

**An investigation into the risk factors of musculoskeletal
diseases and the association between chronic diseases of
lifestyle in an under-resourced area of the Cape Town
Metropole**



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In fulfilment of the requirements for the degree Master of Science in Physiotherapy
(MSc Physiotherapy) by dissertation

February 2019

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Acknowledgements

I would like to acknowledge and extend my sincere thanks to the people without whom this study would not have been possible:

The Lord God, my heavenly Father, for allowing me the opportunity to undertake and complete this challenging task.

Mrs. Candice Hendricks and Professor Jennifer Jelsma, my supervisors, for their words of wisdom and expert guidance in research methodology and statistical analysis, financial assistance, continuous enthusiasm, encouragement and support, and time and work invested into this project. Thank you for both being so patient and for believing in my potential.

The Western Cape Department of Health for granting permission for this study to be carried out within one of their institutions.

The management and staff of Mitchells Plain Community Health Centre for the use of their facility, as well as their patience, understanding and generous assistance.

All volunteers who offered their time to participate in this study.

All research assistants who assisted in interviews and anthropometric measurements during the data collection period.

The National Research Foundation (NRF) Thuthuka student support grant, the University of Cape Town Masters Research Scholarship, and the Yeoman bequest bursary for financial assistance.

Your assistance with this study is greatly appreciated.

Thank you.

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Abstract

Title: An investigation into the risk factors of musculoskeletal diseases and the association between chronic diseases of lifestyle in an under-resourced area of the Cape Town Metropole

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Date: February 2019

Keywords: musculoskeletal disease, hypertension, diabetes mellitus, cardiovascular disease, physical activity, obesity

Background: A recent shift in the global burden of disease from communicable to non-communicable has shown that a third of the global burden of disease is attributable to non-communicable disease, with the heaviest burden affecting poor communities in urban areas. Musculoskeletal disease (MSD) is the most common cause of severe chronic or persistent pain, functional limitations, and physical disability, affecting 20-50% of adults. Globally, disability due to musculoskeletal disease is estimated to have increased by 45% from 1990 to 2010 accounting for 6.8% of total years lived with disability. Research has highlighted a possible co-existence of musculoskeletal disease and chronic non-communicable diseases of lifestyle, however, there is inadequate South African evidence regarding these inter-relationships and possible risk factors. This highlights a gap in research as management may not be appropriately targeted toward risk factors and thus may not reduce the high prevalence rates of musculoskeletal disease.

Aim: The main aims of this study were firstly to determine the prevalence and patterns of acute and chronic musculoskeletal disease. The secondary aim was to explore the relationship between these factors by examining the patterns of onset of musculoskeletal disease, chronic diseases of lifestyle, and risk factors across gender and six age categories (from 18 years to 70 years and older) in patients seeking medical services at a community health centre in Cape Town, South Africa. It was hypothesised that if some conditions were found to have an earlier onset, these conditions might lay the foundation for the development of other chronic diseases of lifestyle and musculoskeletal disease.

Methodology: A descriptive, cross-sectional, analytical study design was used at primary health care level at a community health centre in Cape Town, South Africa. All males and females aged 18 years and older, except those who were pregnant or unable to answer the English, Afrikaans, or isiXhosa versions of the selected questionnaires, were eligible to participate. The outcome measures were the Community Orientated Program for Control of Rheumatic Diseases (COPCORD) screening tool for musculoskeletal disease, the Brief Pain Inventory (BPI), the European Quality of Life-5 Dimensions (EQ-5D) health-related quality of life measure, the International Physical Activity Questionnaire (IPAQ), and anthropometric measures of weight, height, and waist and hip circumference. Data were collected via interview and anthropometric measurement. Responses were captured by online questionnaires on mobile devices using the mobile data collection application Magpi by DataDyne Group, LLC. Data were exported to Microsoft Office Excel spreadsheets for descriptive and inferential statistical analysis. Ethical permission was obtained from the University of Cape Town.

Results: This study recruited 1115 participants, with a mean age of 48.7 ± 16.8 years. A prevalence rate of 33.6% (95% Confidence Intervals; CI: 30.1-36.5%) for acute MSD and 43.3% (CI: 40.4-46.3%) for chronic MSD was found. The number of participants reporting an overall prevalence of any MSD was 505 (45.7%; CI: 42.8-48.7%). The highest prevalence of MSD was found in females aged 40-59 years. The most common anatomical sites of chronic MSD were the knees (35.6%; CI: 31.5-39.9%), low back/pelvis (33.8%; CI: 29.8-38.0%), shoulders (26.8%; CI: 23.1-30.9%), and hands/fingers (21.9%; CI: 18.5-25.7%). Of those with MSD, exercise was reported as the best management strategy for musculoskeletal pain (35.6% of 191 respondents; CI: 29.1-42.6%). Hypertension was found to be the most prevalent chronic disease of lifestyle (47.8%; CI: 44.8-50.7%), followed by type 2 diabetes mellitus (21.4%; CI: 19.1-23.9%), and hypercholesterolaemia (20.2%; CI: 17.9-22.6%). All chronic diseases, except chronic obstructive airway disease (COAD), increased with age, while COAD and both acute and chronic MSD peaked around the 50-59 age category and then decreased with age. Most females reported to be highly physically active (46.0%) while males reported mostly low physical activity levels (47.8%). Around the 50-59 year old age group the proportion of participants with a 'high' physical activity level decreased while that of participants with a 'low' physical activity level increased at the same age group. A higher proportion of those without MSD reported 'high' levels of physical activity (41% compared to 32%). In the 30-39 and 40-49 age groups, low levels of physical activity were associated with chronic MSD (70.6% compared to 37.5% of those

with high levels; Chi-Square=13.833; df=2; p=0.001). Body mass index (BMI) category was found to be associated with MSD ($p<0.001$) with 73% of those with MSD being overweight or obese and 27% being extremely obese. There were significant differences in BMI between those with and without hypertension ($p<0.001$), hypercholesterolaemia ($p<0.001$), and type 2 diabetes mellitus ($p<0.001$). A trend of increasing obesity, high waist-hip ratio and low levels of physical activity with age was observed. In smokers, being 30 years of age or older was associated with an increased risk of MSD (42% compared to 21.1%). Gender emerged as a risk factor in the 40-49 and 50-59 age categories with 76.2% of females in these categories reporting chronic MSD compared to 45.1% of the males. However, no risk factor seemed to track the plot of MSD. Age emerged as having the highest association with chronic MSD (Chi-Square=136.6; $p<0.001$).

Conclusions: Bivariate associations of musculoskeletal disease and chronic diseases of lifestyle were detected because they all become more prevalent with age. The comorbidity of musculoskeletal disease and chronic disease of lifestyle appeared to almost entirely be due to the aging process, rather than the mutual influence that musculoskeletal disease and chronic diseases of lifestyle may have. Low levels of physical activity were only associated with musculoskeletal disease among those in the 30-49 age categories. As previous evidence has shown that increased levels of physical activity can reduce pain in chronic or persistent musculoskeletal disease, a window of opportunity is suggested where increasing physical activity levels in the 30-49 age group may result in a decrease in the prevalence of musculoskeletal disease in the older age group. The only factor that emerged as being predictive in the group with the highest prevalence of musculoskeletal disease, the 40-59 age categories, was gender. Although gender is clearly not modifiable, this finding should inform the development of culturally appropriate intervention strategies.

Implications: Although it was not possible to detect any evidence supporting causation, the co-existence of chronic musculoskeletal disease, chronic diseases of lifestyle, and risk factors highlights the need for holistic care to address the multiple problems experienced by adults, specifically as age progresses. The impact of chronic musculoskeletal disease is large, both in terms of prevalence and impact on health-related quality of life. The management of chronic musculoskeletal disease should thus focus on the most effective and affordable intervention strategies and healthcare systems and coherent policies for dealing with this condition should be developed. This management should not only be

based on a pharmacological model but on biopsychosocial integration emphasising self-management.

Funding acknowledgements: NRF Thuthuka student support grant, the University of Cape Town Masters Research Scholarship, and the Yeoman bequest bursary.

Ethics approval: Approved by the Human Research Ethic Committee of the University of Cape Town (HREC REF: 856/2014), South Africa.

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List of Abbreviations

6MWT	6-Minute Walk Test
ACE	Angiotensin-Converting Enzyme
AIDS	Acquired Immunodeficiency Syndrome
ANOVA	Analysis of Variance
AP	Apparent Prevalence
ARB	Angiotensin-Receptor Blocker
ASA	Acetylsalicylic Acid
BMI	Body Mass Index
BMD	Bone Mineral Density
BOD	Burden of Disease
BP	Blood Pressure
BPI	Brief Pain Inventory
BPQ	Brief Pain Questionnaire
CAD	Coronary Artery Disease
CCB	Calcium-Channel Blocker
CDC	Centres for Disease Control and Prevention
CDL	Chronic Diseases of Lifestyle
CHAID	Chi-Square Automatic Interaction Detector
CHC	Community Health Centre
CI	Confidence Interval
cm	Centimetre

COPCORD	Community Orientated Program for Control of Rheumatic Diseases
COAD	Chronic Obstructive Airway Disease
COX	Cyclo-oxygenase
CRPS	Complex Regional Pain Syndrome
CSA	Computer Science and Applications, Inc
CVD	Cardiovascular disease
DBP	Diastolic Blood Pressure
DI	Disability Index
df	Degrees of Freedom
DM	Diabetes Mellitus
DMARDs	Disease Modifying Anti Rheumatic Drugs
EQ-5D	European Quality of Life-5 Dimensions
FEV1	Forced Expiratory Volume during first second of expiration
FVC	Forced Vital Capacity
GABA	Gamma-Aminobutyric Acid
GAD	Generalised Anxiety Disorder
GBD	Global Burden of Disease
GNI	Gross National Income
H ₀	Null Hypothesis
HAQ	Stanford Health Assessment Questionnaire
HCL	Hypercholesterolaemia
HCTZ	Hydrochlorothiazide

HDL	High Density Lipoprotein
HIV	Human Immunodeficiency Virus
HPT	Hypertension
HRQoL	Health-Related Quality of Life
HVAS	Horizontal Visual Analogue Scale
IASP	International Association for the Study of Pain
IBD	Inflammatory Bowel Disease
IBS	Irritable Bowel Syndrome
ICC	Intraclass Correlation Coefficient
ICF	International Classification of Functioning, Disability and Health
ILAR	International League of Associations of Rheumatology
ILO	International Labour Office
IMMPACT	The Initiative on Methods, Measurement and Pain Assessment in Clinical Trials
IPAQ	International Physical Activity Questionnaire
kg	Kilogram
kg/m ²	Kilogram per metre squared
LBP	Low Back Pain
LDL	Low Density Lipoprotein
m	Metre
MET	Metabolic Equivalent of a Task (energy equivalent of a task/Oxygen consumed at rest)
mm	Millimetre

mmHg	Millimetre of Mercury
mmol/l	Millimoles per litre
MPQ	McGill Pain Questionnaire
MSD	Musculoskeletal Disease
NCD	Non-Communicable Disease
NICE	National Institute for Health and Clinical Excellence (United Kingdom)
NIDDM	Non-Insulin-Dependent Diabetes Mellitus
NRS	Numeric Rating Scale
NSAIDs	Non-Steroidal Anti-Inflammatory Drugs
OA	Osteoarthritis
OGTT	Oral Glucose Tolerance Test
OR	Odds Ratio
OTC	Over-the-counter
PA	Physical Activity
PHC	Primary Health Care
PIS	Pain Interference Score
PPI	Present Pain Intensity
PSS	Pain Severity Score
PVD	Peripheral Vascular Disease
r	Pearson Correlation Coefficient
R	(South African) Rand

RA	Rheumatoid Arthritis
RSST	Repeated Sit-to-Stand Test
sec	Seconds
SBP	Systolic Blood Pressure
SD	Standard Deviation
SE	Sensitivity of a diagnostic test
SE	Standard Error
SES	Socioeconomic Status
SF-MCQ	Short-Form McGill Pain Questionnaire
SLE	Systemic Lupus Erythematosus
SMR	Skeletal Muscle Relaxant
SNRI	Serotonin-Norepinephrine Reuptake Inhibitor
SP	Specificity of a diagnostic test
SSRI	Selective Serotonin Reuptake Inhibitor
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
TB	Tuberculosis
TCA	Tricyclic Antidepressant
TP	True Prevalence
UEMSD	Upper Extremity Musculoskeletal Disease
vs	Versus
VAS	Visual Analogue Scale

VVAS	Vertical Visual Analogue Scale
WCDoH	Western Cape Department of Health
WHO	World Health Organisation
WHR	Waist-Hip Ratio
WOMAC	Western Ontario and McMaster Universities Osteoarthritis Index
YLDs	Years Lived with Disability

1 INTRODUCTION

1.1 Background

In recent years, there has been a global shift in the burden of disease (BOD) from communicable infectious disease to non-communicable or chronic diseases of lifestyle (CDL) which has thus seen more emphasis placed on healthier lifestyles. The non-communicable diseases (NCDs) include musculoskeletal disease.¹

Musculoskeletal disease (MSD) refers to injuries, pain, or disorders of the musculoskeletal, or movement, system of the human body.² These may result from everyday activities and may be acute conditions such as muscle strains and joint sprains, sub-acute conditions, or chronic conditions such as osteoarthritis (OA) and chronic low back pain (LBP). Acute MSD typically have a sudden onset and short duration. The primary goals in the management of acute MSD are to decrease pain intensity, facilitate recovery, and prevent the development of chronic pain, thus management (following a medical model of care) ends when the symptoms resolve.³ Chronic MSD describes musculoskeletal pain that persists for longer than three months or past the normal time of healing.⁴ The primary goal of management of chronic MSD is to improve function, thus a rehabilitation or disease model of management is utilised.⁵

At some point in each individual's lifetime, they are likely to experience some form of MSD.⁶ MSD most often manifests with the onset of pain, and may be accompanied by oedema, haematoma, or stiffness, and may thus result in limitations of activities of daily living.³ It is the most common motive behind self-medication and entry into the global health system,⁷ affecting at least one quarter of the population.⁶ Globally, over one quarter of the cost of illness is accounted for by MSD, which significantly burdens healthcare and social resources.⁶

In peri-urban South Africa, it has been found that over 50% of primary health care (PHC) visits are due to pain, mostly in the head, back, and chest.⁸ Despite this, the complaints of those with musculoskeletal pain have previously been misunderstood by health care professionals and, therefore, patient concerns have not been well addressed and treatment has not been timely and effective.⁶

Importantly, it has been shown that the prevalence of chronic MSD is higher in those with other chronic diseases than in those without.⁹ Additionally, the predominant pain mechanism in those with major CDL is of a musculoskeletal nature. The presence of chronic MSD may further negatively impact the health and wellbeing of affected individuals due to reduction of movement and impaired functional activities, both within the home and community setting.¹⁰ This may then lead to low physical activity levels and possibly obesity. A forced sedentary lifestyle caused by chronic MSD could eventually result in developing CDL such as hypertension (HPT), and type 2 diabetes mellitus (DM).¹¹ It has been reported that those with chronic pain have a threefold risk of dying from heart or respiratory disease compared to those with no chronic pain and it is hypothesised that this may be partly resultant of a decreased exercise capacity in those disabled by chronic MSD.¹⁰ Therefore, it is hypothesised that chronic MSD may contribute to the development of a cycle of life-threatening and disabling CDL and if the primary medical problem, MSD, is not managed effectively, a cycle of secondary complications such as CDL could occur (see Figure 1 below).

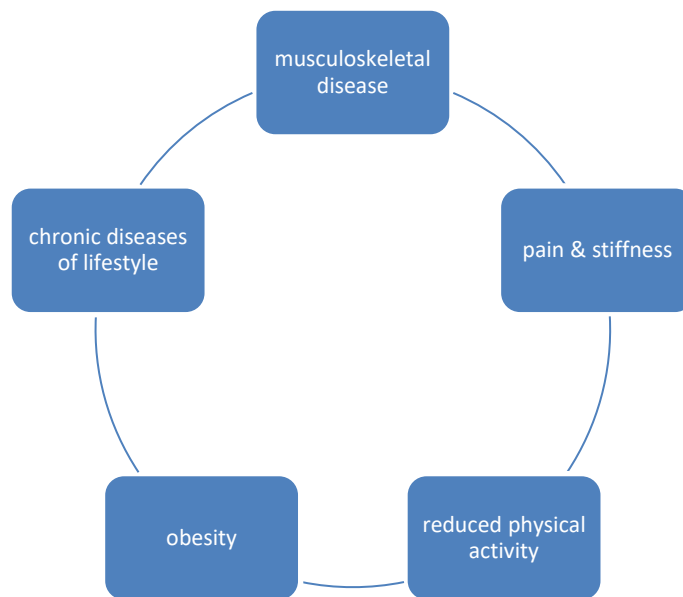


Figure 1: The hypothesised impact of chronic musculoskeletal disease (self-designed model)

It can thus be deduced that other conditions that are not associated with MSD may contribute to the prevalence of MSD if it impacts one of the aspects in the above hypothesised cycle. Clinically, this suggests that an integrated approach to the evaluation and management of those with multiple conditions is required and MSD, especially of a chronic nature, cannot be managed in isolation.

