com>

questionnaire use permission

3 messages

Marshall H <hmayibongwe@gmail.com> Thu, Feb 9, 2023 at 6:54 PM
To: lfpendock@gmail.com

Dear Dr Pendock,

I hope this email finds you well
I am Mayibongwe Hlongwa(Marshall) , a Masters chiropractic student and I am writing this email to request permission to use your questionnaire for my study. I have read your study extensively and I was intrigued by it. I want to take your questionnaire and adapt it to my study , as advised and recommended by my supervisor **Dr Desiree Varatharajullu(Dr V).**

the title of my topic is as follows: **The epidemiology of musculoskeletal disorders in students who commute using public transport at a University of Technology**

If you approve of this, will it be possible for me to get a word version of your questionnaire if it is okay with you ?

i Look forward to hearing from you soon
Kind regards
M. Hlongwa

luke pendock <lfpendock@gmail.com> Tue, Feb 14, 2023 at 11:16 AM
To: Marshall H <hmayibongwe@gmail.com>

Hi Mayibongwe,

Thank you for your email. I hope your research is going well. Please feel free to use and adapt my questionnaire as needed. Unfortunately my laptop was stolen which had all my research on. I will try to find a copy on my old emails to send to you.

You have a very interesting topic. Good luck and please send my regards to Dr. V.

Best wishes,
Luke
[Quoted text hidden]

Marshall H <hmayibongwe@gmail.com> Tue, Feb 14, 2023 at 3:35 PM
To: luke pendock <lfpendock@gmail.com>

Thank you so you so much. i really appreciate it.
[Quoted text hidden]

Appendix D: Provisional approval

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

21 June 2024

Mr M T Hlongwa
B790 Sigodo Road
Ntuzuma
4359

Dear Mr Hlongwa

The prevalence and associated risk factors of musculoskeletal disorders in students who utilise public transport at a university of technology in South Africa

I am pleased to inform you that **PROVISIONAL APPROVAL** has been granted to your proposal subject to:

- No. 25 should be amended by removing the part about the Dean and simply stating that permission will be obtained from the RPS Director.
- Piloting of the data collection tool. *Please note that should there be any changes to the data collection tool, in a letter signed by the researcher and supervisor, list the changes to the documents and submit to DUT-IREC with the final data collection tool. Even when there are no changes to the data collection tool, DUT-IREC has to be notified.*
- Obtaining and submitting the necessary gatekeeper permission/s to DUT-Institutional Research Ethics Committee (DUT-IREC).

PLEASE NOTE THAT THIS IS NOT A FINAL APPROVAL LETTER. KINDLY SUBMIT THE ABOVE MENTIONED DOCUMENTS WITHIN THREE MONTHS TO THE DUT-IREC OFFICE. DATA COLLECTION CAN ONLY COMMENCE WHEN DUT-IREC ISSUES FULL APPROVAL

The Proposal has been allocated the following Ethical Clearance number **IREC 071/24.** Please use this number in all communication with this office.

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

It is compulsory for a student or researcher to apply for recertification on an annual basis. The failure to do so will result in withdrawal of ethics clearance. It is the responsibility of the researcher and the supervisor to apply for recertification.

Yours Sincerely

Prof J K Adam
Chairperson: DUT-IREC

Appendix E: Confidentiality statement

Confidentiality Statement for Focus Group Participants Evaluating a Questionnaire

Thank you for participating in this focus group. Your input is crucial in helping us evaluate and refine a questionnaire that will be implemented for research purposes. To ensure a respectful and secure environment for all participants, we ask you to adhere to the following confidentiality guidelines:

- Respect Privacy: Please respect the privacy of all focus group members. Do not share any personal information, stories, or opinions expressed by other participants outside of this group.
- Anonymity: The feedback and information you provide during this focus group will be used solely for the purpose of improving the questionnaire. Your responses will be anonymized, and any identifying information will be removed before reporting or publication.
- Non-Disclosure: Do not discuss, share, or disclose any specific details or content of the focus group discussions, including the questionnaire itself, with anyone outside the group. This includes, but is not limited to, verbal discussions, written notes, or electronic communications.
- Data Security: All data collected during the focus group will be stored securely and only accessible to the research team. Measures will be taken to protect the data from unauthorized access or breaches.
- Voluntary Participation: Participation in this focus group is voluntary. You may withdraw at any time without any penalty. If you choose to withdraw, any data you have provided will be removed from the study upon request.