In Cape Town, primary health care (PHC) is provided at a number of community health centres (CHCs) and these are the primary source of health care for those living in under-resourced communities (refer to Section 1.5 below). As the focus of this research is the impact of MSD and CDL on people who were previously disadvantaged by the apartheid system and who still have limited access to material resources, the research was targeted at those attending CHCs. In addition, research undertaken at similar CHC facilities has indicated a high prevalence of MSD in females, ranging from 36%¹² reported musculoskeletal pain not due to injury in the past three months in Cape Town to 62%¹³ in Bloemfontein in the Free State province of South Africa. Both studies reported that MSD had a moderate to severe impact on health-related quality of life (HRQoL) and functional ability in older women.^{12,13} In addition, both studies recommended the need to provide a physiotherapy management programme which would not only address the musculoskeletal pain experienced by women attending CHCs, but that would also include non-pharmaceutical management of comorbidities and risk behaviours.^{12,13}

1.2 Problem Statement and Research Questions

A wide ranging literature search could find little South African research on the prevalence of MSD and the various comorbidities in under-resourced communities. There is also a lack of South African evidence regarding the inter-relationships between MSD and CDL, and about risk factors (such as gender, obesity and physical inactivity) associated with these chronic diseases. Furthermore, there is insufficient evidence regarding the timing of the onset of these chronic diseases, information which would contribute to the understanding of the complex relationship between these diseases. As indicated in Figure 1 above, although it is likely that there is a relationship between different chronic diseases, it is unclear which chronic disease emerges first and may then be a causal or risk factor in the development of subsequent health conditions and functional impairments. This gap in research highlights that current management may not be targeted appropriately at risk

factors and thus may not reduce the high prevalence rates of MSD and possible comorbidities in adults.

Furthermore, if this hypothesised impact of MSD is correct, it would suggest that affected individuals should be offered an integrated approach to the evaluation and management of multiple chronic diseases such as MSD and other common CDL. This may be in contrast to the current management strategies available at primary health care facilities which generally manage these conditions in disease specific clinics rather than in a single multi-disciplinary clinic which would provide integrated, holistic management.

Thus, the **research questions** for this study are:

- What is the prevalence and types of MSD in adult males and females across six age categories (i.e. 18-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years, and 70 years and older) attending a CHC in Cape Town?
- What comorbidities and risk factors occur in the population?
- At which age is the onset of MSD and CDL?
- Are these comorbidities associated with MSD?
- What are the management and treatment strategies for MSD and CDL?
- What is the self-reported level of physical activity in the population with MSD?
- Is the self-reported level of activity associated with MSD and/or identified comorbidities?
- What is the health-related quality of life in population with MSD and/or CDL?
- What is the impact and association of MSD and CDL on health-related quality of life across various age categories?

1.2.1 Null Hypothesis

The null hypotheses (H_0) of this study are as follows:

- The prevalence of MSD and CDL does not increase with age.
- The presence of chronic MSD is not associated with CDL and is not a risk factor for the development of CDL.
- Age, gender, obesity and social habits are not associated with or are not risk factors for the development of chronic MSD and CDL.
- Self-reported low levels of physical activity are not associated with or are not risk factors for the development of chronic MSD and CDL.

- There is no association between self-reported poor health-related quality of life and chronic MSD and CDL.

1.3 Aims & Objectives

1.3.1 Aims

The aims of this study were to investigate the prevalence and patterns of onset of musculoskeletal disease (MSD) and chronic diseases of lifestyle (CDL) across six age categories (i.e. 18-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years, and 70 years and older), and to identify the risk factors associated with MSD and CDL in patients attending a community health centre (CHC) in Cape Town, South Africa.

1.3.2 Objectives

The specific objectives include, within a sample of adult patients attending a CHC in Cape Town:

1. To determine the proportion of people with musculoskeletal diseases and pain in men and women aged 18 years and older, using an adapted version of the COPCORD questionnaire to identify those with MSD.
2. To determine the proportion of people with chronic diseases of lifestyle such as hypertension, type 2 diabetes mellitus, and cardiovascular disease.
3. To describe the physiotherapy and medical management of MSD and CDL.
4. To determine the proportion of respondents with MSD and/or CDL across different age categories ranging from 18 years and older to establish how these change over the adult lifespan.
5. To determine the association between MSD and CDL and risk factors such as age, gender, obesity, occupations, and social habits such as smoking.
6. To determine whether self-reported physical activity levels are associated with musculoskeletal disease and chronic diseases of lifestyle through investigating the level of self-reported physical activity, using the IPAQ (International Physical Activity Questionnaire).
7. To determine the association between the health-related quality of life, health index score and MSD.

1.4 Significance of this study

As those adults who attend CHCs are likely to be older females with limited income,^{12,13} they represent a vulnerable population. Severe MSD can be particularly devastating for this group as they are likely to be dependent on public transport, be responsible for child care and reliant on physical mobility for income generation. As reported above, previous studies have indicated that the prevalence of MSD in similar populations is high, as is the presence of comorbid CDL.^{12,13} However, the cited studies have not included males in their samples and there is less information regarding the prevalence and impact of MSD and CDL in males. This study will assist in filling this information gap. The authors recommended that more appropriate methods of holistic management of MSD, together with comorbidity, be developed.^{12,13} Although comorbidity is very common, the possibility of a “cascade” of health conditions and functional limitations was not examined. If specific health conditions or risk factors consistently emerge earlier in this population, it might be possible to design intervention strategies which target these conditions early on, possibly disrupting the cycle as described earlier. Information relating to the current pharmacological and non-pharmacological management of patients with MSD and CDL will also assist in making recommendations regarding appropriate management strategies.

1.5 Research Setting

The World Bank classifies country's economies into four groups based on the country's gross national income (GNI) per capita for the fiscal year, assigned on the first of July of each year.¹⁴ The four income economy groups are: low income, lower middle income, upper middle income, and high income.¹⁴ South Africa is classified as an upper middle-income economy, with a GNI per capita of between 3956 and 12235 United States dollars.¹⁵ Other notable countries also classified as upper middle income economies include Namibia, Botswana, Mauritius, Brazil, Argentina, Mexico, Turkey, Romania, Croatia, Malaysia, Thailand, China, and the Russian Federation.¹⁵

In South Africa, 70.7% of households utilize public health care institutions.¹⁶⁻¹⁸ Thus, in the Western Cape province, where the City of Cape Town is situated, approximately 70% of the population, do not have health insurance and are reliant on public health care institutions

for medical services. The first point of contact within the public health care system most commonly occurs at CHCs which are primary health care multidisciplinary institutions.

According to the 1978 Declaration of Alma-Ata, the World Health Organization (WHO) describes PHC as “essential health care based on practical, scientifically sound, and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination” (p.1).¹⁹ In the South African public health care system, as with that of other low to middle income countries, primary health care consists of two systems.²⁰ The first level of contact for individuals, families, and communities, is a network of clinics and CHCs that deliver basic and preventative health care services and the second is the hospital care system.²⁰ This study was conducted at primary health care level at a CHC in the Cape Town Metropole region of the Western Cape.

The City of Cape Town region is constituted of 3740025 inhabitants.²¹ The area is serviced by 44 CHCs. The Mitchells Plain health district within the City of Cape Town services a population of 507237²² and has been identified as an under-resourced area of the Cape Town Metropole. The Mitchells Plain CHC within the Mitchells Plain health district provides health services to an area where 24.2% of the inhabitants are unemployed and 17.9% of households are below the poverty line, thus relying solely on public sector health care services.²³ The CHC services 1 480 patients per day, and thus approximately 46000 patients per month, making it one of the busiest CHCs in the city, and the only one in the Mitchells Plain sub-district to offer comprehensive primary healthcare services.²³

Current daily services include, but are not limited to, trauma and medical emergency services, a midwife obstetric unit, general medical services, chronic disease clubs, HIV/AIDS services (testing, counselling, ARV treatment), reproductive health services, mental health services, pharmacy, physiotherapy, occupational therapy, radiology, and women and child health care services.²³ The majority of patients seen per day partake in the chronic disease clubs.²³ The chronic disease clubs manage those with stable CDL after they have been initially managed by a medical doctor.²³ Clients are seen every six months, by appointment, where general observations, health screening, education, advice, and referral are done.²³ Thereby, the chronic disease clubs address various medical, pharmacological, and lifestyle factors associated with CDL.²³

1.6 Dissertation Outline

The first chapter provides motivation for this study by providing a contextual background and a statement of the problem, as well as the aim, objectives and significance of this study. A description of the research setting is also included. The dissertation is presented in five further chapters.

Chapter 2 presents a literature review that provides additional background information on the burden of MSD. It contextualises the need for the investigation into its risk factors and association between CDL within a South African context. The prevalence of MSD is discussed, followed by the pathophysiology of MSD, for both acute and chronic, and risk factors for MSD. It also elaborates on the prevalence, pathophysiology and risk factors of CDL, and related intervention strategies. The review further describes the intervention strategies commonly used for MSD. The chapter concludes with a summary of the literature review.

The following four chapters relate to the epidemiological study. Chapter 3 describes the research design, study sample, instrumentation, procedure of the study, ethical considerations, and data management and statistical analysis. In Chapter 4 the results of the study are presented. In Chapter 5 the results and possible reasons for associations and identified problems are discussed. The limitations of the study are highlighted and recommendations for future action are made.

The final chapter, Chapter 6, provides a summary of the results of this study and presents the final conclusions and recommendations for implementation and further research.

2 LITERATURE REVIEW

2.1 Introduction to the Literature Review

The following literature review presents musculoskeletal disease (MSD) and contextualises the need for the investigation into its risk factors and association with chronic diseases of lifestyle (CDL) within a South African context. The review begins by exploring the burden of disease (BOD). This is followed by MSD and its prevalence, both worldwide and locally, the pathophysiology of MSD, both acute and chronic, and risk factors for MSD.

Research exploring CDL, their prevalence, pathophysiology, risk factors, and intervention strategies are also presented. Literature on the associations between MSD and CDL is then presented, followed by current intervention strategies for MSD. Finally, a summary of the above information concludes the literature review.

Relevant literature for this review was searched from inception to February 2019 and was found using the online databases Pubmed, Google Scholar, Cinahl, EBSCO, Medline, BioMed Central, and Science Direct. Key words entered into these databases included 'musculoskeletal diseases', 'non-communicable diseases', 'Africa', 'South Africa', 'physical activity levels', 'obesity', 'body mass index', 'waist-hip ratio', 'chronic diseases of lifestyle', 'hypertension', 'diabetes mellitus', 'hypercholesterolaemia', 'cardiovascular disease', and 'chronic obstructive airway disease'. While reading relevant articles from the above search, other applicable cited references were also searched for using the above method. Articles included in this review were limited to full text articles, freely available and published in English.

2.2 Burden of Disease

In recent years, there has been a shift in the global burden of disease (GBD) from communicable to non-communicable, with a third of the GBD attributable to non-communicable disease (NCD) such as chronic diseases of lifestyle (CDL), which includes musculoskeletal disease (MSD).²⁴ In 2008, 63% of global mortalities were due to non-communicable diseases such as cardiovascular disease (CVD) (39%), type 2 diabetes mellitus (4%), various cancers (27%), and chronic respiratory and other diseases (30%).²⁵ A

high percentage (80%) of mortalities in low middle-income countries were due to non-communicable diseases as the vulnerable and socially disadvantaged population get sicker sooner as a result of non-communicable diseases than people of higher social positions.²⁵

Pain has been found to be the most common reason for healthcare visitations in low-resource countries.²⁶ A six-country study found that, in those with two or more CDL, the prevalence of pain was 59%.²⁷ Globally, disability due to MSD is estimated to have increased by 45% from 1990 to 2010 with MSD accounting for 6.8% of total years lived with disability (YLDs), increasing from between 4% and 7% in 1990 to between 6% and 8% in 2010.²⁸ This could be attributed to the rapid increase in CDL in developing countries as a consequence of the aging of the population²⁹ and demographic and lifestyle changes caused by globalisation, urbanisation, and increasing sedentary lifestyles.^{25,30} This burden is gradually growing with the rise in age, little change over time, and an ageing world population.²⁸ The burden of MSD is also one on social and health care resources as, globally, it accounts for a quarter of the overall cost of illness and is the second most common reason for visiting a primary health care physician.⁶

An increase in non-communicable diseases, as well as the associated risk factors, is found in communities in South Africa.³¹ The World Health Organisation (WHO) estimates that these non-communicable diseases caused 29% of the total burden of disease, with the heaviest burden affecting poor communities in urban areas.³¹ In 2008, the following NCDs accounted for mortality in South Africa: cardiovascular disease (11%), type 2 diabetes mellitus (3%), cancers (7%), and other diseases including MSD (7%).³²

2.3 Musculoskeletal Disease and Its Prevalence

Musculoskeletal disease encompasses a diverse group of pathophysiological conditions that are linked by anatomical area and association with pain and impaired physical function. These include a variety of conditions, ranging from those of acute onset and short duration to lifelong disorders such as osteoarthritis (OA), rheumatoid arthritis (RA), and chronic low back pain (LBP).³³ Mortality associated with these conditions is generally low, however, MSD impacts medical costs, disability and quality of life.³⁴

When describing prevalence, point prevalence is said to be the proportion of a population that has a specific condition at a specific point in time. Relating this to biostatistics, in

diagnostic testing the apparent prevalence (AP) is the proportion of positive test results in a sample representative of a population, while true prevalence (TP) is the actual proportion of positive test results in a population, which may never be known unless an entire population is tested.³⁵ The performance of a diagnostic test is dependent on two factors: the test sensitivity (SE), which is “the probability that a truly infected individual will test positive”(p. 2), and the test specificity (SP), which is “the probability that a truly non-infected individual will test negative” (p.2).³⁵ True prevalence can be estimated using the following equation:

$$TP = \frac{AP + SP - 1}{SE + SP - 1}$$

2.3.1 Global Prevalence of Musculoskeletal Disease

Musculoskeletal disease is the most common cause of severe chronic pain, functional limitations, and physical disability, affecting 20-50% of adults.^{33,36} Thus, MSD is globally common with evidence suggesting that it is becoming even more prevalent over time.³⁷ McBeth and Jones (2007)³⁷ found that 50% of the general global population reported pain in the low back region, 20-33% reported pain in the shoulder, and an average of 8.2% reported chronic widespread pain.³⁷ A Swedish population study found a prevalence of 34.5% of chronic pain, both regional and widespread,³⁸ while in a Brazilian, also an upper middle income country like South Africa, systematic review on the prevalence of MSD, 50% of the population reported lower limb pain, while the prevalence of arthritic pain varied between 9.4% and 39.6%.³⁹

Despite the abundance of global research on MSD, there is a paucity of epidemiological data on MSD within the African context. The prevalence of low back pain in Africa has been shown to be 16-59% among adults, potentially increasing with age.⁴⁰ The wide discrepancy in rates could be due to the differing samples used in varying socio-economic climates or, despite the efforts of the Community Orientated Program for Control of Rheumatic Diseases (COPCORD), lack of a standard definition of what constitutes MSD.

2.3.2 South African Prevalence of Musculoskeletal Disease

Global literature has shown that South Africa has a higher prevalence of chronic MSD, than other developed and developing countries.⁴¹ In a 2010 South African study at two

community health centres (CHCs), 362 participants reported having non-traumatic MSD. This constituted a prevalence of 36% of the sample initially screened for MSD.¹² A prevalence of osteoarthritis (10%) and rheumatoid RA (5%) was found in these participants, but no definitive musculoskeletal diagnosis was made for each participant, thus not allowing for area-specific prevalence rates.

A prevalence rate of 45.8% (95% CI: 40.5%-51.35%) of MSD was found in a 2013 South African study conducted at a CHC in Bloemfontein, Free State province.⁴² Three hundred and twenty-three male and female adult participants were recruited, where back, knee, wrist, elbow, and ankle pain were the most commonly reported complaints.⁴² This is supported by another study that showed similar results where a prevalence rate of 42.9% (95% CI: 37.4%-47.1%) of MSD was found, where chronic pain in the back, knees, ankles, head, shoulders and elbows were most commonly reported.⁴³ This study was conducted in the rural community of Baziya in the Eastern Cape province and recruited 394 adult males and females.⁴³ Further literature found a prevalence rate of 41% of MSD, where back ache and joint pain were most reported.⁴⁴

The Institute for Health Metrics and Evaluation found that low back and neck pain was the second most prevalent cause of disability behind HIV/AIDS, and notably increasing by 22.8% between 2005 and 2016.⁴⁵ Even though some studies on the prevalence of MSD were conducted in South Africa, there seems to be a lack of evidence regarding the onset of MSD according to age and whether there are any comorbidities associated with the presence of MSD.

2.3.3 Age and Gender

The prevalence of MSD has been shown to be higher among females and increasing with age.^{33,2,46} Therefore, as the average age of the population increases the impact of MSD will most likely increase in parallel.^{12,34} In adults aged 20-74 years, a prevalence rate of chronic MSD was also shown to be higher in females (38.3%) than in males (30.9%), with a significant difference between gender ($p < 0.002$) and a peak in prevalence in females between ages 65-69 years and in males between ages 55-64 years.³⁸ The same has been found for upper limb MSD where females had significantly higher rates of upper extremity musculoskeletal disease (UEMSD) than males.⁴⁷ It is estimated that a prevalence rate of 85.5% of MSD may be found in adults older than 60 years, with females being more affected males.³⁹ An increase in MSD appears to be related to age, with CDL being

displayed more in the older population.¹² A recent African study also found that age, and not gender, was significantly associated with MSD ($p=0.043$).⁴⁸ In South Africa, 42% of adults older than 50 years reported having MSD.⁴⁹

According to Fillingim (2001),⁵⁰ females are overrepresented in several chronic pain conditions and thus appear to be at greater risk for the symptoms of these conditions.⁵⁰ However, there is a substantial amount of evidence that demonstrates differences in the experience of pain between males and females.⁵⁰ Mechanisms attributed for the difference in pain experience are largely interpreted as physiological or endogenous and psychosocial, as described in Section 2.6.1, which is based more on the level of analysis as opposed to the actual mechanism of action.⁵⁰

2.4 Pathophysiology and Development of Musculoskeletal Pain

The International Association for the Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (p.210).⁴ Thus, pain is described as a complex multidimensional experience that is influenced by a variety of biopsychosocial variables⁵⁰ and is always subjective as each individual applies the meaning of pain based on their own experiences.⁵¹ Pain is therefore thought to have a sensory dimension (“where and how much does it hurt?”); an emotional dimension (“how unpleasant is the experience?”); and a cognitive dimension (“how do we interpret the pain based on our previous experience? does it cause fear and anxiety? how do we respond to the threat posed by pain?”).⁵¹

2.4.1 Classification of Pain

There seem to be various classifications of pain which may overlap with each other. However, these classifications are useful as they aid in the assessment and management of pain. Pain may be classified by aetiology, duration, location/region, intensity, and nature, among others.

Mechanisms contributing to the development of pain include: input mechanisms/categories such as nociceptive, inflammatory, and peripheral neuropathic; processing mechanisms, such as central sensitisation and the understanding and emotion of pain; and output mechanisms such as autonomic, motor, neuroendocrine, and immune

system response.⁵² More recently, mechanism-based classifications of musculoskeletal pain are being used to develop clinical criteria for diagnostic purposes.⁵³ These mechanisms are nociceptive, peripheral neuropathic, and central.⁵³ Nociceptive and neuropathic mechanisms will be reviewed here, while the central mechanism of musculoskeletal pain will be reviewed in section 2.4.3.

2.4.1.1 Nociceptive Pain

Nociception is the detection of noxious stimuli that aids in protection by generating a reflex of withdrawal and by causing an unpleasant sensation which results in avoidance behaviour strategies.⁵⁴ Deep and superficial tissue structures receive innervations from the primary afferent/sensory neurones that synapse in the dorsal horn of the spinal cord.⁵⁵ The noxious stimuli are detected by specialised transducers attached to the primary A-delta and C afferent/sensory fibres.⁵⁶ A-delta afferent fibres are thinly myelinated, while afferent C fibres are unmyelinated.⁵⁷ They have a high threshold and reflect changes that are produced by injury to the axon, activity, or inflammation.⁵⁷ Thus, nociceptive pain is resultant of actual tissue damage or stimuli that can potentially cause actual tissue damage.⁵⁸

Nociceptive pain can further be classified as somatic and visceral pain. Somatic pain occurs in bodily tissues such as skin, muscles, and joints, and can hence be termed superficial or deep.⁵⁹ Superficial somatic pain may feel burning, pricking, or sharp, while deep somatic pain may feel dull and aching.⁵⁹ Somatic pain is usually localised to a specific area.⁵⁹ An example of deep somatic pain is muscle pain due to strain.⁵⁹ Visceral pain, from bodily organs, can be described as diffuse or poorly localised pain that is referred to other locations that is not always linked to all visceral injury and is also not evoked by all viscera.⁶⁰ These characteristics are due to the relative scarcity of sensory nociceptors within the internal organs and cavities.⁶⁰ It is usually accompanied by motor and autonomic reflexes, such as muscle spasm, nausea, and vomiting.⁶⁰ Examples of visceral pain include that from functional gastrointestinal disorders such as irritable bowel syndrome (IBS),⁶¹ indigestion,⁶² renal colic,⁶² gastroenteritis,⁶³ appendicitis,⁶³ cystitis,⁶³ myocardial infarction,⁶³ and pleurisy.⁶³

Subjective clinical indicators of nociceptive musculoskeletal pain include: “clear, proportionate mechanical/anatomical nature to aggravating and easing factors” (p.83), “pain associated with and in proportion to trauma or a pathological process (inflammatory

nociceptive) or movement/postural dysfunction (ischaemic nociceptive)” (p.83), “pain localised to the area of injury/dysfunction” (p.83), “usually rapidly resolving” (p.83), “responsive to simple analgesia/NSAID’s” (p.83), “usually intermittent and sharp with movement” (p.83), “pain in association with other symptoms, such as swelling, redness, and heat (inflammatory nociceptive)” (p.83), and “pain of recent onset” (p.83).⁵³ Objective clinical indicators of nociceptive musculoskeletal pain include: “clear, consistent and proportionate mechanical/anatomical pattern of pain reproduction on movement/mechanical testing of target tissues” (p.84), “localised pain on palpation” (p.84), and “antalgic (i.e. pain relieving) postures/movement patterns” (p.84).⁵³

2.4.1.2 Neuropathic Pain

The IASP defines neuropathic pain as “pain initiated or caused by a primary lesion or disease of the somatosensory system” (p.50).⁶⁴ Neuropathic pain can further be divided into central neuropathies and peripheral neuropathies.⁶⁴ Stimulation of central neuropathic pain is not adequate enough to stimulate peripheral sensory nerve endings.⁶⁵ Examples of central neuropathic pain include pain related to cerebrovascular accidents and radiculopathy.^{4,64} Examples of peripheral neuropathic pain are diabetic peripheral neuropathy and pain owing to cancer or multiple sclerosis.⁵⁸ Most notably, neuropathic pain does not include pain that is caused by other nervous system disorders, such as fibromyalgia and spinal cord injury.⁶⁴

Subjective clinical indicators of peripheral neuropathic musculoskeletal pain include: “pain variously described as burning, shooting, sharp, aching or electric-shock-like” (p.84), “history of nerve injury, pathology or mechanical compromise” (p.84), “pain in association with other neurological symptoms such as pins and needles, numbness, and weakness” (p.84), “pain referred in a dermatomal or cutaneous distribution” (p.84), “less responsive to simple analgesia/NSAID’s and/or more responsive to anti-epileptic/anti-depression medication” (p.84), “pain of high severity and irritability (i.e. easily provoked, taking longer to settle)” (p.84), “mechanical pattern to aggravating and easing factors involving activities/postures associated with movement, loading or compression of neural tissue” (p.84), and “pain in association with other dysaesthesias (e.g. crawling, electrical, heaviness)” (p.84).⁵³ Objective clinical indicators of peripheral neuropathic musculoskeletal pain include: “pain/symptom provocation with mechanical/movement tests” (p.85), “pain/symptom provocation on palpation of relevant neural tissues” (p.85), “positive neurological findings” (p.85), “antalgic posturing of the affected limb/body part” (p.85),

and “positive findings of hyperalgesia and/or allodynia within the distribution of pain” (p.85).⁵³

For the purpose of this study, we will refer to a duration-based classification of pain, i.e. acute and chronic. It must be noted that some conditions may also be classified as subacute, but that will not be presented or discussed in this study.

2.4.2 Acute Musculoskeletal Pain

Acute pain refers to episode of pain that lasts for three months or less.³ Acute musculoskeletal pain is often nociceptive, arising through local tissue damage⁵¹ or peripheral noxious stimuli of sufficient intensity to lead to or to threaten tissue⁵⁷ and thus is perceived in a specific region of the body, and named for that region, e.g. shoulder pain, elbow pain, etc. The aim of acute pain is to protect the individual as an early warning when there is a harmful or potentially harmful process occurring in the body.⁵ Thus, acute pain usually results from acute tissue injury and inflammation and is known as a reparative function.⁶⁶ This type of pain is mostly seen after trauma and surgical interventions.⁵⁶ The tissues around the site of trauma or inflammation become hypersensitive or tender⁶⁷ so to avoid contact with external stimuli.⁶⁶

Musculoskeletal pain after exertion or injury may be attributed to muscle strains or ligament sprains. When there is no injury, the mechanism of pathology is unknown. Pain in a joint does not necessarily imply pain that originates from that joint, because muscular pain may be referred to a joint. After injury, the thinly myelinated A-delta and unmyelinated C afferent (sensory) fibres detect the nociceptive messages in the periphery or the site of injury,^{56,57,68} a process known as transduction.⁵⁵ These messages or stimuli may be mechanical, chemical or thermal.⁶⁸ The afferent A-delta and C fibre nociceptors innervate joint and muscle tissue, but not visceral tissue,⁶⁸ which make these relatively significant in the generation of acute musculoskeletal pain. The afferent/sensory neurones then conduct the sensory input from the periphery to the dorsal horn of the spinal cord, known as conduction, and also function to transfer the input transsynaptically within the laminae of the dorsal horn, known as transmission.⁵⁵ Inflammatory mediators such as bradykinin, histamine, serotonin, and prostaglandins are released⁶⁹ at the site of tissue damage. Immune cells also release mediators such as cytokines and growth factors.⁵⁵ The release of these mediators decreases the nociceptor activation threshold and increases its response to noxious stimuli which is known as hyperalgesia.^{55,68} Allodynia is the term used

when normally innocuous stimuli produce pain.⁵⁵ These mediators are thus released to alter the activity of the nociceptors which results in peripheral sensitisation.^{55,68} Bradykinin is involved in the initiation of inflammation and has been found to result in pain and inflammation, as well as hyperalgesia.⁷⁰ Cytokines also contribute toward initiating and maintaining inflammation, while also stimulating the release of prostaglandins.⁵⁵ Prostaglandins are mediators of pain and fever that are synthesized by the cyclo-oxygenase-1 (COX- 1) enzyme.⁵⁵ This enzyme has a protein variant or isoform called COX-2 enzyme.⁵⁵ Neurotrophic growth factors also influence the sensitivity of neurons during the inflammation process.⁵⁵ Thus, the changes in the sensitivity of afferent/sensory neurones encourages the development of hyperalgesia or hypersensitivity that occurs during the inflammatory stage.⁵⁵

Clinical features of acute musculoskeletal pain include pain, oedema, tenderness, and decreased range of motion, yet the physical examination of acute musculoskeletal pain lacks reliability and validity.⁷¹ These clinical features are also diagnostic criteria, but it is important that other more serious causes of pain should be excluded as differential diagnoses for acute musculoskeletal pain, such as referral of pain from visceral or vascular tissue as well as thromboembolism and peripheral vascular disease (PVD).⁷¹

2.4.3 Chronic or Persistent Musculoskeletal Pain

One of the aims of this research was to investigate the relationship between MSD and CDL. In a systematic review by van Hecke et al (2014),⁷² the interaction between chronic MSD and CDL was highlighted: “Those with severe chronic pain are up to three times more likely to die from ischaemic heart disease or respiratory disease than those with no chronic pain, and this may be partly a result of reduced exercise capacity in those disabled by chronic pain. There is evidence that several chronic physical conditions may increase the risk of chronic pain. This may occur directly, through increased nociception from the periphery, resulting in central and peripheral pathophysiological changes associated with chronic pain, or indirectly, by accumulated stress or load, with pro-longed activation of the stress-regulation systems leading to breakdown of muscle, bone and neural tissue, resulting in more pain” (p.210).⁷²

As the impact of chronic pain is considerable, this section of the review examines chronic pain in greater detail. Chronic, or persistent, pain refers to an episode of pain that persists for longer than three months.⁴ Due to the unrelenting nature of chronic pain it is likely that

stress, environmental, and affective factors may be superimposed on the original damaged tissue and contribute to the intensity and persistence of pain.⁵⁶ The cause of the perception of pain may persist irrespective of conventional medical treatments.⁷³ Consequently, psychological forms of treatment such as cognitive behavioural therapies can be used to change the effect of pain as the brain may be capable of minimising the pain impact by changing the manner in which the pain-producing information is processed.⁷³ Physiological and behavioural research has also shown that plasticity or learning has a role to play in the pain mechanism.⁵⁶

2.4.3.1 Central Sensitisation

Alterations in central nervous system processing⁷⁴ and general somatosensory system hypersensitivity⁷⁵ characterises chronic MSD. Central sensitisation refers to this increase of the responsiveness to input from unimodal and polymodal receptors of the central neurons.⁷⁴ It is defined as “an amplification of neural signalling within the central nervous system that elicits pain hyper-sensitivity” (p.55).⁷⁶ The descending inhibitory mechanisms is impaired,⁷⁷ while the descending and ascending pain facilitatory pathways are overactive.^{78,79} There is also an increased efficacy in the processing of incoming nociceptive stimuli which is known as temporal summation of second pain⁷⁹. Thus, central sensitisation also entails altered sensory processing in the brain⁷⁹ as well as a modulated ‘pain signature’ arising in the brain⁷⁴. Increased brain activity is shown in the areas most commonly involved in the acute pain sensation, except the primary or secondary somatosensory cortex, various brain stem nuclei, the dorsolateral frontal cortex, and the parietal associated cortex, as they are not involved in the acute pain sensations.⁸⁰ In the absence of new peripheral input, central sensitisation will not resolve quickly, but will rather sustain the chronic nature of the MSD condition,⁷⁴ however it has been shown that brain abnormalities in patients with chronic MSD are reversible.⁷⁵

Subjective clinical indicators of centrally sensitised musculoskeletal pain include: “disproportionate, non-mechanical, unpredictable pattern of pain provocation in response to multiple/non-specific aggravating/easing factors” (p.85), “pain persisting beyond expected tissue healing/pathology recovery times” (p.85), “pain disproportionate to the nature and extent of injury or pathology” (p.85), “widespread, non-anatomical distribution of pain” (p.85), “history of failed interventions (medical/surgical/therapeutic)” (p.85), “strong association with maladaptive psychosocial factors (e.g. negative emotions, poor self-efficacy, maladaptive beliefs and pain behaviours, altered family/work/social life,

medical conflict)" (p.85), "unresponsive to NSAID's and/or more responsive to anti-epileptic)/anti-depressant medication" (p.85), "reports of spontaneous (i.e. stimulus-independent) pain and/or paroxysmal pain (i.e. sudden recurrences and intensification of pain)" (p.85), "pain in association with high levels of functional disability" (p.85), "more constant/unremitting pain" (p.85), and "night pain/disturbed sleep" (p.85).⁵³ Objective clinical indicators of centrally sensitised musculoskeletal pain include: "disproportionate, inconsistent, non-mechanical/non-anatomical pattern of pain provocation in response to movement/mechanical testing" (p.86), "positive findings of hyperalgesia (primary, secondary) and/or allodynia within the distribution of pain" (p.86), "diffuse/non-anatomic areas of pain/tenderness on palpation" (p.86), and "positive identification of various psychosocial factors such as catastrophisation, fear-avoidance behaviour, and distress" (p.86).⁵³

Central sensitisation has been found to contribute to various clinical syndromes.⁷⁶ These include, but are not limited to, osteoarthritis, rheumatoid arthritis, fibromyalgia, temporomandibular disorders, chronic neck pain and headaches, shoulder impingement syndrome, tennis elbow (lateral epicondylalgia), chronic low back pain, complex regional pain syndrome (CRPS), irritable bowel syndrome (IBS), non-cardiac chest pain, and chronic phantom limb pain.⁷⁶

Diagnosis of chronic musculoskeletal pain can be based on the above-mentioned underlying mechanisms. Widespread hypersensitivity to touch and/or mechanical pressure, bright light, noise, medication, and temperature (both warm and cold) are symptoms that aid in recognising the presence of central sensitisation.⁸¹ Where more than one of these symptoms are present, a clinical examination is needed to provide further evidence of central sensitisation.⁸¹ Other symptoms that may indicate central sensitisation, but with less evidence, are fatigue, sleep disturbances, non-refreshing sleep, difficulty concentrating, tingling and/or numbness, and a sensation of swelling in the limbs.⁸¹ The following clinical exam findings could indicate central sensitisation: a generalised reduction of the pressure pain threshold (most notably in an area not anatomically related to the injury site), hypersensitivity to touch, vibration, or temperature, and a heightened response to the brachial plexus provocation tests bilaterally.⁸¹ Notably, these symptoms should be assessed and interpreted within the clinical context and the presence of central sensitisation may only be found during treatment or rehabilitation.⁸¹

2.5 Measurement of Musculoskeletal Pain

While understanding the definitions and mechanisms of pain and its related impacts is of utmost importance, it is also important to understand how to accurately measure and interpret the measure of pain. The Initiative on Methods, Measurement and Pain Assessment in Clinical Trials (IMMPACT) group have described core outcome measures to consider when measuring pain.⁸² These core values include pain intensity, physical function, emotional function, patient rating of received treatment, symptoms and adverse effects, and participant disposition.⁸² Thus, the measurement of pain should be multidimensional. There are many different instruments available to evaluate pain however, for the purpose of this study and review, frequently used instruments are presented below.

2.5.1 Visual Analogue Scale and Numeric Rating Scale

The Visual Analogue Scale (VAS) is a self-administered tool that is commonly used in current research to measure pain in adults.⁸³ This is a continuous scale that is used to rate pain intensity and may either be used vertically (VVAS) or horizontally (HVAS).⁸³ Only one item is reported on and marked by the participant with the scale being anchored at zero, which is equivalent to experiencing no pain, and ending at ten, or 100, on a 100mm scale, which is equivalent to the maximum amount of or worst pain imaginable by the participant.⁸³ No numbers or descriptors are made available between these two points to avoid clustering of responses around any one numeric value.⁸³ When interpreting this scale, it is accepted that the higher the score, the higher the intensity of the pain reported by the participant.⁸³ It has been shown to be a reliable⁸⁴ and valid⁸⁵ tool for the measurement of musculoskeletal pain.