By participating in this focus group, you agree to uphold the confidentiality and privacy standards outlined above. Your cooperation is essential in creating a trusting and open environment for everyone involved.

Thank you for your understanding and participation.

Signature: _____

Date: _____

Please review this statement and let me know if there are any additional details or modifications you would like to include.

Appendix F: Focus group letter of information

Dear Focus Group Participant,

I trust you are well.

Title of the Research Study: The prevalence and associated risk factors of musculoskeletal disorders in students who utilize public transport at a university of technology in South Africa

Principal Investigator/Researcher: Mayibongwe Hlongwa (B.Tech: Chiropractic)

Supervisor: Dr Desiree Varatharajullu (PhD: Health Sciences, M.Tech: Chiropractic)

Brief Introduction and Purpose of the Study: Several individuals, including university students like yourself within the South African population, use public transport, namely minibus taxis and buses. Due to this, you are at risk for further exacerbation of current musculoskeletal disorders or the onset of new musculoskeletal disorders. There is a gap in the literature with respect to musculoskeletal disorders in university students who travel using public transport. This study aims to fill that gap.

Outline of the Procedures: All focus group participants who have completed the confidentiality statement are encouraged to participate in the evaluation of the questionnaire, which was sent to you via email. You are free to withdraw from the study at any point should you feel the need to during the evaluation of the questionnaire.

Risks or Discomforts to the Participant: There are no risks or discomforts to you for being involved in this critique. There will be no consequences for you should you choose to withdraw, as you are free to do so at any point during the study.

Reason/s why the Focus Group Participant may be Withdrawn from the Study: You, as the participant, are free to withdraw from the study at any time. Once the evaluation and critique are completed, the information collected will be confidentially saved and may be implemented in the study.

Benefits of the Study: Many people within the general population suffer from musculoskeletal disorders, and there is a paucity of knowledge regarding musculoskeletal disorders and public transportation. With your participation in this study, it will add significant knowledge to medical professionals, which may help in diagnosing and treating musculoskeletal conditions in the student population who travel using public transportation.

Costs of the Study: There will be no cost involved in participating in the evaluation of the data collection tool.

Thank you for your participation in the evaluation of this Data collection tool.

Appendix G: Pre-pilot questionnaire

Thank you for agreeing to participate in my survey.

For each question, select the ONE response option that best applies to you.

Section A: Demographics

1 Your age in years

18 – 22	23 - 26	27 - 30

2 What gender were you assigned at birth?

Male	Female

3 Your Race

Black	Coloured	Indian	White	Other

If you selected 'other' specify your race: _____

4 Year of study

1st	2nd	3rd	4th	5th	6th and above

Section B: Travel History

1 What form of public transport do you use most often?

Minibus Taxi	Bus	Train	Other (please specify) _____	None of these (if so, the process should automatically go to section C)

1.1 Do you take more than one mode of transport in your daily travels?

Yes	No

1.2 If yes to 1.1 please specify _____

2 On average, what distance (in km) do you travel on public transport in total each day?

Less than 10km	10 - 20 km	More than 20km

3 Do you have to walk to reach your public transport?

Yes	No

3.1 If yes, to Question 3 please specify how far

Less than 0.5 km	1 - 2 km	More than 2km

4 On average, what is the total duration (in minutes) of your travel on public transport?

Less than 10 minutes	10- 15 minutes	15 - 30 minutes	More than 30 minutes

5 On average, what posture do you assume when travelling?

sitting	standing	Other (please specify) _____

6 Do you experience any pain because of your travels?

Yes	No	Maybe

6.1 If **you responded YES to Question 6**, rate on a scale from 0 = no pain to 10 = the worst pain you have ever experienced, the pain you are currently experiencing _____

7 Respond yes or no to each of the following questions:

	YES	NO
7.1 Do you think the pain you experience is associated with your use of public transport?		
7.2 Do you carry heavy bags regularly on your commutes?		
7.3 Do you engage in a lot of repetitive movements on your commutes?		
7.4 Do you do a lot of overhead movements on your commutes?		
7.5 Do you experience significant vibration from the vehicle when commuting?		
7.6 Have you ever experienced any accidents or injuries during your commutes with public transport (e.g. slips, falls, whiplash, etc.)?		