The Numeric Rating Scale (NRS) is also a commonly used clinical and research tool that is based on the same structure as the VAS. However, it is more specific as it is segmented and contains whole numeric numbers from zero to ten, thus making it an 11-item numeric scale.⁸³ It is also anchored at zero, which is equivalent to experiencing no pain, and ten, which is equivalent to the maximum amount of or worst pain imaginable by the participant.⁸³ When interpreting this scale, it is accepted that the higher the score, the higher the intensity of the pain reported by the participant.⁸³

It must, however, be noted that research has shown that those with chronic MSD have found the VAS and NRS to be too simplistic when describing their complex pain experiences.⁸⁶

2.5.2 McGill Pain Questionnaire

The McGill Pain Questionnaire (MPQ) was developed in the 1970's by Robert Melzack at McGill University and evaluates the quality of pain by providing information on major groups of descriptors of pain which include the sensory, affective and evaluative aspects of pain.⁸⁷ It also evaluates the quantity of pain via the present pain intensity (PPI) which is rated from zero to five.⁸⁷ This allows for the tool to be used to distinguish pain associated with or without a clear physical cause.⁸⁸ This tool is widely used, however, due to the 78 items or words listed as pain descriptors in the questionnaire⁸⁹ it can take up to 20 minutes to complete⁸³, usually via interview. This led to the development of the Short-Form McGill Pain Questionnaire (SF-MPQ)⁹⁰ which correlates highly with the MPQ⁹¹ yet is a more compact version of the MPQ that can be completed in an easier and shorter manner.

2.5.3 Brief Pain Inventory

The Brief Pain Inventory (BPI) is a self-, or interviewer-administered questionnaire that was developed in the 1980's by Charles Cleeland,⁹² initially named the Wisconsin Brief Pain Questionnaire (BPQ).⁹³ As research progressed, a short version of the BPI became the most commonly used tool within clinical and research settings.⁹² The aim of the tool is to assess pain multidimensionally, although, to simplify the approach, two dimensions are captured – severity, or the sensory aspect of pain, and interference, the reactive aspect of pain.⁹² Severity of pain is determined by asking the participant to rate their pain according to: “worst”, “least”, “average” and “present” pain on a numeric scale of 0 – 10.⁹² The four pain severity scores ranging from 0-10 are averaged to generate a pain severity score (PSS).⁹² A pain interference score (PIS) is also generated from the 11 questions used. The BPI questionnaire has been shown to be a valid and reliable tool for MSD research^{94,95} and is widely used as it assesses pain severity as well as interference with activities of daily living.⁹⁶ The BPI has been validated for use in South African languages to measure the prevalence of pain, as well as pain severity and interference.⁹⁷

As can be determined from the above-mentioned literature, the pain experience, as well as the impact thereof, can be quite convoluted. Therefore, when measuring musculoskeletal

pain or disease, it is necessary to do so accurately and consider these complexities to fully understand how musculoskeletal disease affects each individual within their biopsychosocial context. The MPQ does not evaluate the effect of pain on function,⁹⁸ is quite lengthy which increases the likelihood of error compared to the BPI, and has not been evaluated within the South African context. It was therefore not selected for use in this study. Instead the BPI, which meets all of the aforementioned criteria, was selected as a more relevant and applicable tool within the context of this study.

2.5.4 Community Orientated Programme for Control of Rheumatic Diseases

The Community Orientated Program for Control of Rheumatic Diseases (COPCORD) was launched as a collaboration between the International League of Associations of Rheumatology (ILAR) and the WHO in the late 1980's.⁹⁹ The purpose of the WHO-ILAR COPCORD is to facilitate screening of musculoskeletal pain or complaints particularly in developing communities and economies by focusing on recording symptoms such as pain and disability, instead of syndromes or diseases.⁹⁹ The COPCORD is typically divided into three phases with phase one and two forming the basis of the questionnaire collecting information on musculoskeletal pain and disability while phase three is comprised of a rheumatological assessment which mainly requires objective evaluation.¹⁰⁰

The COPCORD has been used in research within the South African context, including in a sample similar to that used in this study.^{12,42} Therefore, as the COPCORD has been shown to be a valid and reliable tool, especially within a similar setting,^{12,42} phase one and two were selected for use in this study.

2.6 Risk Factors for Musculoskeletal Disease

Literature has shown the reporting of musculoskeletal disease is multifactorial.¹⁰¹ Changes in lifestyle, e.g. increased obesity and physical inactivity, when combined with the urbanisation and motorisation of the modern society has the potential to further increase the burden of MSD in South Africa.³³ This section elaborates on potential risk factors for MSD as identified from literature. A summary of literature on the prevalence of MSD and its risk factors is shown in Table 1 below.

Table 1: Musculoskeletal disease: articles on prevalence and risk factors

Author, Year of Publication	Study Design	Location	Study Sample	Outcome Measures & Results	Conclusions	Level of evidence ¹⁰²
Woolf & Pfleger ³³ , 2003	Descriptive review	Global	Adults with OA, RA, osteoporosis, and LBP	<ul style="list-style-type: none"> ▪ OA: 9.6% of males and 18% of females aged 60 years and older; prevalence increases indefinitely with age. Obesity is a risk factor. ▪ RA: prevalence varies between 0.3% and 1%. Twice as many females are affected than males. Smoking and obesity are risk factors. ▪ LBP: Lifetime prevalence of 58–84% and point prevalence of 4–33%. 	MSD affects up to 20% of the adult population. There is a higher prevalence among females. Prevalence increases with age.	V
McBeth & Jones K ³⁷ , 2007	Review	Global	Adolescent and adult population	<ul style="list-style-type: none"> ▪ Point prevalence of MSD 13% - 28%. 	The prevalence of chronic MSD increases with age, is more common in females, in subjects from lower socioeconomic groups, and in psychologically stressed populations	V
Miranda et al ³⁹ , 2012	Systematic Review	Brazil	25 studies reporting on a total of 116091 elderly (60 years of age or older)	<ul style="list-style-type: none"> ▪ Chronic MSD prevalence ranging from 14.1% to 85.5%. ▪ Statistically significant associations shown between chronic MSD and older age, female gender, married status, cognitive deficit, current or previous smoking, report of falls and comorbidities, lower education, lower income, higher BMI, excessive alcohol consumption, work impact, fatigue, depression and anxiety. 	High prevalence of Chronic MSD among elderly Brazilians This should be considered when addressing healthcare policies, especially in the elderly.	II

Author, Year of Publication	Study Design	Location	Study Sample	Outcome Measures & Results	Conclusions	Level of evidence ¹⁰²
Parker & Jelsma ¹² , 2010	Descriptive Cross-Sectional Study	Cape Town, South Africa	1005 adults in 2 low-income areas	<ul style="list-style-type: none"> ▪ COPCORD and HAQ. ▪ Chronic MSD prevalence rate of 36%. ▪ Back pain was the most common complaint, both in isolation (18.5%) and combined with peripheral pain (55%). ▪ Most common comorbidities were HPT (59.1%), type 2 DM (24.8%) and heart problems (18.9%). ▪ Mean DI indicated a mild to moderate functional impact in those with MSD; no significant difference between genders. ▪ Positive correlation between age and DI ($r=0.31$; $p<0.001$). 	Higher prevalence of MSD compared to that found in community-based studies in developed and developing countries. In South Africa, both the illness and rehabilitation of the disability needs to be addressed at PHC level.	II
Igumbor et al ⁴³ , 2011	Descriptive Cross-Sectional Study	Baziya, rural Transkei, Eastern Cape, South Africa	394 adults	<ul style="list-style-type: none"> ▪ Chronic MSD prevalence rate of 42.9%; 68.9% female. ▪ Increase in prevalence from the age of 55 years onwards, with noticeably high prevalence in the 24 and under age group. ▪ Most common sites of chronic MSD: back, knee and ankles, head, and shoulders and elbows. ▪ Female gender and being 50 years of age or older were the only significant variables associated with chronic MSD. 	High prevalence of chronic MSD in rural community. There is an urgent need for targeted public healthcare interventions, particularly toward females and the elderly.	II
Copley et al ⁴² , 2013	Descriptive Cross-Sectional	Bloemfontein, Free State,	323 adults attending	<ul style="list-style-type: none"> ▪ COPCORD and HAQ. ▪ MSD prevalence of 45.82%. ▪ Back, knee, wrist, elbow and ankle pain were the 	Prevalence of MSD higher than previous SA studies with significant functional impact	II

Author, Year of Publication	Study Design	Location	Study Sample	Outcome Measures & Results	Conclusions	Level of evidence ¹⁰²
	Study	South Africa	CHC	<p>most commonly reported complaints.</p> <ul style="list-style-type: none"> Mean DI indicated a mild to moderate functional impact within those with MSD. 	of MSD. Suggestions: Community education regarding symptoms and management of MSD, (awareness campaigns, community empowerment, posters/pamphlets).	
Ruaf et al ⁴⁴ , 2013	Prospective Cross-Sectional Study	Tshwane, Gauteng, South Africa	1066 adults	<ul style="list-style-type: none"> BPI Chronic MSD prevalence of 41%. Chronic MSD was significantly more prevalent in higher age groups (p=0.001) and in women than in men (p=0.019). Most common sites of MSD: Back (30.83%) and joint pains (23.48%). 	High prevalence of chronic MSD. Further interventions and training of healthcare professionals in appropriate pain management is suggested.	I

OA=Osteoarthritis; RA=Rheumatoid Arthritis; LBP=Low Back Pain; MSD=Musculoskeletal disease; BMI=Body Mass Index; COPCORD=Community Orientated Program for Control of Rheumatic Disease; HAQ=Stanford Health Assessment Questionnaire; DI=Disability Index; HPT=Hypertension; DM=Diabetes Mellitus; PHC=Primary Health Care; BPI=Brief Pain Inventory

2.6.1 Gender

2.6.1.1 Physical Factors

Females report more endogenous pain in more regions than males, with no underlying rationale for why some painful diseases are more prevalent in females or males.¹⁰³ However, pain perception is modulated by multiple internal systems, with evidence that these systems may be utilised differently for females and males.⁵⁰ Females may be more pain sensitive and with a less efficient internal pain inhibitory capacity compared to males.¹⁰⁴ The internal pain regulatory systems as well as other factors such as expectancies, conditioning, and ovarian hormones change the neurophysiology of pain and could attribute to the difference in the reporting of pain between males and females.⁵⁰ Studies have previously described gender differences in sensitivity to noxious stimuli as sex hormones influence pain sensitivity due to variations in pain threshold and pain tolerance in females during the menstrual cycle.¹⁰⁵ In the case of osteoarthritis, it is thought that the prevalence of the condition increases with age and in the female gender, which suggests an X-chromosome or oestrogen receptor genetic link, or associated female factors such as lower muscle strength and decreased bone density leading to osteopaenia or osteoporosis.¹⁰⁶

2.6.1.2 Psychosocial Factors

Emotional distress, pain coping strategies, and pain-related expectancies and understanding have been thought to contribute to the gender differences in the reporting of pain.⁵⁰ Females have higher levels of catastrophising compared to males which may also contribute to their increased risk for experiencing pain.⁵⁰ Socio-cultural beliefs about femininity and masculinity have also been determined to have an effect on different gender pain responses as it is generally more socially acceptable to express pain among females than among males.¹⁰⁷ This may lead to biased reporting of pain.¹⁰⁷

2.6.2 Obesity

According to the WHO, obesity is a serious chronic condition of either abnormal or excessive accumulation in adipose which may lead to impairment of health.¹⁰⁸ Hypercellular obesity is typically characterised by an increase in the total number of fat cells and often begins in childhood.¹⁰⁹ Hypertrophic obesity is characterised by existing fat

cells enlarging and producing proteins and metabolites involved in the pathophysiology of obesity¹¹⁰ and typically begins in adulthood.¹⁰⁹

Obesity has been identified as a growing problem in Western countries,¹¹¹ but also appears to be affecting low to middle income countries where undernutrition co-exists with obesity, with urban populations more affected than rural populations.¹⁰⁸ Globally, in 2008, the WHO estimated that 35% of adults aged 20 and over were overweight while 12% were obese.¹¹²

The South African prevalence of obesity is much higher than the global equivalent and one of the highest in sub-Saharan Africa¹¹³ with 68% of adults aged 20 years and older found to be overweight (males 62.% [95% CI: 56.1-66.6%]; females 73.6% [CI: 69.5-77.1%]), and 33.5% [CI: 30.4-36.5] found to be obese (males 23.2% [CI: 18.9-26.9]; females 42.8% [CI: 38.2-47.2%]).¹¹⁴ A South African study also found a high prevalence of obesity in adults older than 30 years with a mean BMI of 28.7 (\pm 0.14) kg/m² for females and 24.1 (\pm 0.11) kg/m² for males.¹¹⁵ Among males, wealthier men are more likely to be obese than poorer males by 6-18%.¹¹³

According to Aronne (2002),¹⁰⁹ the initial step to evaluating obesity is the calculation of the body mass index as it significantly correlates with body fat, morbidity, mortality, and can be calculated quickly in a clinical setting.¹⁰⁹

2.6.2.1 Body Mass Index

The body mass index (BMI) is a universally used outcome measure to determine the relative weight of individuals.¹⁰⁹ BMI is calculated using total body mass, which is constituted by lean mass, and to a lesser extent adipose tissue.¹¹⁶ This is then divided by the individual's height squared.

The following formula calculates BMI:¹⁰⁸

$$\text{BMI} = \frac{\text{(body weight in kg)}}{\text{(body height in meters)}^2}$$

According to the WHO, BMI can be divided into six (6) classifications,¹⁰⁸ as shown below in Table 2.

Table 2: Classification of body mass index (BMI)

BMI Category	BMI (kg/m²)	Risk of Obesity-related Diseases
Underweight	< 18.5	low
Normal	18.5 – 24.9	low
Overweight	25.0 – 29.9	increased
Obese I	30.0 – 34.9	high
Obese II	35.0 – 39.9	very high
Obese III (extreme)	≥ 40	extremely high

A BMI equal to or greater than 25kg/m² is considered to be the accepted benchmark for identifying those who would be more at risk of developing obesity-related complications or diseases, specifically hypertension, type 2 diabetes mellitus, and cardiovascular disease.¹¹⁷ It is estimated that 80% of deaths caused by comorbidities associated with obesity occur in patients who present with a minimum BMI of 30kg/m².¹⁰⁹

Literature suggests that there is a linear relationship between increasing BMI and severe self-reported pain with 13.5% of BMI category III (i.e. obese III) respondents reporting severe pain on a regular basis.¹¹⁸ This trend persists despite adjustment to demographic and lifestyle variables.¹¹⁸ A BMI of 25.0kg/m² and higher “has been found to be associated with an increased 12 month prevalence of musculoskeletal symptoms and being obese significantly increased the risk of developing musculoskeletal symptoms during 12-month follow-up” (p.241).¹¹⁹

2.6.2.2 Waist and Hip Circumference and Waist-Hip Ratio

The measurement of the waist circumference is regarded as a practical indicator of visceral abdominal or truncal fat, the distribution of which shows a correlation with the hypertrophic form of obesity and thus a higher risk of developing obesity.¹⁰⁹ Waist circumference is measured at the end of normal expiration,¹²⁰ either at the narrowest part of the waist or at the level of the right iliac crest, with the measuring tape being level with the floor and of a snug fit.¹⁰⁹ The WHO reports that both general and abdominal obesity is associated with decreased glucose tolerance, reduced insulin sensitivity and adverse lipid profiles.¹²¹ These are risk factors for type 2 diabetes mellitus and cardiovascular disease.¹²¹

Hence, having an alternative measure to BMI that is reflective of abdominal adiposity may prove to be a more effective in determining obesity. A waist measurement $\geq 94\text{cm}$ in males, and $\geq 80\text{cm}$ in females, indicates obesity, while a waist-hip ratio of > 1.0 in males and > 0.85 in females is also accepted as being indicative of obesity, particularly abdominal adiposity.¹⁰⁸ A combination of BMI and waist circumference measurement, when assessing risk factors for obesity, may thus aid in compensating for the differences in fat distribution.¹⁰⁹

Both BMI and increased waist circumference have been found to be associated with chronic MSD in a population older than 70 years.⁴⁶ The association between obesity and MSD could be attributed to an excess load being placed on musculoskeletal structures and/or the accompanying sedentary lifestyle leading to obesity and a weaker musculoskeletal system.¹¹¹ This also serves to support the cycle hypothesised in Figure 1.