HOW OFTEN DO YOU…	Never	Rarely	Occasionally	Often	Always
8.1 Experience overcrowding during your commutes?					
8.2 Have proper seating during your commutes on public transport?					

Section C: Associated Risk Factors

1 Sleeping habits

1.1 How many hours of sleep do you have on average within a 24-hour period? _____Hours

1.2 Do you have difficulty sleeping?

Yes, often	Yes, sometimes	No, never

1.3 When you sleep, is your sleep interrupted?

Yes, often	Yes, sometimes	No, never

If you responded YES to Question 1.3:

	Rarely/never	Occasionally	Often
1.3.1 How often is your sleep interrupted?			
1.3.2 How often do you battle to fall asleep again			
1.3.3 How often is your interruption of sleep due to some form of body pain that wakes you up?			

2 Stress

2.1 Are you receiving any form of treatment for anxiety, stress, or depression?

yes	no

If you responded YES to Question 2.1:

2.1.1 Rate your level of stress (physical or mental) in the last 3 months (from 0 = no stress to 10 = extreme stress) _____

2.1.2 What treatment are you receiving for your stress? _____

3 Smoking

3.1 Do you smoke cigarettes?

Yes	No

3.1.1 If you responded YES to Question 3.1, how many cigarettes do you smoke in a day, on average?
_____

3.2 Were you a smoker in the past but have given up?

Yes	No

If you responded YES to Question 3.2:

3.2.1 How many years ago did you stop smoking? _____ years

3.2.2 How many cigarettes did you smoke on average per day? _____

4 Alcohol consumption

4.1 How many units of alcohol do you consume on average per week (2 units = an average beer)? _____

5 Recreational drugs

5.1 Do you partake in any recreational drug use?

Yes	No

If you responded YES to Question 5.1:

Indicate which of the following drugs you use:

5.1.1 Vape/e-cigarette	
5.1.2 Marijuana	
5.1.2 Cocaine	
5.1.3 Ecstasy	
5.1.4 Other: specify _____	

6 Medical history

6.1 Do you have any significant medical conditions for which you are being treated?

Yes	No

If you responded YES to q6.1:

6.1.1 For what condition(s) are you being treated? _____

6.1.2 Do you take any medication for these conditions?

Yes	No

6.2 Do you have any previous history of trauma that resulted in prolonged pain?

yes	no

6.2.1 If you responded YES to Question 7.2, did you receive any treatment for the injury?

Yes	No

Section D: musculoskeletal pain History

1 Have you ever been diagnosed with any musculoskeletal (muscle, bone, joint) conditions?

Yes	No

If you responded YES to Question 1:

1.1 What was/were the diagnosis/es?

_____

_____

1.2 Did you ever get treatment for the condition?

Yes	No

1.3 Who did you see for your musculoskeletal condition? (e.g. Chiropractor, physiotherapist, pharmacist, general practitioner etc.) _____

1.4 Indicate which of the following symptoms you experienced with the condition:

1.4.1 Nausea	
1.4.2 Vomiting	
1.4.3 Swelling	
1.4.4 Decreased movement of the affected area	
1.4.5 Fatigue	
1.4.6 Muscle twitches	
1.4.7 Joint pain	
1.4.8 Other: specify _____ _____	

Section E: Musculoskeletal characteristics

1 Indicate the level of pain you are currently experiencing (0 = no pain and 10 = the worst pain you have ever experienced) _____

2 Indicate the areas where you are experiencing/have experienced pain within the last 6 months

Location	Pain currently		Pain in past week		Pain in past 6 months	
	Yes	No	Yes	No	Yes	No
2.1 Neck						
2.2 Shoulder(s)						
2.3 Elbow						
2.4 Hand/wrist						
2.5 Upper back						
2.6 Lower back						
2.7 Hip/thigh						
2.8 Knee						
2.9 Foot/ankle						