2.6.3 Low Levels of Physical Activity

Physical activity (PA) refers to “body movements that occur from skeletal muscle contraction resulting in increased energy expenditure above resting metabolic rate” (p.1205).¹²² However, it should be noted that physical activity is different from physical fitness as physical activity is behavioural and is measured across four domains (work, domestic, transport, discretionary time) which are representative across activities of daily life that are common to most people despite socioeconomic development or culture.¹²³ Based on available evidence, persons who are physically active are less likely to develop health problems compared to those who are sedentary but it is difficult to determine if this is due to physical activity or fitness.¹²⁴

2.6.3.1 The Impact of Low Physical Activity Levels on Musculoskeletal Disease

Literature has shown that there is a significant association between physical activity and MSD in almost all parts of the body, where lower levels of physical activity were reported with more MSD.¹²⁵ A recent South African study found no significant difference in the self-reported scores for physical activity levels of subjects with chronic MSD compared to matched controls, where 56% of all participants were found to have low levels of physical activity.¹²⁶ However, despite the small sample size of 24 participants, significant differences were found between the objective measures of those with chronic MSD and matched

controls.¹²⁶ Those with chronic MSD scored worse on the repeated sit-to-stand test (RSST) and 6-minute walk test (6MWT), and had lower daily mean and total pedometer readings.¹²⁶ It was also shown that a lack of physical activity in individuals with MSD could lead to secondary complications such as obesity, hypertension, and type 2 diabetes mellitus.¹¹

Thus, a lifestyle that is physically active, in both work and leisure, could decrease the prevalence of chronic MSD. This has been shown in literature as a 2014 longitudinal study found that self-reported leisure-time levels of physical activity were a significant predictor of pain and disability after 12 months.¹²⁷ Those with a sedentary lifestyle were found to have more pain (4.8/10 [95% CI: 4.3-5.2/10]; $p=0.001$) than those who were physically active.¹²⁷ Furthermore, females between the ages of 45 and 59 also show generally higher attributable factors than other age groups with 59% being physically inactive.¹²⁸ This has also been described in South African literature where females have been shown to have lower physical activity levels than males, which decreases further with increased age.¹²³ Therefore, available evidence suggests that physical activity may aid in reducing pain and improving function, while having few to no adverse effects, in those with chronic MSD and pain.¹²⁹

2.6.3.2 Measurement of Physical Activity

The International Physical Activity Questionnaire (IPAQ) was developed to obtain comparable estimates of levels of physical activity.¹³⁰ It is an acceptable measurement of physical activity for use in adults in many settings and in different languages. Participants respond to questions relating to time spent being physically active in the last seven days during activities at work, house chores, outside of the house, to get from place to place, and in their spare time for recreation, exercise or sport.¹³¹ The IPAQ has been shown to be a valid and reliable tool for surveillance of physical activity in adults.¹³² The IPAQ has also been shown to be a valid and reliable tool when used in other South African languages.¹³³ Because of the reliability and validity within a South African context, the IPAQ was selected for use in this study to monitor and establish physical activity levels.

2.6.4 Other Risk Factors

2.6.4.1 Cigarette Smoking

Cigarette or tobacco smoking has been described to have negative effects on multiple bodily systems including the musculoskeletal system.¹³⁴⁻¹³⁶ Current smoking has been found to be significantly and independently associated with MSD in various anatomical sites (OR=1.69; 95% CI: 1.45-1.97).¹³⁴ Cigarette smoking has two phases: the volatile phase, which accounts for 95% of cigarette smoke, and the particulate phase, where most of the carcinogenic substances are found.¹³⁵ Associations between smoking and low back pain, spinal disc disease, and impaired soft tissue healing have been shown.^{135,136} Within an orthopaedic context, the musculoskeletal effects of smoking include decreased bone mineral density (BMD), as well as increased wound and fracture-healing complications.¹³⁶ It has also been found that smoking 20 cigarettes or more increases the risk of developing relatively severe MSD compared to those that have never smoked before (OR=1.47).¹³⁷ From the literature it can thus be deduced that people who have a current history of cigarette smoking are more at risk for or prone to developing chronic MSD.

2.6.4.2 Alcohol Consumption

Recently, a relationship between alcohol consumption and reported widespread pain or fibromyalgia has been shown (males adjusted OR=2.53; 95% CI: 1.78-3.6) (females adjusted OR=2.11; 95% CI: 1.67-2.66).¹³⁸ This has also been shown in a Brazilian study where males who consumed an excessive amount of alcohol were more at risk for developing MSD (crude risk ratio=1.59; 95% CI: 1.11-2.28; p=0.012).¹³⁹

2.6.4.3 Occupation

Physically demanding occupations have been shown as a risk factor for the development of osteoarthritis in the hip and knee.¹⁰⁶ Higher prevalences of neck and low back pain have also been found in those with labour intensive occupations,¹⁴⁰ while occupations with repetitive movements produce a higher prevalence of upper limb MSD.¹⁴¹

2.7 Chronic Diseases of Lifestyle

Chronic diseases of lifestyle (CDL) are non-infectious, non-transmissible, slow or progressive human diseases that are of long duration.³⁰ This section provides literature on common CDL including prevalence, pathophysiology, risk factors, and intervention strategies.

2.7.1 Prevalence of Chronic Diseases of Lifestyle

2.7.1.1 Global Prevalence of Chronic Diseases of Lifestyle

In recent years an increase in chronic disease trends has been shown with the WHO estimating that these NCDs caused 29% of the total burden of disease (BOD), with the heaviest burden affecting poor communities in urban areas.³¹ It was found that, in 2000, 26.4% (26.6% of males and 26.1% of females) of the global adult population had hypertension (HPT).¹⁴² This is projected to be 29.2% (29% of males and 29.5% of females) by 2025.¹⁴² In sub-Saharan Africa the prevalence of type 2 diabetes mellitus has been found to range from 10% to 16%, while the prevalence of hypertension has been found to range from 6 to 48%.¹⁴³ Notably, in South Africa, the prevalence of type 2 diabetes mellitus has been found to be significantly higher than the global mean.⁴⁵ The global prevalence of chronic obstructive airway disease (COAD) has been found to be between 7% and 11.8%.¹⁴⁴ However, these prevalence estimates increase with age and in smokers.¹⁴⁴ Mental illness is an umbrella term describing conditions that are, or were, undergoing psychiatric or psychotherapeutic diagnosis or interventions.¹⁴⁵ The two main types of mental illness that appear in the global burden of disease (GBD) is major depression, with a prevalence of 4.4%, and anxiety disorders, with a prevalence of 4%, of the global population.^{29,146} Therefore, when describing mental illness, this review will focus on mood and anxiety disorders.

2.7.1.2 South African Prevalence of Chronic Diseases of Lifestyle

The increase in CDL, as well as their risk factors, is also a trend shown in South Africa.³¹ In 2008, the following NCDs accounted for mortality in South Africa: cardiovascular disease (11%), type 2 diabetes mellitus (3%), cancers (7%), other diseases including MSD (7%).³² The prevalence of familial hypercholesterolaemia (HCL) has also been found to be as high as 1% in some South African communities.¹⁴⁷ In an African population, where more than

80% of the sample was South African, a history or risk of developing hypertension was found to be higher than the global population (OR=3.44; 95% CI: 2.64-4.48 for the African sample vs [versus] OR=2.49; 95% CI: 2.35-2.63 in the global study; p=0.0023).¹⁴⁸ A 2014 study investigated the disease profiles and prescription costs of NCDs at ten CHC's in the Cape Town Metropole of the Western Cape province. Across the ten CHC's 82.4% of patients reported a chronic condition, with hypertension being the most prevalent chronic condition (59%) followed by arthritis (21.8%) and type 2 diabetes mellitus (20%).¹⁴⁹ Type 2 diabetes mellitus (28.4%), hypertension (69.1%), asthma/COAD (18.5%), and arthritis (35.8%) were most prevalent at Mitchells Plain CHC with 94,8% of the visits being for chronic disease management and 71.3% of the patients having comorbidities (type 2 diabetes mellitus, hypertension, asthma, epilepsy, arthritis, mental illness, and other), the most within the study.¹⁴⁹ Previous research in a similar area of Cape Town found that that 38.3% of participants reported respiratory symptoms of COAD.¹⁵⁰

A lifetime prevalence for major depression of 9.7% has been found in South Africa, where females were found to be 1.7 times more likely to develop the condition (95% CI: 1.3-2.4).^{151,152} A lifetime prevalence for anxiety disorders of 15.8% has been found in a South African population, the highest of any one type of mental illness.¹⁵² Of the anxiety disorders, agoraphobia without panic was found to be the most prevalent (9.8%), followed by social anxiety (2.8%) and generalised anxiety disorder (GAD) (2.7%).¹⁵² The Western Cape province showed the highest prevalence of mental illness (39.4%) of which the majority was attributed to substance abuse (20.6%).¹⁵² The Free State province showed the highest prevalence of mood (14.6%) and anxiety (21.5%) disorders.¹⁵² Mood and anxiety disorders were found to be more common in females, while substance abuse was found to be more common in males.¹⁵²

2.7.2 Pathophysiology of Chronic Diseases of Lifestyle

2.7.2.1 Hypertension, Hypercholesterolaemia, and Cardiovascular Disease

Hypertension is known as a progressive cardiovascular syndrome with various related aetiologies, and thus can be described as a sustained increase in blood pressure (BP) with functional and structural vascular and cardiac abnormalities as the syndrome progresses.¹⁵³ Hypertension can be divided into two types.¹⁵⁴ Primary or essential hypertension constitutes approximately 95% of hypertension cases, and is defined as hypertension

without any identifiable cause.¹⁵⁴ Secondary hypertension is defined as hypertension caused by underlying renal or adrenal disease, and constitutes approximately 5% of hypertension cases.¹⁵⁴ Balanced cardiac output and peripheral resistance results in normal blood pressure. Peripheral resistance is mostly implicated in hypertension as prolonged contraction of the smooth muscle in the walls of small arterioles lead to the thickening of the vessel walls and an irreversible increase in peripheral resistance.¹⁵⁴ The contraction of the smooth muscle is due to an increase in calcium concentration within the cells, while the thickening of the vessel walls may be mediated by angiotensin.¹⁵⁴ The autonomic nervous system also plays a vital role in maintaining normal BP, as it can stimulate both constriction and dilation of the arteriole vessel walls.¹⁵⁴ This is why the short-term effects of stress and physical activity are also important.¹⁵⁴ Other physiological mechanisms that may be involved in the development of primary hypertension are the rennin-angiotensin system, dysfunction of vascular epithelial cells, insulin sensitivity, hypercoagulability, diastolic dysfunction, genetic factors, and vasoactive substances that affect vascular tone as well as the transport of sodium.¹⁵⁴

Normal blood pressure ranges from around 120/80mmHg (at rest) to 140/90mmHg.¹⁵³ Therefore, hypertension is defined as “an average systolic blood pressure of 140mmHg or greater, and diastolic blood pressure of 90mmHg or greater” (p.217).¹⁴² Systolic blood pressure (SBP) refers to the pressure within arteries during contraction of the heart muscle and diastolic blood pressure (DBP) refers to the pressure in the arteries when the heart is relaxed (i.e. between heart beats). Stage one or mild hypertension is defined as SBP of 140-159mmHg and DBP of 90-99mmHg.¹⁵⁵ Stage two or moderate hypertension is defined as SBP of 160-179mmHg and DBP of 100-109mmHg.¹⁵⁵ Stage three or severe hypertension is defined as SBP greater than 180 mmHg and DBP greater than 110mmHg.¹⁵⁵ In South Africa, a diagnosis of hypertension may be made if repeat measurements of blood pressure have been performed on three separate occasions over a period of two months, where either the initial SBP is greater than or equal to 140mmHg, or the DBP is greater than or equal to 90mmHg.¹⁵⁵

Cholesterol is a fat-like substance in the body that is used in bodily functions such as hormone synthesis and cell membrane build-up.¹⁵⁶ Cholesterol is transported in the bloodstream via lipoproteins, which are classified into two types.¹⁵⁶ High density lipoproteins (HDL) transport “good” cholesterol, whereas low density lipoproteins (LDL) transport “bad” cholesterol which may lead to an accumulation of plaque within arteries,

making the vessels narrower and decreasing blood flow to various organs.¹⁵⁶ Hypercholesterolaemia (high cholesterol) (HCL) is thus a type of dyslipidaemia, defined as a total plasma cholesterol level higher than 5mmol/l or a LDL cholesterol level higher than 3mmol/l.¹⁴⁷

Hypertension and hypercholesterolaemia are both forms of cardiovascular disease (CVD). Others include coronary artery disease (CAD) such as angina and myocardial infarction and peripheral vascular disease (PVD). Most cardiovascular diseases are caused by atherosclerosis.

2.7.2.2 Diabetes Mellitus

According to the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, diabetes mellitus (DM) is a group of metabolic diseases characterised by hyperglycaemia (high blood glucose level) which is resultant from a defect in insulin secretion or action, or both.¹⁵⁷ This hyperglycaemia is chronic, disturbing the metabolism of carbohydrates, fat, and protein,¹⁵⁸ and is thus associated with long-term damage, dysfunction, and failure of various organs, most significantly the eyes, kidneys, nerves, heart and blood vessels.¹⁵⁷ Insulin is the key hormone in the regulation of blood glucose.¹⁵⁹ The pancreatic beta-cell adapts to changes in insulin action and, in diabetes mellitus, this beta-cell functions inadequately low, making dysfunction of the pancreatic beta-cell the critical component of the pathophysiology of diabetes mellitus.¹⁵⁹ When the effect of insulin is less than expected, this is referred to as insulin resistance, which has been found to be strongly associated with obesity and physical inactivity.¹⁵⁹

Type 2 diabetes mellitus, also known as non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes, is the most prevalent form of diabetes mellitus which results from insulin resistance with an insulin secretory defect that is insufficient to compensate for this insulin resistance.¹⁵⁷ According to the WHO, someone is considered to have type 2 diabetes mellitus if fasting plasma glucose levels are equal to or above 7.0mmol/l or if two hours after an 75g oral glucose tolerance test (OGTT) plasma glucose concentration rises to greater than or equal to 11.1mmol/l.¹⁵⁸

2.7.2.3 Chronic Obstructive Airway Disease

There are several definitions of chronic obstructive airway disease (COAD), however, it is characterised by reduced airflow, most notable expiratory airflow, and is a nonspecific term

referring to a set of conditions which vary in their disease processes and is classified into varying stages.¹⁶⁰ The conditions include chronic bronchitis and emphysema, and usually display symptoms such as wheezing and exertional dyspnoea,¹⁶⁰ and persistent coughing.¹⁶¹

The most noted pathogenesis of COAD is continuous pulmonary inflammation¹⁶² and oxidative stress due to an oxidant-antioxidant imbalance.¹⁶³ Thus, COAD is known as a progressive inflammatory disease which affects the small airways and alveoli.¹⁶³ The inflammatory cells involved in COAD are neutrophils, lymphocytes, and macrophages, which do not respond to steroid treatment and result in fixed airway obstruction or resistance and therefore reduced airflow.¹⁶³ Tobacco smoking has been found to be the global leading cause of COAD. Clinical symptoms of COAD are usually gradually progressive, starting in midlife, and include coughing, shortness of breath, and wheezing or chest tightness.¹⁴⁴ A diagnosis of COAD is made using lung spirometry.¹⁶³ A ratio of forced expiratory volume during the first second of expiration (FEV1) and forced vital capacity (FVC) of less than 0.7 is indicative of COAD,^{161,163} with the decrease in FEV1 being most indicative of airway obstruction.¹⁶³

2.7.2.4 Mental Illness

For purpose of this study, the umbrella term of mental illness refers to major depressive and anxiety disorders, as these have been found to have the most notable impact on the global burden of disease.^{29,146} Symptoms of mental illness range from mild to severe and may have significant effects on daily functioning.¹⁴⁶ Major depression is defined by the occurrence of depressed mood lasting a minimum of two weeks¹⁶⁴ and may be persistent/long standing or recurrent, thereby significantly affecting the ability to function during activities of daily living.¹⁴⁶ Symptoms of major depression include sadness, loss of interest or pleasure, feeling of fatigue or tiredness, low self-esteem, poor concentration, and disturbed sleep and/or appetite.¹⁴⁶ Anxiety disorders refer to a group of conditions characterised by feelings of excessive worry, anxiety, and fear.¹⁴⁶ These conditions include generalised anxiety disorder (GAD), panic disorder, post-traumatic stress disorder (PTSD), social anxiety disorder, phobias, and obsessive-compulsive disorder (OCD).¹⁴⁶

Clarity in the identification of the pathophysiological processes involved in major depression and anxiety disorders remains elusive.¹⁶⁴ Therefore there are currently diverse theories being researched.¹⁶⁴ Most recently the most popular theory suggests dysfunction of the biogenic monoamine (serotonin, norepinephrine, and dopamine) and serotonergic system where the monoamine neurotransmitters may be lacking, thus affecting appetite

regulation, aggression, and mood.¹⁶⁴ This theory is most widely accepted due to the success of selective serotonin reuptake inhibitors (SSRIs) in effectively managing symptoms of major depression.¹⁶⁴

2.7.3 Risk Factors for Chronic Diseases of Lifestyle

2.7.3.1 Age, Gender, and Ethnicity

Along with the association to a strong genetic predisposition,¹²² the risk of developing type 2 diabetes mellitus has been shown to increase with age, and occurs more in females and those with concurrent hypertension and hypercholesterolaemia, while variations occur in different racial/ethnic groups.¹⁵⁷ As the risk of developing type 2 diabetes mellitus progressively increases with age, individuals aged 60 years and older have been shown to be six times more likely to develop type 2 diabetes mellitus than those aged 18-39 years.¹⁶⁵ It has also been found that being female, although the reasons for this are unclear, and of an older age have been found to be risk factors for developing COAD.¹⁶³ In South Africa, it has been found that males are more at risk for developing hypertension.¹⁶⁶ Females have been found to be more compliant with medication regimes and thus have significantly better controlled hypertension.¹⁶⁶ In elderly with hypertension, mainly SBP is increased due to decreased arterial compliance.¹⁶⁷

2.7.3.2 Obesity and Waist Circumference

The increased prevalence of obesity in South Africa, as described by Alaba and Chola (2014),¹¹³ is a major health concern for the country because of the negative impact it will have on the country's resources as obesity is a risk factor for CDL and will have a corresponding increase effect on the burden of NCDs within the country.^{31,113} Being overweight or obese has been shown to increase the likelihood of having hypertension, hypercholesterolaemia, and metabolic syndrome compared to those of normal weight.¹⁶⁸ This has also been shown by studies in South Africa where those that are obese are shown to have twice the risk of developing hypertension than those with normal weight.¹⁶⁶ A BMI of and above 30kg/m² or a waist circumference more than 94cm in males and 80cm in females have been found to be risk factors for hypercholesterolaemia.¹⁴⁷ Most individuals with type 2 diabetes mellitus have also been found to be obese or to have an increased percentage of body fat which is predominantly distributed in the abdominal region.¹⁵⁷ A BMI of 30kg/m² or more has been shown to be associated with a 15 times increased risk of

type 2 diabetes mellitus.¹⁶⁵ Obesity plays a key role in the dysfunction of pancreatic beta-cell and insulin resistance.¹⁶⁹

Waist circumference also explains obesity-related health risk.¹⁶⁸ Large hip and thigh circumferences have been shown to be associated with a lower risk (independent of age and BMI) of type 2 diabetes mellitus, whereas a larger waist circumference has been shown to be associated with a higher risk.¹⁷⁰ As both overall and abdominal adiposity are strongly related to the development of type 2 diabetes mellitus, waist circumference should be measured in addition to BMI to assess the risk of type 2 diabetes mellitus in both males and females.¹⁷¹ A recent Belgian cross-sectional case-control study found that there is no significant association between obesity and COAD.¹⁷²

2.7.3.3 Low Physical Activity Levels

A lack of physical activity has been associated with at least a 1.5-2.0 fold increased risk of CDL. A global estimate of physical inactivity accounting for 14% of type 2 diabetes mellitus and 22% of ischaemic cardiovascular disease is suggested by previous data, while in South Africa it could account for 20% of type 2 diabetes mellitus and 30% of ischaemic cardiovascular disease.¹²³ Individuals who reportedly have never exercised have been shown to be twice as likely to develop type 2 diabetes mellitus.¹⁶⁵ Research has shown that regular physical activity is important for the primary prevention of type 2 diabetes mellitus, with aerobic and resistance training shown to improve glucose homeostasis,¹⁷³ by enhancing insulin sensitivity, decreasing abdominal adipose tissue, increasing muscle density, and improving inflammatory responses and immune system function.¹⁷⁴ Literature suggests that 30 minutes of moderate intensity physical activity each day can decrease the incidence of type 2 diabetes mellitus and cardiovascular disease.¹⁷⁴

It has also been shown that in low-and middle-income countries, physical activity is associated with a decreased risk of hypertension.¹⁷⁵ Despite this, the African INTERHEART study found that exercise was not related to the development of hypertension and risk of acute myocardial infarction in a predominantly African population (OR=0.88; 95% CI: 0.65-1.20; p=0.15).¹⁴⁸ Participants in the INTERHEART study were considered to be physically active if they were regularly involved in moderate or strenuous exercise for more than four hours per week.¹⁴⁸ It must, however, be noted that the INTERHEART study primarily assessed for risk factors of acute myocardial infarction, where hypertension was considered a risk factor and not the primary outcome measure.¹⁴⁸ A walking regimen as

physical activity has been shown to lower SBP by 3.84mmHg (95% CI: -5.19 to -1.97 mmHg) and DBP by 1.54mmHg (95% CI: -2.83 to-0.26mmHg).¹⁷⁶ Progressive resistance exercise has also been shown to lower SBP by between 3.0 and 4.6mmHg and DBP by between 3.0 to 3.8mmHg.¹⁷⁷

As shown in previous literature, exertional dyspnoea, which is one of the cardinal symptoms of COAD, may lead to limitations of physical activity in daily life, which may in turn influence the development of disability.¹⁷⁸ In those with COAD, reduced physical activity and smoking were associated with the presence of comorbidities¹⁷² and it has been found that physical activity decreases over time independent of the severity of COAD.¹⁷⁸ The decline in physical activity is accompanied by a worsening of airflow obstruction and health status while sustained low levels of physical activity was found to be related to a continual decrease in exercise tolerance.¹⁷⁸

As previously stated, a lack of physical activity in individuals with MSD could lead to secondary complications such as obesity, hypertension, and type 2 diabetes mellitus.¹¹ Therefore, it is suggested that if the primary medical problem, MSD, is not managed effectively, a cycle of secondary complications such as CDL could occur. International guidelines recommend moderate-intensity physical activity of at least 150 minutes per week in order to achieve any form of health benefit.¹⁷⁹

2.7.3.4 Unhealthy Diet, Smoking & Alcohol Consumption

The WHO has also identified unhealthy dietary habits as one of the four main behavioural risk factors for the causation of CDL.²⁴ Excessive salt and saturated fat intake as well as low intake of fruits, vegetables, and whole grains are responsible for the increase in the burden of CDL.¹⁸⁰

Smoking is known for its hazardous effect and contribution towards cancer, cardiovascular disease, type 2 diabetes mellitus, and respiratory diseases, including tuberculosis (TB).¹⁸⁰ Of over one billion global cigarette smokers the majority now live in low- and middle-income countries.¹⁸⁰ Cigarette smoking is also a risk factor for cardiovascular disease and hypercholesterolaemia.¹⁴⁷ Smoking has been found to contribute toward approximately 85% of COAD cases, with at least 50% of smokers developing the disease in developed countries.¹⁶³ Smokers have been found to have more abnormalities of lung function than

non-smokers.¹⁸¹ In South Africa, it has been shown that excessive consumption of alcohol significantly increases the risk for developing hypertension.¹⁶⁶

2.7.4 Intervention Strategies for Chronic Diseases of Lifestyle

2.7.4.1 Hypertension, Hypercholesterolaemia, and Cardiovascular Disease

The goal of management of hypertension is to decrease the blood pressure of uncomplicated patients to 140/90mmHg or below, and of high-risk patients to 130/80mmHg or below.¹⁵⁵

In South Africa, guidelines for management of hypertension specify drug therapy and lifestyle modification education.¹⁵⁵ Drug therapy should include a combination of a diuretic, an angiotensin-converting enzyme (ACE) inhibitor or angiotensin-receptor blocker (ARB), and a calcium-channel blocker (CCB).^{155,182} A beta blocker and blood thinning agent may also be used. The following medications are used in the South African public health care sector and are recommended by the WHO for use in the primary health care management of individuals with hypertension:

- The thiazide diuretic Hydrochlorothiazide (HCTZ),¹⁸³ also known as Ridaq in South Africa. Thiazide diuretics only effectively lower blood pressure in those with hypertension by reducing peripheral resistance.¹⁸⁴
- The calcium-channel blocker (CCB) Amlodipine.¹⁸³ CCBs inhibit the flow of calcium through vascular cell walls which relaxes vascular smooth muscle.¹⁸⁵ This then lowers blood pressure by dilating arteries, which has been shown to occur across all patient groups.¹⁸⁵ Side effects of CCBs are headache, dizziness, drowsiness, nausea, constipation, rash, and oedema.¹⁸⁵ Grapefruit juice should also be avoided when using CCBs as it increases the proportion of the drug that enters the circulation for absorption (bioavailability).¹⁸⁵ Alternatives to Amlodipine are Verapamil and Nifedipine, also known as Adalat or Fedaloc in South Africa.¹⁸²
- The angiotensin-converting enzyme (ACE) inhibitor Enalapril,¹⁸³ also known as Pharmapress in South Africa. These medications inhibit the renin system.¹⁸³ Side effects of ACE inhibitors include persistent coughing.¹⁸⁶
- Angiotensin-receptor blockers (ARBs) such as Losartan.¹⁸⁶ These medications also inhibit the renin system and are considered as new drugs and are not considered as

first line hypertension drugs in South Africa. ACE inhibitors and ARBs have been found to have similar long-term effects on blood pressure with ARBs having less side effects, of which the most notable for Losartan is dizziness.¹⁸⁶

- The beta blocker Atenolol.¹⁸³ Beta blockers decrease heart rate, cardiac output, and peripheral vascular tone.¹⁶⁷ These inhibitory mechanisms are reported to be incompletely understood.¹⁶⁷ However, beta blockers are effective in the treatment of cardiac arrhythmias, cardiac failure, and coronary artery disease due to its heart rate lowering effects.¹⁶⁷
- The blood thinner Acetylsalicylic Acid (ASA), also known as Aspirin.¹⁸³ It has been reported that, in those with hypertension, ASA can significantly decrease major cardiovascular events by 15% (p=0.03).¹⁸⁷

Lifestyle modifications aim to decrease blood pressure and total cardiovascular risk, and enhance drug efficiency.¹⁵⁵ These modifications include education on weight reduction, regular physical activity, cessation of smoking, moderation of alcohol intake, reduction of salt and fat intake, and increasing intake of fresh fruits and vegetables.¹⁵⁵ Exercise has also been shown to lower SBP by 4.16 mmHg which is clinically relevant as it is similar to the effects of blood pressure lowering therapy using a combination of an ACE inhibitor and thiazide diuretic.¹⁶⁹

In South Africa the treatment of hypercholesterolaemia includes lifestyle modification and pharmacotherapy.¹⁵⁶ Lifestyle modifications should include a healthy diet, a reduction in alcohol consumption, smoking cessation and regular physical activity.¹⁴⁷ The medication of choice, and the gold standard of treatment, are Statins, such as Simvastatin, which have very few side effects, are cost effective and act by prohibiting the synthesis of LDL cholesterol.¹⁵⁶ It has been found that the effect of Statin therapy is best after one year and continues to improve thereafter.¹⁴⁷ This effect is similar in all subgroups.¹⁴⁷ High dose Simvastatin treatment may result in myopathy, therefore the presence of MSD in those on Simvastatin treatment should be monitored before and during treatment.¹⁴⁷

2.7.4.2 Diabetes Mellitus (Type II)

As insulin resistance plays a fundamental role in the pathophysiology of type 2 diabetes mellitus, interventions have been identified to initially be aimed toward improving tissue insulin sensitivity.¹⁵⁹ Insulin resistance in type 2 diabetes mellitus may improve with reduction of weight and/or pharmacological treatment of hyperglycaemia but is seldom

restored to normal.¹⁵⁷ Structured lifestyle interventions combined with the oral use of Metformin remains the first treatment of choice.¹⁵⁹ If oral dose adjustment of Metformin is not effective, early insulin therapy may be started.¹⁶⁹ Metformin is the most commonly used medication for type 2 diabetes mellitus as it is a highly effective antihyperglycaemic agent which works independently of the pancreas and decreases hepatic glucose output.¹⁵⁹ Thiazolidinediones are medications which reduce glycaemia and enhance vascular function, and can be used in diabetics with reduced renal function.¹⁵⁹

Increasing physical activity has been found to reduce the incidence of type 2 diabetes mellitus in high risk individuals.¹⁸⁸ Exercise therapy has been shown to improve glycaemic control in type 2 diabetes mellitus.¹⁶⁹ When compared to control groups, exercise significantly improved glycaemic control, while no adverse effects or diabetic complications have been reported with exercise.¹⁸⁹ A decrease in visceral and subcutaneous adipose tissue and plasma triglycerides, as well as an increase in insulin response, has also been shown with exercise.¹⁸⁹ Recent literature has suggested that there are significant benefits related to physical activity after meals (ten minute walk within five minutes after each of the three main meals), particularly when the meals contain a substantial amount of carbohydrates, compared to walking 30 minutes a day at any time of the day.¹⁹⁰ As previously mentioned, exercise decreases post exercise blood pressure and increases the bioavailability of nitric oxide.¹⁹¹ Most notably, the metabolic stress from exercise can increase the oxidation of carbohydrates during exercise and also maintains the post exercise consumption of oxygen, increasing the rate of fat oxidation after exercise, which improves glucose tolerance and insulin sensitivity and reduces hyperglycaemia for between two and 72 hours.¹⁹¹ Weight loss and improvement in fitness have also been shown to slow the decline in mobility in overweight adults with type 2 diabetes mellitus.¹⁹²

2.7.4.3 Chronic Obstructive Airway Disease

The treatment for COAD is also pharmacological and non-pharmacological.¹⁶¹ It has been established that smoking cessation remains the cornerstone of treatment for COAD.¹⁶⁰ Pharmacological intervention for COAD is aimed at improving symptoms, exercise tolerance, and overall health status.¹⁹³ Bronchodilators are most commonly prescribed and may be used in combination with anti-inflammatories such as corticosteroids.¹⁹³ An increase in physical activity within a pulmonary rehabilitation context which includes education is also recommended.¹⁶¹

2.7.4.4 Mental Illness

As previously mentioned, the best current practice of pharmacological intervention for major depressive and anxiety disorders are the antidepressant SSRIs as well as serotonin-norepinephrine reuptake inhibitors (SNRIs).¹⁶⁴ These are thought to improve the levels of serotonin and norepinephrine by affecting the neurotransmitter receptors to alter neurotransmission.¹⁶⁴ Psychotherapy is also one of the first-line management strategies for major depressive and anxiety disorders and has been shown to be effective in doing so.¹⁹⁴

2.8 Associations between Musculoskeletal Disease, Chronic Diseases of Lifestyle, and Risk Factors

In a South African study, common comorbidities such as hypertension (59,1%), type 2 diabetes mellitus (24,8%), and cardiovascular problems (18,9%) were found in the sample of participants with MSD.¹² These findings highlight a possible co-existence of MSD and CDL in patients attending disadvantaged CHCs in Cape Town.

According to the Nord-Trondelag Health Study,¹⁹⁵ the higher the blood pressure (specifically SBP) the lower the prevalence (10-60% decrease) of chronic MSD in subjects 20 years and older.¹⁹⁵ This could be due to hypertension-associated hypoalgesia, an effect of blood pressure on pain perception via the central nervous system.¹⁹⁵ Hypertension-associated hypoalgesia refers to an increase in the threshold to noxious stimuli and thus a decreased perception of pain associated with hypertension.¹⁹⁶ These changes are thought to be related to the baroreflex system and changes in pathways within the central nervous system.^{196,197} It is thought that the hypoalgesia effect is related to the process that increases blood pressure and not the increased blood pressure itself, as even when blood pressure is reduced in those with hypertension the same hypoalgesic effects occur.¹⁹⁶ This could be due to a stress response in which pain would be a distracting factor and thus a pain suppression system is activated.¹⁹⁶ An internal component mediated by opioids has also been shown to be potentially related to hypertension-associated hypoalgesia in healthy individuals, particularly males.¹⁹⁸ The Nord-Trondelag Health Study consisted of two surveys, with the second study, HUNT-2 (August 1995 to June 1997), measuring blood pressure with an automatic oscillometric method and including questions regarding musculoskeletal symptoms which were adopted from the Standardised Nordic Questionnaire.^{199,195} The Standardised Nordic Questionnaire has been found to be a valid

tool for estimating discomfort in the upper limb and spine, although information for the lower limb has not been validated.¹⁹⁹ These studies were carried out in the Nord-Trøndelag county in northern Norway,¹⁹⁵ a high income country according to the World Bank.¹⁵ No information on MSD was investigated in the first of the two studies, HUNT-1, to provide a baseline. Most responders who responded to the MSD questions in HUNT-2 were younger, and likely to be female, with a higher socioeconomic status than the non-responders.²⁰⁰ The effect of antihypertensive medication was also not evaluated.¹⁹⁵ Although the study is a large-scale population-based study, the results were specific to the sample in its context and may not be generalizable and applicable in an under-resourced area of Cape Town especially in relation to musculoskeletal symptoms. It must also be noted that an association between chronic elevated blood pressure and the decreased perception of pain was not always found.¹⁹⁶ In a cross-sectional study done in Brazil, a country similar in socio-economic status to South Africa, it was found that the presence of MSD was positively associated with hypertension in both males (crude risk ratio=1.91; 95% CI: 1.40–2.59; p<0.001) and females (crude risk ratio=1.77; 95% CI: 1.46–2.15; p<0.001).¹³⁹ However, when adjusting for other variables, this association in females was no longer significant.¹³⁹ Notably, males who were using antihypertensive medication were found to have the highest adjusted risk of MSD (adjusted risk ratio=1.78; 95% CI: 1.11–2.86) and no association between the prevalence of MSD and blood pressure was found.¹³⁹

A 2009 North West England population-based prospective cohort study found a moderate relationship between MSD and cardiovascular disease (mortality rate ratio=1.02; 95% CI 0.99-1.1).²⁰¹ A total of 4515 adult participants, in stratified gender and age groups (16-44, 45-64, 65-74, 75+ years), returned a questionnaire that gathered demographic information and information on MSD.²⁰¹ The study found that those with widespread pain were more likely to be female and older.²⁰¹ The moderate relationship between an increased risk of cardiovascular disease mortality and widespread MSD was hypothesised to be associated with decreased physical activity levels.²⁰¹ More recently, another English study also found that chronic MSD is associated with an increased risk of cardiovascular disease which increases with age, but physical activity levels were not found to contribute toward this relationship.²⁰² This study is expanded upon in Table 3.