3 Describe the type of pain you are <u>currently</u> experiencing using the descriptions in the table below (if possible, please tick more than one)

Pain type	Not at all	Intermittent	Constant
3.1 Dull			
3.2 Tight			
3.3 Throbbing			
3.4 Aching			
3.5 Sharp			
3.6 Shooting			

4 Indicate which of the following actions aggravates your pain

4.1 Getting up out of bed/a chair	
4.2 Bending over	
4.3 Stress	
4.4 Strenuous exercise	
4.5 Moderate exercise	
4.6 Light exercise	
4.7 Sitting	
4.8 Walking	
4.9 Standing	
4.10 Lying down	

5 Indicate which of the following activities, if any, alleviates the current pain:

5.1Application of something cold to the area	
5.2 Applying pressure to the area of pain	
5.3 Stretching	
5.4 Lying down	
5.5 Massage	
5.6 Being active (walking/moving around)	
5.7 Standing	

6 Respond yes or no to each of the following questions:

	Yes	No
6.1 Does the pain affect your physical activities?		
6.2 Does the pain affect your relationship with others?		
6.3 Does the pain affect your mental health?		
6.4 Does the pain prevent you from doing your work properly?		
6.5 Does the pain affect your movement/moving around?		
6.6 Does the pain affect your academic performance?		

THANK YOU FOR YOUR TIME

Appendix H: Pilot study evaluation sheet

Pilot Study Questionnaire Evaluation Sheet

(Please tick one number per question)

1. What is your opinion of the subject presented in this questionnaire?
   1.1 very interesting
   1.2 Interesting
   1.3 Neutral
   1.4 Uninteresting
   1.5 Very uninteresting

2. Have the topics that have been raised in the questionnaire been adequately covered?
   2.1 Yes
   2.2 No

3. What is your opinion on the letter of information?
   3.1 Very informative
   3.2 Informative
   3.3 Adequate
   3.4 Not clear
   3.5 needs revision.

4. Do you think the questionnaire is too long?
   4.1 Yes
   4.2 No

5. What is your opinion on the phrasing of the questionnaire?
   5.1 The phrasing in the questionnaire was clear.
   5.2 Most of the phrasing in the questions is clear.
   5.3 There is too much medical jargon.
   5.4 the questionnaire needs some work on its clarity

   If you had any difficulty answering any question/s, please write the number/s of the question/s in the space below with a suggestion on how the question/s can be improved?

   _____
   _____
   _____
   _____
   _____

Appendix I: Final questionnaire

Thank you for agreeing to participate in my survey.

For each question, select the ONE response option that best applies to you.

Section A: Demographics

1 Your age in years

18 – 22	23 - 26	27 - 30

2 What gender were you assigned at birth?

Male	Female

3 Your Race

Black	Coloured	Indian	White	Other

If you selected 'other' specify your race: _____

4 Year of study

1st	2nd	3rd	4th	5th	6th and above

Section B: Travel History

1 What form of public transport do you use most often?

Minibus Taxi	Bus	Train	Other (please specify) _____	None of these (if so, the process should automatically go to section C)

2.1 Do you take more than one mode of transport in your daily travels?

Yes	No

2.2 If yes to 1.1 please specify _____

3 On average, what distance (in km) do you travel on public transport in total each day?

Less than 10km	10 - 20 km	More than 20km

3 Do you have to walk to reach your public transport?

Yes	No

3.1 If yes, to Question 3 please specify how far

Less than 0.5 km	1 - 2 km	More than 2km

4 On average, what is the total duration (in minutes) of your travel on public transport?

Less than 10 minutes	10- 15 minutes	15 - 30 minutes	More than 30 minutes

5 On average, what posture do you assume when travelling?

sitting	standing	Other (please specify) _____

6 Do you experience any pain because of your travels?

Yes	No	Maybe

6.1 If **you responded YES to Question 6**, rate on a scale from 0 = no pain to 10 = the worst pain you have ever experienced, the pain you are currently experiencing _____

7 Respond yes or no to each of the following questions:

	YES	NO
7.1 Do you think the pain you experience is associated with your use of public transport?		
7.2 Do you carry heavy bags regularly on your commutes?		
7.3 Do you engage in a lot of repetitive movements on your commutes?		
7.4 Do you do a lot of overhead movements on your commutes?		
7.5 Do you experience significant vibration from the vehicle when commuting?		
7.6 Have you ever experienced any accidents or injuries during your commutes with public transport (e.g. slips, falls, whiplash, etc.)?		