Due to the long term metabolic changes (i.e. persistent hyperglycaemia) involved in type 2 diabetes mellitus, numerous complications may develop, including MSD.²⁰³ These complications are intensified by inconsistent or poor control of glycaemic levels and

improved by adequate pharmacotherapy, a healthy diet, and a monitored exercise regime.²⁰³ MSD has been found to be more prevalent in people with type 2 diabetes mellitus which may be associated with glycaemic control, gender and duration of diabetes.²⁰⁴ A 2005 study found that 60% of people with type 2 diabetes mellitus reported chronic pain.²⁰⁵ Those reporting chronic pain reported poorer overall self-diabetes management, which included an exercise and eating plan.²⁰⁵ The Nord-Trøndelag Health study provided data on the association between diabetes mellitus and MSD, where individuals with diabetes mellitus were more likely to report chronic widespread MSD than those without.²⁰⁶ The study also found that the prevalence of chronic MSD increased with age, peaking in ages 60-64 years, increased with BMI, and were higher among females and in those who were physically inactive.²⁰⁶

Owing to the broad, nonspecific literature on COAD and MSD, the links between risk factors such as smoking, reduced physical activity, systemic and local inflammation, oxidative stress, vitamin D deficiency, nutritional deficits, and age, have been identified as aspects for future research in the co-occurrence of these conditions.²⁰⁷ Some of these risk factors were identified in a 2014 study on preclinical COAD and smoking control subjects, where cardiovascular disease and MSD were reported to be the most prevalent comorbidities, and reduced physical activity and smoking were found to be independent risk factors for having two or more comorbidities.¹⁷² It has been shown that 32% of those with COAD have presented with skeletal muscle weakness and endurance.²⁰⁷ This weakness may contribute toward less physical activity, decreased active joint stability, and limitation of function.²⁰⁷ Osteoporosis has also been found to be associated with COAD due to the obstruction of airflow, which may increase bone fracture risk.²⁰⁷ Thus, the decrease in exercise capacity associated with COAD may lead to or aggravate MSD.

Research has shown that the prevalence of pain in those with depression (approximately 65%) and the prevalence of depression in those with pain (5-85%) is higher than those that only experience one of the two conditions.²⁰⁸ Additionally, those who experience depression and anxiety may experience more pain and disability than those with either depression or anxiety.²⁰⁹ A global study, which included South Africa, found that 5% of the population experience chronic MSD, such as low back pain, neck pain and headaches, and joint pain, along with major depression and/or an anxiety disorder.⁴¹ This was then found to be higher in females than males.⁴¹ Of those with central processing dysfunction, such as fibromyalgia, 30% have also been diagnosed with major depression at the same time and

74% have been diagnosed with the condition in their lifetime.²¹⁰ Additionally 60% of those with fibromyalgia have been diagnosed with an anxiety disorder in their lifetime.²¹⁰ These prevalence rates are significantly higher than for those without central sensitisation. It can thus be deduced that MSD is commonly associated with depression and anxiety, with these conditions frequently coexisting, and hence the assessment and treatment of both is of great importance.²⁰⁸

There is a lack of South African evidence regarding the inter-relationships between MSD, CDL, obesity and physical activity levels. Because of this, management is not targeted appropriately at risk factors and thus cannot reduce the high prevalence rates of MSD. Further literature on the association between MSD and CDL is summarised in Table 3 below.

Table 3: Association between musculoskeletal disease and chronic diseases of lifestyle: review articles

Author, Year of Publication	CDL	Study Design	Location	Study Sample	Results	Conclusions	Level of Evidence ¹⁰²
Hagen et al ¹⁹⁵ , 2005	Hypertension (HPT)	Cross Sectional Survey	Sweden: Nord-Trondelag Study:	HUNT-1: Jan 1984-Feb 1986 – no MSD outcomes HUNT-2: Aug 1995-June 1997 46901 adults completed HUNT 1 & 2	<ul style="list-style-type: none"> ▪ An SBP and DBP was associated with a 10% to 60% lower prevalence of chronic MSD. ▪ There was a strong linear trend (p<0.001) of decreasing prevalence of chronic MSD with increasing BP values. ▪ The prevalence of chronic MSD was highest among those with a low DBP ▪ Individuals with an elevated SBP or DBP in HUNT-1 and/or HUNT-2 had a lower prevalence of chronic MSD compared with those with a normal BP in both surveys. ▪ The lowest prevalence of chronic MSD was found among those with a high SBP or DBP in both studies. 	Individuals with a high BP had a lower prevalence of chronic MSD than individuals with a normal BP.	II
Ryan et al ²⁰² , 2014	Cardiovascular Disease (CVD)	Secondary analysis of a population-based survey (2008)	England – private households	3332 adults aged 45-64 years & 2022 adults older the 66 years	<ul style="list-style-type: none"> ▪ Higher prevalence of cardiovascular disease in those with MSD for both the middle-aged (22.5% vs. 13.5%) and the older (46.8% vs. 28.2%) adults (p <0.001). ▪ Older adults with cardiovascular disease were significantly more likely to have chronic MSD. 	MSD is associated with an increased risk of cardiovascular disease especially in older adults. Neither physical activity nor sedentary behaviour contributed to this relationship.	II
Klemp et al ²¹¹ , 1993	Hypercholesterolaemia (HCL): Familial and juvenile	Case Control Study	Western Cape, South Africa:	88 patients with hyperlipidaemia	<ul style="list-style-type: none"> ▪ 65 (74%) patients had one or more MSD (p=0 026). ▪ 57 (65%) of the 88 patients had one 	Long term prospective studies relating serial lipid profiles to MSD	III

Author, Year of Publication	CDL	Study Design	Location	Study Sample	Results	Conclusions	Level of Evidence ¹⁰²
	hypercholesterolaemia and mixed hyperlipidaemia (increased cholesterol and triglycerides)			and 88 age and gender matched controls	<p>or more of the MSD claimed to be associated with hyperlipidaemia (p<0.001).</p> <ul style="list-style-type: none"> ▪ MSD occurred in significantly more patients with adult familial hypercholesterolaemia and mixed hyperlipidaemia than controls. ▪ MSD of some patients improved after lipid lowering treatment. 	should be carried out as the pathogenesis of the relation is not understood.	
Hoff et al ²⁰⁶ , 2008	Type 2 Diabetes Mellitus	Cross Sectional Survey	Sweden: Nord-Trondelag Study	HUNT-2: Aug 1995-June 1997 65081 (70.0%) answered the first question about DM 64785 (69.7%) responded to the first question about MSD	<ul style="list-style-type: none"> ▪ Adapted Standardized Nordic Questionnaire¹⁹⁹ ▪ 46.5% of 64785 reported chronic MSD ▪ The prevalence of chronic MSD: <ul style="list-style-type: none"> - increased with age with a peak in the age group 60–64 years (59.7%), - higher for females in all age groups (overall 50.1% versus 42.6%, p<0.001). - increased with BMI with a peak among obese with BMI ≥ 30 kg/m² (54.6%) - higher those with low physical activity (55.4% versus 44.9%, p<0.001). - higher among patients with DM than among individuals without (OR = 1.2, 95% CI 1.1–1.3) 	Those with type 2 diabetes mellitus were more likely to report chronic widespread MSD.	II

Author, Year of Publication	CDL	Study Design	Location	Study Sample	Results	Conclusions	Level of Evidence ¹⁰²
Abaraogu et al ⁴⁸ , 2016	Type 2 Diabetes Mellitus	Cross-sectional Survey	Nigeria	347 participants 167 diabetics (48.1%) 180 non-diabetics (51.9%)	<ul style="list-style-type: none"> ▪ LBP most common MSD = 49.7% diabetics and 38.9% of non-diabetics. ▪ Chronic low back discomfort was 1.5 times more likely among diabetics compared to non-diabetics. ▪ Age, and NOT gender, was significantly associated with MSD (p=0.043). ▪ Diabetics had 2.5 odds of MSD in at least one body part compared to non-diabetics. ▪ Diabetics are more than 28 times at risk of MSD of the knee and are close to 29 times at risk of chronic upper back MSD compared to non-diabetics. 	Individuals with type 2 diabetes mellitus are at increased risk of developing chronic MSD.	II
Cielen et al ²⁰⁷ , 2014	COAD	Review	Not Specified	Not Specified	<ul style="list-style-type: none"> ▪ Skeletal muscle weakness and osteoporosis are two comorbidities of COAD. ▪ Risk factors: smoking, low physical activity, systemic and local inflammation, oxidative stress, vitamin D deficiency, nutritional deficits, and age. 		V

CDL=Chronic Disease of Lifestyle; HPT=hypertension; SBP=Systolic blood pressure; DBP=Diastolic blood pressure; BP=Blood Pressure; MSD=Musculoskeletal disease; CVD=Cardiovascular disease; PA=Physical Activity; HCL=Hypercholesterolaemia ; DM=Diabetes Mellitus; LBP=Low Back Pain; COAD=Chronic Obstructive Airway Disease

2.9 Health-Related Quality of Life and Musculoskeletal Disease and Chronic Diseases of Lifestyle

The European Quality of Life-5 Dimensions (EQ-5D) health index (see Appendix VIII) describes the health-related quality of life (HRQoL) of an individual. It uses five domains of function: mobility, self-care, usual activities which includes study, work, housework, family or leisure, pain or discomfort and lastly depression or anxiety.²¹² The instrument also includes a visual analogue scale (VAS) on which participants can indicate their health status.²¹² The EQ-5D has been validated in a wide range of settings. Construct validity was explored by examining correlations between EQ-5D and Health Assessment Questionnaire (HAQ) and found moderate to high correlations with measures of impairment (Spearman $r=0.61$; $p<0.05$) and high correlations with disability measures (Spearman $r=0.78$; $p<0.05$).²¹³ Reliability was analysed and found acceptable agreement between responses with intraclass correlation coefficient (ICC) of 0.70 (CI: 0.60-0.80) for EQ-5D VAS and ICC of 0.73 (CI: 0.63-0.83) for EQ-5D utility.²¹³

2.10 Intervention Strategies for Musculoskeletal Disease

The literature suggests that management of patients with MSD should include pharmacological treatment and management of pain, education and advice, and exercise treatment programmes focussing on maintaining and improving gross motor and whole body function.¹² As chronic MSD often presents without specific findings, it has been noted that it is important to not only adhere to a biomedical approach to treatment but to follow a biopsychosocial model which gives a better understanding of the condition and appropriate management.⁵ Most current intervention therapies for MSD are focused on input mechanisms by treating peripheral elements such as muscles and joints, as well as output mechanisms which address motor control, while less attention is being paid to processing (central) mechanisms.⁷⁵ In South Africa, 90% of patients with low back pain, including chronic pain, at primary health care level have been shown to receive only analgesia as a form of pain management, omitting any form of education and markedly limiting any referral for physiotherapy management.²¹⁴

2.10.1 Pharmacological Intervention for Musculoskeletal Disease

The pharmacological analgesic management of MSD follows three steps: Firstly, a non-opioid analgesic such as Paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs), and ASA; secondly, weak opioids such as Codeine and Tramadol; and thirdly, strong opioids such as Morphine and Fentanyl.²¹⁵ Other pharmacological agents used in the management of MSD are antidepressants, muscle relaxants and steroids,²¹⁶ as well as antiepileptics and antiarrhythmics.²¹⁷

2.10.1.1 Non-Opioid Analgesia

2.10.1.1.1 Paracetamol

Paracetamol, or Acetaminophen, is commonly used as an antipyretic and analgesic for mild to moderate pain²¹⁸ and has little to no anti-inflammatory effects.²¹⁹ It is thought to inhibit descending pain pathways and has been shown to be as effective as NSAIDs.²²⁰ However, despite being safer than NSAIDs, Paracetamol seems to be underused for MSD as patients perceive it to be harmful or ineffective or dislike taking any form of medication.²²⁰ For MSD, Paracetamol is considered to be the first step in a step-wise method applied to guide the safety and efficacy of medications.^{221,222} As a result of its efficacy, good safety profile, lack of side effects, low cost, and ease of availability, Paracetamol should be the anchor of pharmacological management of MSD, especially when acute.^{218,221} The usual dose of Paracetamol ranges from 0.5 to 1 mg every four to six hours.²²¹ There is insufficient evidence to determine the efficacy of Paracetamol in the treatment of non-specific low back pain²²³ or other non-specific chronic pain such as in conditions like fibromyalgia.²²⁴ Recent literature has shown that Paracetamol is ineffective in decreasing pain intensity or improving quality of life in those with low back pain.²²⁵ For more specific chronic conditions, such as osteoarthritis, Paracetamol is also used as the first line of analgesic management²²⁶ but has been shown to be ineffective in reducing pain²²⁷ and stiffness.²²⁷

2.10.1.1.2 Non-Steroidal Anti-Inflammatory Drugs

Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) are anti-inflammatory, analgesic, antipyretic, and antithrombotic pharmacological agents that are widely used in acute and chronic MSD with mild to moderate pain, but has no effect on the disease process of chronic MSD.²²⁸ Commonly prescribed NSAIDs include Diclofenac Potassium (Cataflam, Voltaren), Ibuprofen, Indomethacin, Acetylsalicylic Acid (ASA), and Celecoxib (Celebrex).

The primary mechanism of NSAIDs is to inhibit COX enzymes which are responsible for synthesising prostaglandins that are involved in the inflammatory process.^{68,229} NSAIDs have been shown to have increased morbidity, and to be the main cause of drug related morbidity,²³⁰ in those aged 65 years and older, due to associated gastric ulceration and haemorrhage and cardiovascular complications.³⁴ Due to these gastrointestinal, cardiovascular, and renal complications and associated risk, the use of NSAIDs is limited in the management of chronic MSD.²¹⁵ Selective COX-2 inhibitors may decrease these side effects compared to non-selective inhibitors.⁵⁵ Low dose Ibuprofen appears to have a lower risk of gastrointestinal side effects or complications.²²¹ NSAIDs have also been shown to be effective for short-term treatment of acute MSD but there is insufficient evidence of their efficacy in chronic MSD.²³¹ In the management of MSD, Ibuprofen has been shown to be tolerated as well as Paracetamol, while both are better tolerated than ASA.²³² NSAIDs are the most commonly used pharmacological intervention for osteoarthritis but should be considered only when Paracetamol does not provide effective pain relief, due to the side effects.²²⁶ Topical NSAIDs obtaining formulations of Diclofenac, Ibuprofen, Ketoprofen, Piroxicam, and Indomethacin have also been shown to be associated with good pain relief for acute MSD such as joint sprains, muscle strains, and overuse injuries, and are not associated with adverse local skin effects when compared with placebo.²³³ Thus, topical NSAIDs may be useful when treating acute MSD in those where oral NSAIDs are not tolerated well or are contraindicated.²³³

2.10.1.2 Opioid Analgesia

Opioids are the most potent acting analgesics²³⁴ and are used in the treatment of moderate to severe pain.²¹⁹ The usual opioid treatment for MSD, including post-surgery, include Codeine, Oxycodone, Hydrocodone, or Morphine.²¹⁹ Opioids frequently result in side effects such as sedation, dizziness, constipation, nausea, and vomiting²⁶ and have a high affinity for addiction, abuse, and overdose.²³⁵ Opioids have been shown to be effective in pain management in the short-term but have not shown any long-term improvement in functional abilities or quality of life in those with chronic MSD,²³⁵ a finding that must be carefully considered with prescription and re-evaluated with long-term use.²³⁶ A risk-benefit analysis is recommended before any prescription of opioids in chronic MSD.²³⁷ Possible reasons for the long-term inefficacy of opioids include the development of pharmacologic opioid tolerance or increased sensitivity to pain.²³⁸

Tramadol, a synthetic form of Codeine,²¹⁹ is a centrally acting weak opioid analgesic indicated for use in individuals who have NSAID intolerance (particularly gastrointestinal) or pain that is not aided by NSAIDs.²¹⁵ Tramadol inhibits the reuptake of noradrenaline and serotonin.²²⁶ It has been shown to be a potent analgesic with less opioid-type side effects such as drowsiness, dry mouth, constipation, nausea, and vomiting, and can safely be used in combination with NSAIDs, antidepressants, and anticonvulsants.²¹⁵ Tramadol has now become a first-line treatment for MSD with clinicians being recommended to decrease the use of NSAIDs in favour of weak opioids due to fewer side effects with long-term use.²²² It has been shown to be effective in treating nociceptive and neuropathic pain and is now recommended in guidelines on the management of MSD,²²² including osteoarthritis.²²⁶ Recent literature has shown that weak opioids are as effective as NSAIDs in reducing pain in lower limb osteoarthritis patients.²³⁹

The combination of oral Diclofenac and Paracetamol has been shown to produce a greater decrease in mean pain score than either NSAIDs or Paracetamol alone, but this benefit is small and not clinically significant, while the combination produces a higher proportion of abdominal pain, nausea, or vomiting.²²⁸ Thus the use of Paracetamol, NSAIDs, and the Diclofenac-Paracetamol combination has been shown to be equally safe in managing pain in MSD.²²⁸ The combination of Ibuprofen-Paracetamol has been shown to produce modest short-term benefits for knee pain/osteoarthritis, with an increase in side effects and the combination appearing to be additive.²⁴⁰ The combination of Tramadol-Paracetamol has been found to be associated with a significant reduction in pain and increase in pain relief.²³¹

2.10.1.3 Skeletal Muscle Relaxants

Skeletal muscle relaxants are pharmacological agents that decrease muscle tone and are thus thought to decrease musculoskeletal pain and muscle spasm.²¹⁹ There are two major therapeutic classes of skeletal muscle relaxants – spasmolytics, or antispasmodics, and neuromuscular blockers. Spasmolytics are more applicable for MSD as they may act centrally, on the cortex of the brain, the brain stem, or the spinal cord, to reduce spasm and spasticity,²¹⁹ whereas neuromuscular blockers do not act on the central nervous system. Neuromuscular blockers cause paralysis by interfering with neuromuscular end-plate transmission and are thus only used during surgery, in intensive care units, and in emergency medicine. Examples of spasmolytics include Carisoprodol, Cyclobenzaprine Hydrochloride, and Metaxalone.^{241,242} Skeletal muscle relaxants have been found to be

more effective than placebo in relieving short-term pain in acute, and perhaps chronic, MSD such as in LBP,^{241,243} as they may reduce pain associated with muscle spasm.²⁴⁴ They improve range of movement and interrupt the spasm-pain-spasm cycle that may accompany acute musculoskeletal injury.²⁴⁵ It must, however, be noted that muscle relaxants bring about significant side effects such as drowsiness and dizziness,²⁴³ and ataxia and irritability.²⁴¹ Muscle relaxants also have an increased risk of abuse^{241,243,245} and their use for MSD should be with caution,²⁴³ hence they are not recommended as first-line pharmacological treatment for MSD.