HOW OFTEN DO YOU…	Never	Rarely	Occasionally	Often	Always
8.1 Experience overcrowding during your commutes?					
8.2 Have proper seating during your commutes on public transport?					

Section C: Associated Risk Factors

1 Sleeping habits

1.1 How many hours of sleep do you have on average within a 24-hour period? _____Hours

1.2 Do you have difficulty sleeping?

Yes, often	Yes, sometimes	No, never

1.3 When you sleep, is your sleep interrupted?

Yes, often	Yes, sometimes	No, never

If you responded YES to Question 1.3:

	Rarely/never	Occasionally	Often
1.3.1 How often is your sleep interrupted?			
1.3.2 How often do you battle to fall asleep again			
1.3.3 How often is your interruption of sleep due to some form of body pain that wakes you up?			

2 Stress

2.1 Are you receiving any form of treatment for anxiety, stress, or depression?

yes	no

If you responded YES to Question 2.1:

2.1.1 Rate your level of stress (physical or mental) in the last 3 months (from 0 = no stress to 10 = extreme stress) _____

2.1.2 What treatment are you receiving for your stress? _____

3 Smoking

3.1 Do you smoke cigarettes?

Yes	No

3.1.1 If you responded YES to Question 3.1, how many cigarettes do you smoke in a day, on average? _____

3.2 Were you a smoker in the past but have given up?

Yes	No

If you responded YES to Question 3.2:

3.2.1 How many years ago did you stop smoking? _____ years

3.2.2 How many cigarettes did you smoke on average per day? _____

4 Alcohol consumption

4.1 How many units of alcohol do you consume on average per week (2 units = an average beer)? _____

5 Recreational drugs

5.1 Do you partake in any recreational drug use?

Yes	No

If you responded YES to Question 5.1:

Indicate which of the following drugs you use:

5.1.1 Vape/e-cigarette	
5.1.2 Marijuana	
5.1.2 Cocaine	
5.1.3 Ecstasy	
5.1.4 Other: specify _____ _____	

6 Medical history

6.1 Do you have any significant medical conditions for which you are being treated?

Yes	No

<u>If you responded YES to q6.1:</u>

6.1.1 For what condition(s) are you being treated? _____

6.1.2 Do you take any medication for these conditions?

Yes	No

6.2 Do you have any previous history of trauma that resulted in prolonged pain?

yes	no

6.2.1 If you responded YES to Question 7.2, did you receive any treatment for the injury?

Yes	No

Section D: musculoskeletal pain History

1 Have you ever been diagnosed with any musculoskeletal (muscle, bone, joint) conditions?

Yes	No

If you responded YES to Question 1:

1.1 What was/were the diagnosis/es?

_____

_____

1.2 Did you ever get treatment for the condition?

Yes	No

1.3 Who did you see for your musculoskeletal condition? (e.g. Chiropractor, physiotherapist, pharmacist, general practitioner etc.) _____

1.4 Indicate which of the following symptoms you experienced with the condition:

1.4.1 Nausea	
1.4.2 Vomiting	
1.4.3 Swelling	
1.4.4 Decreased movement of the affected area	
1.4.5 Fatigue	
1.4.6 Muscle twitches	
1.4.7 Joint pain	
1.4.8 Other: specify _____ _____	

Section E: Musculoskeletal characteristics

1 Indicate the level of pain you are currently experiencing (0 = no pain and 10 = the worst pain you have ever experienced) _____

2 Indicate the areas where you are experiencing/have experienced pain within the last 6 months

Location	Pain currently		Pain in past week		Pain in past 6 months	
	Yes	No	Yes	No	Yes	No
2.1 Neck						
2.2 Shoulder(s)						
2.3 Elbow						
2.4 Hand/wrist						
2.5 Upper back						
2.6 Lower back						
2.7 Hip/thigh						
2.8 Knee						
2.9 Foot/ankle						

3 Describe the type of pain you are currently experiencing using the descriptions in the table below (if possible, please tick more than one)

Pain type	Not at all	Intermittent	Constant
3.1 Dull			
3.2 Tight			
3.3 Throbbing			
3.4 Aching			
3.5 Sharp			
3.6 Shooting			

4 Indicate which of the following actions aggravates your pain

4.1 Getting up out of bed/a chair	
4.2 Bending over	
4.3 Stress	
4.4 Strenuous exercise	
4.5 Moderate exercise	
4.6 Light exercise	
4.7 Sitting	
4.8 Walking	
4.9 Standing	
4.10 Lying down	

5 Indicate which of the following activities, if any, alleviates the current pain:

5.1Application of something cold to the area	
5.2 Applying pressure to the area of pain	
5.3 Stretching	
5.4 Lying down	
5.5 Massage	
5.6 Being active (walking/moving around)	
5.7 Standing	

6 Respond yes or no to each of the following questions:

	Yes	No
6.1 Does the pain affect your physical activities?		
6.2 Does the pain affect your relationship with others?		
6.3 Does the pain affect your mental health?		
6.4 Does the pain prevent you from doing your work properly?		
6.5 Does the pain affect your movement/moving around?		
6.6 Does the pain affect your academic performance?		

THANK YOU FOR YOUR TIME

Appendix J: Full IREC approval

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

28 August 2024

Mr M T Hlongwa
B790 Sigodo Road
Ntuzuma
4359

Dear Mr Hlongwa

The prevalence and associated risk factors of musculoskeletal disorders in students who utilise public transport at a university of technology in South Africa
Ethical Clearance number IREC 071/24

The DUT-Institutional Research Ethics Committee acknowledges receipt of your final data collection tool for review.

We are pleased to inform you that the data collection tool has been approved. Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the DUT-IREC acknowledges receipt of your gatekeeper permission letter.

Please note that FULL APPROVAL is granted to your research proposal. You may proceed with data collection.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the DUT-IREC according to the DUT-IREC Standard Operating Procedures (SOP's).

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

It is compulsory for a student or researcher to apply for recertification on an annual basis. The failure to do so will result in withdrawal of ethics clearance. It is the responsibility of the researcher and the supervisor to apply for recertification.

Please note that you are required to submit a Notification of Completion of Study form together with an abstract to the DUT-IREC office on completion of your study.

Yours Sincerely

Prof J K Adam
Chairperson: DUT-IREC

Appendix K: Letter of information

LETTER OF INFORMATION

Title of the Research Study: The prevalence and associated risk factors of musculoskeletal disorders in students who utilise public transport at a university of technology in South Africa

Principal Investigator/s/researcher: Mayibongwe Hlongwa (B.Tech: Chiropractic)

Co-Investigator/s/supervisor/s: Dr Desiree Varatharajullu (PhD: Health Sciences, M.Tech: Chiropractic)

Hello, I Trust you are well**.**

My name is Mayibongwe Hlongwa, a Chiropractic student at the Durban University of Technology doing research for my Master of Health Science in chiropractic degree.

Brief Introduction and Purpose of the Study:

Several individuals, including university students like yourself within the South African population use public transport namely minibus taxis and buses. Due to this, you are at risk for further exacerbation of current musculoskeletal disorders or the onset of musculoskeletal disorders. There is a gap in the literature with respect to musculoskeletal disorders in university students who travel using public transport, this study aims to fill the gap in that literature.

I would like to invite you to participate in the research.

What is Research

Research is a systematic process of investigating a question or problem to discover new knowledge or insights. It involves collecting and analysing data to find answers or test hypotheses.

It is important to note that you can ask as many questions as you wish. This is important to make sure that you fully understand the study. You are entitled to discuss the study with anyone, and you are under no obligation to commit at this stage. And this digital copy of this letter is for you to keep

Outline of the Procedures:

If you are willing to participate in this study, the informed consent section is present in the questionnaire, and you are encouraged to complete the questionnaire. You are free to

withdraw from the study at any point should you feel any discomfort while completing the questionnaire.

Here is the link to the questionnaire: **https://dut.questionpro.com/t/AbRa0Z39qX**

Risks or Discomforts to the Participant:

There are no risks or discomforts to you for being involved in this study. In the case of noncompliance, injury, or illness you may withdraw from the study. There will be no consequences for you should you choose to withdraw, as you are free to do so at any point during the study.

Reasons he/she may be withdrawn from the Study:

You as the participant are free to withdraw from the study at any time. Once the questionnaire is completed, the data will be confidentially saved in QuestionPro.

Benefits: Many people within the general population suffer with musculoskeletal disorders, there is a paucity of knowledge with regards to musculoskeletal disorders and public transportation. With your participation in this study, it will add significant knowledge to medical professionals, which may help in diagnosing and treatment of musculoskeletal conditions in the student population who travel using public transportation.

Remuneration: Participation in this study is voluntary. No remuneration will be awarded to you as a participant.

Costs of the Study: There will be no cost involved to participate in this study.

Confidentiality: Confidentiality will be ensured in this study. All answers given will not be linked to your participation. Informed consent and questionnaires will be kept in separate to ensure that no questionnaire is linked to you. The researcher and supervisor will only access the information when necessary. The questionnaires will be analysed by the statistician and all information gathered will be used for research purposes. A minimum period of five years will be given before the data will be erased through the process of deletion.

Results: The data from the questionnaires will be extracted by the researcher and processed by a statistician, after which results, and a conclusion will be drawn. This will be available in a hard copy as well as a published article.

Research-related Injury: There are no risk of research-related injuries in this study

Storage of all electronic and hard copies including tape recordings: The electronic information processed in QuestionPro will be stored within the QuestionPro Platform as well as a USB that will only be accessible by the researcher. Both forms of storage will be encrypted with a

password. The information will be saved within the chiropractic department for five years before it will be destroyed.

Persons to contact in the Event of Any Problems or Queries: Please contact the researcher: Mayibongwe Hlongwa (0670424233), my supervisor (0313732533/2094) or the DUT-Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Acting Director: Research and Postgraduate Support on researchdirector@dut.ac.za

Appendix L: Informed consent

INFORMED CONSENT FORM

Full Title of the Study: The prevalence and associated risk factors of musculoskeletal disorders in students who utilise public transport at a university of technology in South Africa

Name of Researcher: Mayibongwe Hlongwa

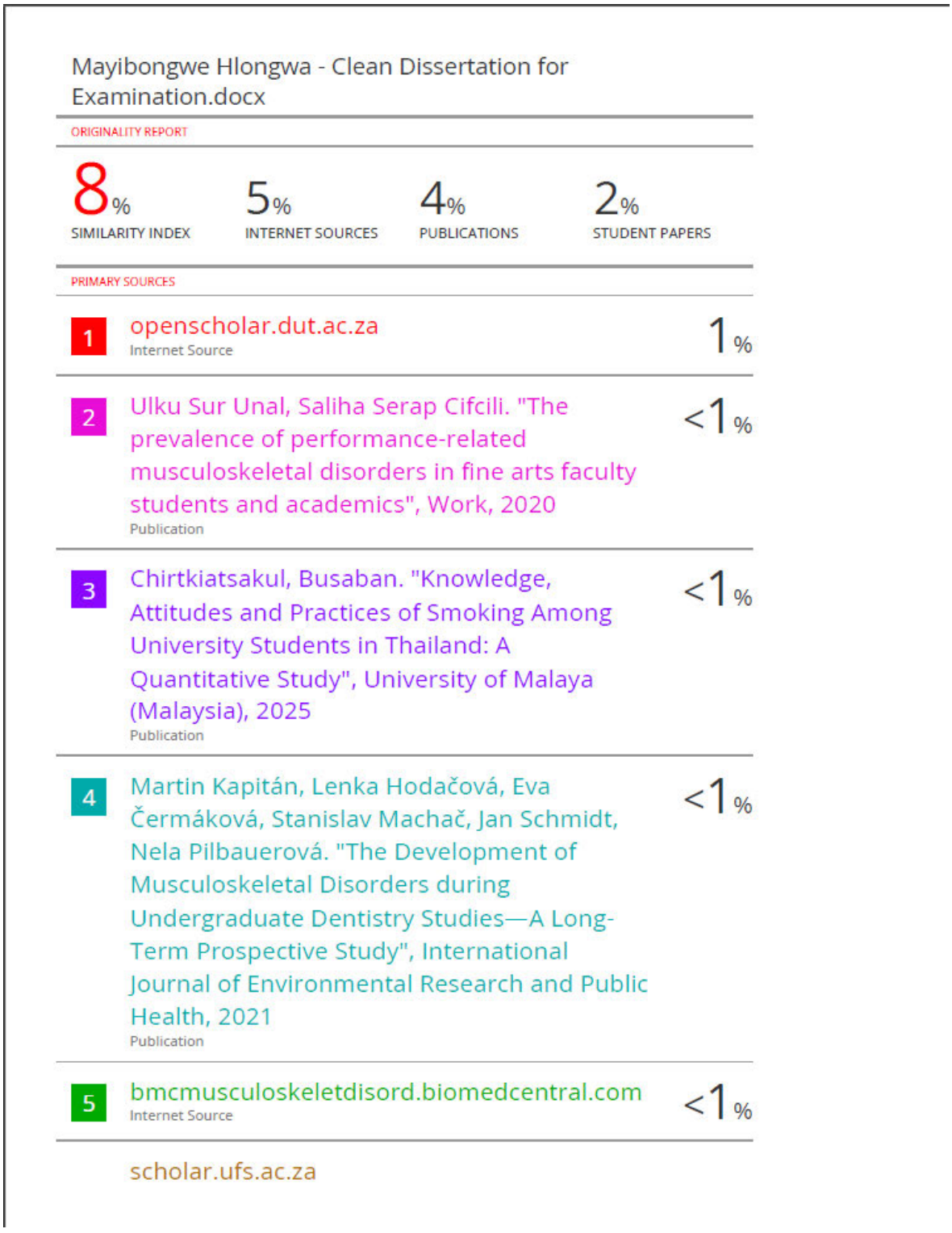
Name of the research supervisor: Dr Desiree Varatharajullu

Statement of Agreement to Participate in the Research Study:
I hereby confirm that I have been informed by the researcher, Mayibongwe Hlongwa
about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: IREC 071/24

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

- ◯ Yes, I give consent to participate in this study ▸▸ 1
- ◯ No, I do not consent ▸▸ Terminate

Appendix M: Plagiarism report



Mayibongwe Hlongwa - Clean Dissertation for Examination.docx

ORIGINALITY REPORT

8%	5%	4%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	openscholar.dut.ac.za Internet Source	1%
2	Ulku Sur Unal, Saliha Serap Cifcili. "The prevalence of performance-related musculoskeletal disorders in fine arts faculty students and academics", Work, 2020 Publication	<1%
3	Chirtkiatsakul, Busaban. "Knowledge, Attitudes and Practices of Smoking Among University Students in Thailand: A Quantitative Study", University of Malaya (Malaysia), 2025 Publication	<1%
4	Martin Kapitán, Lenka Hodačová, Eva Čermáková, Stanislav Machač, Jan Schmidt, Nela Pilbauerová. "The Development of Musculoskeletal Disorders during Undergraduate Dentistry Studies—A Long-Term Prospective Study", International Journal of Environmental Research and Public Health, 2021 Publication	<1%
5	bmcmusculoskeletdisord.biomedcentral.com Internet Source	<1%
	scholar.ufs.ac.za	

Appendix N: Editor's certificate

Helen Bond
IMPELA EDITING SERVICES
impelaediting@gmail.com
079 395 5873

25 July 2025

CERTIFICATE

Mayibongwe Thandokuhle Hlongwa

Dear Mayibongwe

Thank you for using Impela Editing Services to edit your Master's thesis entitled "*The prevalence and associated risk factors of musculoskeletal disorders in students who utilise public transport at a university of technology in South Africa*".

I have proofread for errors of grammar, punctuation, spelling, syntax and typing mistakes. I have formatted your work and checked the references (this means checking the formatting) according to DUT Harvard referencing.

Please note that Impela Editing accepts no responsibility for work changed after issuing this certificate.

I wish you the very best in your submission and your career.

Kind regards

Helen Bond (Bachelor of Arts, HDE)