2.10.1.4 Corticosteroids

Intra-articular injection of corticosteroids have been found to be anti-inflammatory and useful for joint pain in the short term while found to be effective for between one and four weeks.²²⁶ However, long term benefits have not been proven, and repeated injection may lead to degeneration of cartilage, destruction of the joint, and atrophy of the surrounding tissue.²²⁶ Thus, corticosteroid injections may only be repeated after three months and their use is not recommended.²²⁶ Corticosteroid injections into facet joints of individuals with chronic low back pain have also proved to be ineffective and are thus of little value in the management strategy of chronic low back pain,²⁴⁶ however, subacromial injections of corticosteroids have been shown to improve rotator cuff tendonitis for up to nine months.²⁴⁷

2.10.1.5 Antidepressants

It is thought that the neurochemical pathways involved in mood disorders and in pain transmission and processing have similar neurotransmitters.⁶⁴ Antidepressants, particularly serotonin-norepinephrine reuptake inhibitors (SNRIs) such as Venlafaxine, Duloxetine, and Desvenlafaxine, are preferentially prescribed for neuropathic and centralised pain states²⁴⁸ and may be considered when a comorbid mood disorder is also present.⁶⁴ Venlafaxine also inhibits the reuptake of dopamine and is less expensive than Duloxetine.⁶⁴ Tricyclic antidepressants (TCAs) such as low dose Amitriptyline may also be used.²⁴⁹ Amitriptyline, more commonly known as Trepiline in South Africa, inhibits the reuptake of serotonin and noradrenaline⁶⁴ and are thus prescribed for their specific analgesic effects rather than their mood altering effects, as serotonergic and noradrenergic activity has been shown to be important in the analgesic effect.²¹⁷ These medications are more effective in treating neuropathic pain, generally require weeks to take effect, and should be used with caution

in the elderly.⁶⁴ They also have a moderate effect on chronic pain processes such as fibromyalgia.²⁵⁰ Those with chronic MSD may also experience additional depression and anxiety, despite the use of optimised antidepressant therapy.²⁰⁹

2.10.1.6 Gabapentinoids

Gabapentinoids, such as gabapentin and pregabalin (also known by the trade name Lyrica) may also be used in the treatment of MSD. Gabapentin inhibits excitatory neurotransmitters along the pain pathway, while pregabalin is a precursor to gamma-aminobutyric acid (GABA), a neurotransmitter, both affecting calcium channels.²⁵¹ They are antiepileptics, anticonvulsants, analgesics (mostly in neuropathic conditions),²⁵² and anxiolytics²⁵¹ and are thus used to treat epilepsy, neuropathic pain, fibromyalgia, and generalised anxiety disorder.

2.10.1.7 Disease Modifying Anti Rheumatic Drugs

Disease Modifying Anti Rheumatic Drugs (DMARDs), such as Methotrexate, are widely used for rheumatoid arthritis²⁵³ due to its unique anti-inflammatory effects.^{253,254} Other conditions where Methotrexate has been used include inflammatory bowel disease (IBD), cancer, and systemic lupus erythematosus (SLE).²⁵⁴ The standard dosage of Methotrexate for those with rheumatoid arthritis is 7.5-25mg once per week.²⁵³ It has recently been suggested that low dose (5-10mg) Methotrexate may be a helpful adjunct to other medication in those with severe fibromyalgia.²⁵⁴ This is based on the theory that all pain originates from inflammation and the inflammatory process and thus the broad spectrum anti-inflammatory action of Methotrexate helps to decrease pain.²⁵⁴

2.10.2 Non-Pharmacological Intervention for Musculoskeletal Disease

For acute MSD, physical management including the PRICE (protect, rest, ice, compression, elevation) principle is generally recommended.²³³ This may be done with the assistance of appropriate analgesia where necessary.²³³ The National Institute for Health and Clinical Excellence (NICE) in the United Kingdom, developed a clinical guideline recommending that health education, physical activity, and exercise should be used as the primary choice of non-pharmacological treatment for chronic MSD.²⁵⁵ This is due to modern pain neuroscience which lends itself toward treatment strategies that are aimed at desensitising the central nervous system.²⁵⁶

2.10.2.1 Manual Therapy

Manual therapy includes massage and mobilisation of soft tissue and joints.²⁵⁷ These techniques are intended to modify the range and quality of movement of the targeted soft tissue and joint structures.²⁵⁸ Literature has shown that manual therapy in acute and chronic MSD is effective in reducing symptoms^{259,260} but has short-term effects on pain which do not persist, hence repeated use may lead to dependency on the therapist with little functional gain.²⁵⁷

2.10.2.2 Pain Physiology and Health Education

Patients with MSD often seek out an explanation and further information on their symptoms.⁶ Evidence suggests that personal sessions of pain neurophysiology education, along with written educational material, are effective for changing pain perceptions, disability, health status, catastrophisation, and physical performance in patients with various chronic MSD.^{74,261} Before the initiation of these sessions, two prerequisites should be present – evidence that the clinical presentation illustrates central sensitisation and that maladaptive pain cognitions such as fear avoidance and increased awareness of somatic symptoms are both present.⁷⁴

The first session should be educational and should explain the rationale of treatment. Here, patients should have an understanding of the mechanism of central sensitisation to improve their knowledge and perception about their pain state.⁷⁴ After the first session, patients receive an information booklet about the neurophysiology of pain to be read carefully at home.⁷⁴ This written information should reinforce the verbal educational information given and serve as revision.⁷⁴ The second session should also be educational with insight given into “somatic, psychosocial and behavioural factors associated with pain” (p.416).⁷⁴ The application of this knowledge to everyday situations should also be discussed to promote better pain coping strategies, self-management programs, and graded activity or exercise.⁷⁴ Examples of this are stopping rumination and worrying about their pain disorder, reducing stress, increasing physical activity levels, and promoting relaxation.⁷⁴ This education on pain physiology should be a continuous process throughout active therapy and rehabilitation.⁷⁴

2.10.2.3 Exercise Therapy

The amygdala is a part of the brain involved in the pain neuromatrix which is likely to be overactive when central sensitisation has occurred.⁸⁰ The amygdala is also the fear-memory centre of the brain and, due to the key role it plays in negative emotions and pain-related memory, it may facilitate the association of fear between movement and pain.²⁵⁶

Manual therapy has been shown to provide a similar benefit to exercise therapy when combined with usual care in hip and knee osteoarthritis.²⁵⁸ However, exercise therapy is then required to desensitise the abovementioned process by being cognition-targeted and also by setting SMART (Specific, Measurable, Attainable, Realistic, Timed) goals for treatment, followed by repeated exposure to movement to “generate a new memory of safety, replacing or bypassing the old and maladaptive movement-related pain memories” (p.219).²⁵⁶ Exercise, such as walking, has been shown to have significant improvements in pain outcomes in those with chronic MSD.²⁶² Interestingly, no difference has been shown in the pain relieving effects for MSD between exercise on land or in water, as in during hydrotherapy, although both are more effective than no exercise.^{263,264}

In a South African context, an intervention of education, exercise, and relaxation has been shown to have significant effects on pain severity and pain interference, as measured by the BPI, compared to usual care in individuals with osteoarthritis, awaiting arthroplasty.²⁶⁵ Exercise does play an important role in managing symptoms in those with hip and knee osteoarthritis. The prescription thereof should be based on the assessment of individual impairments, preference, comorbidities, and accessibility, while maximising adherence which may be enhanced by the use of supervised exercise sessions possibly in a class format.²⁶⁶

2.11 Summary of the Literature Review

As one of the aims of the study was to determine the prevalence of both MSD and CDL, the literature review explored papers which reported on both the impact and prevalence of these conditions. NCDs, which include both MSD and CDL, were found to be a major cause of both mortality and morbidity and to contribute significantly to the global burden of disease, particularly in low-income countries. The reported community prevalence of MSD

has a very high range: from 20-50% of adults globally, and from 16-59% in Africa. In South Africa most information available is based on samples of those attending CHCs, also mostly women, and these consistently report a prevalence rate of between 40 and 45%. Even though some studies on the prevalence of MSD were conducted in South Africa, there seems to be a lack of evidence regarding the onset of MSD according to age and the prevalence of comorbidities associated with the presence of MSD. It is hoped that this study will assist in filling this gap.

Pain is used to define the presence of MSD in the COPCORD screening tool. In addition, the review revealed that there is a clear relationship between chronic MSD and CDL. For these reasons, both the nature of pain and the measurement of pain was discussed in detail. Based on an evaluation of the different pain measurement methods available, the review concluded that the COPCORD approach to screening and BPI for pain measurement were the most feasible instruments to use within the context of this study. As a further aim was to determine the association between risk factors and MSD and CDL, literature related to MSD was sourced. The prevalence of different risk factors was discussed with emphasis on obesity and decreased levels of physical activity, as both contributing to and resulting from MSD. The IPAQ was identified as a suitable measure of physical activity within this study context. Literature on the prevalence and pathophysiology of the most common CDL were presented to further explain the relationship between MSD and CDL. These conditions were defined, and methods of screening and measurement were presented. An examination of the identified risk factors for CDL revealed considerable overlap with those of MSD, including obesity and low levels of physical activity. Finally, the different management strategies for chronic MSD were discussed. There was no documentation found on the current management at CHCs, which hinders the development of appropriate methods of holistic management of MSD and CDL.

It is concluded that both MSD and CDL have a high prevalence and a major functional impact. There are interactions between these health conditions, and they share common risk factors. A study of these health conditions, within a specific under-resourced context, could inform the development of a holistic management strategy for Mitchells Plain CHC, targeting the common risk factors and the interaction between these conditions.

3 METHODOLOGY

3.1 Introduction

Chapter 3 herewith describes the methodology of this study. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for reporting on observational studies²⁶⁷ were used to inform the design, planning, implementation, analysis, and presentation of the this study (see Table 29). The research design and sampling procedure are described first, followed by the selected instruments for data collection. The study procedure is then described, followed by the process and rationale of data management and analysis. The chapter is concluded by expanding upon the ethical considerations of this study.

3.2 Research Design

A descriptive, cross-sectional, analytical study design was used. This study design was chosen to describe the existing prevalence of, and association between, musculoskeletal disease (MSD), chronic diseases of lifestyle (CDL), and risk factors within the sample.

3.3 Participants

All males and females, aged 18 years and older, attending any medical services at the Mitchells Plain Community Health Centre (CHC) in Cape Town, South Africa, were eligible to participate in this study. This CHC was purposefully selected as it is situated in an under-resourced area and, as described in section 1.5, it is one of the busiest clinics in the Cape Metropole with approximately 46000 patients attending per month.

The study was not limited to any ethnic group, i.e. people who met the inclusion criteria attending the CHC were eligible to participate in the study, irrespective of ethnicity, on the days when data were scheduled to be collected. There was no randomization as all people who agreed to participate and who met the inclusion criteria were included in this study. Participants who were pregnant^{120,268} or who were unable to complete either the English,

Afrikaans, or isiXhosa versions of the questionnaires were excluded. The eligibility criteria are summarised in Table 4 below.

Table 4: Inclusion and exclusion criteria for participation in this study

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> ▪ Males and females older than 18 years of age. ▪ Willing to participate in the study and able to give informed consent. ▪ Able to understand, read and write either in English, Afrikaans or isiXhosa. ▪ Attending CHC for medical treatment on day of recruitment. 	<ul style="list-style-type: none"> ▪ Inability to complete either the English, Afrikaans, or isiXhosa versions of the questionnaires. ▪ Pregnancy.

3.3.1 Sample Size Determination

A 2010 South African study in a similar context, albeit with only female participants, found the overall prevalence of MSD to be 36%.¹² The prevalence of MSD per age category was: 18-29 years: 7.9% (n=201); 30-39 years: 10.7% (n=177); 40-49 years: 20% (n=192); 50-59 years: 40% (n=209); 60-69 years: 47% (n=134); and 70 years and older: 45.8% (n=85).¹² Using the lowest expected prevalence of 7.9% in a population of N=1000, a minimum sample size of 149 subjects per age category was required to estimate the true prevalence (TP) with a margin of error of 4% (precision) with a 95% confidence level (Open Epi™ Version 7.2013) (see Table 5). In other words, if the true prevalence was 7.9%, the sample prevalence would fall between 3.9 and 11.9% in 95 of 100 samples drawn.

Table 5: Sample size calculation

Population size (N)	1000
Expected Frequency	7.9%
Margin of Error	4%
Design Effect	1.0
Sample for Each Age Group	149

Stratified sampling was used to ensure that there were an equal number of respondents in each age group. The first person in the waiting area was approached, informed about the study, and asked to disclose their age if they agreed to participate. Recruitment continued until the quota per age group, as aforementioned, was reached.

3.4 Instrumentation and Outcome Measures

As discussed in the literature review, a suite of instruments and outcome measures was identified to screen for MSD, CDL, and risk factors. These instruments and outcome measures measure pain, monitor body weight and levels of physical activity, and explore the health-related quality of life (HRQoL) of the participants.

3.4.1 Community Orientated Program for Control of Rheumatic Diseases

The screening questions used in phases one and two of the Community Orientated Program for Control of Rheumatic Diseases (COPCORD) questionnaire were used to identify those with MSD and CDL. The questions used to identify those with acute and chronic MSD were “during the last 7 days have you experienced pain, aching, swelling, stiffness (tightness) in or around your joints or back which is not related to an injury/accident?” and “during the last 3 months have you experienced pain, aching, swelling, stiffness (tightness) in or around your joints or back which is not related to an injury/accident?”. Thus, pain related to specific trauma was excluded. In addition, the COPCORD questions were used to gather data on demographic characteristics, risk factors, comorbidities and management of MSD and CDL. The COPCORD was previously adapted and validated by Hendricks (2019) (see Appendix VI).¹⁰ The adapted questionnaire was then translated into Afrikaans and

isiXhosa languages. The translated versions of the adapted COPCORD were also assessed for criterion validity by Hendricks (2019).¹⁰ The COPCORD has been shown to be a valid and reliable tool when used in other South African languages.¹³³ The English, Afrikaans, and isiXhosa versions of this questionnaire were used in this study.

3.4.2 The Brief Pain Inventory

Pain was assessed using the Brief Pain Inventory (BPI) (see Appendix VII). This is a self-, or interviewer-administered questionnaire which measures the severity of pain by asking the participant to rate their pain according to: “worst”, “least”, “average” and “present” pain on a numeric scale of 0–10.⁹² The four pain severity scores ranging from 0-10 are averaged to generate a pain severity score (PSS).⁹² When exploring the reliability of the BPI, in terms of internal consistency, high Cronbach alphas of 0.89 (study 1) and 0.82 (study 2), and an intraclass correlation coefficient (ICC) of 0.81 (95% CI: 0.68-0.90) for test-retest reliability was found.⁹⁴ Construct validity was explored between the BPI and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). A high degree of correlation was found between the BPI interference scale ($r=0.62$; $p<0.01$) and BPI sleep item ($r=0.29$; $p<0.0001$) and the WOMAC.⁹⁴ The BPI interference scale and the sleep item both demonstrated strong responsiveness.⁹⁴ The BPI has been validated for use in South African languages to measure the prevalence of pain, as well as pain severity and interference.⁹⁷ The BPI has thus been shown to be a valid and reliable tool for MSD research.^{94,95} Additionally, an isiXhosa version of the BPI has been shown to be a valid tool to measure pain prevalence, severity, and interference with the Cape Town context.⁹⁷ The English, Afrikaans, and isiXhosa versions of the BPI were used in this study.

3.4.3 Body Mass Index and Waist-Hip Ratio

Anthropometric measurements were taken to calculate body mass index (BMI) and waist-hip ratio (WHR). Body weight was measured using the MDW 300L health and fitness electronic digital scale, manufactured in Johannesburg, South Africa, calibrated and accurate to 0.05kg. The height of each participant was recorded to the nearest 0.1cm using a measuring tape which was placed securely against a flat wall and a flat headboard at a right angle to the wall.²⁶⁹ Participants stood with their backs, buttock and heels as close to the wall as possible. The measurement was taken without shoes.²⁶⁹ BMI, in kg/m^2 , was calculated using the above measurements for each participant.

The waist and hip circumferences were measured in order to determine the waist-hip ratio. The participant was asked to stand erect, arms at their side, feet positioned closely together, and their body weight equally distributed.¹²⁰ Measurements were taken over the participants' undergarments. Waist circumference was measured across the smallest portion of the waist, usually found at the midpoint between the top of the iliac crest and the lower margin of the last palpable rib in the mid axillary line. This was measured at the end of normal expiration and parallel to the floor.¹²⁰ Hip circumference was measured over the widest portion of the buttocks, also parallel to the floor.¹²⁰

3.4.4 International Physical Activity Questionnaire

The short version of the International Physical Activity Questionnaire (IPAQ) was used to monitor physical activity (see Appendix IX). It is an acceptable measurement of physical activity for use in adults in many settings and in different languages. Participants respond to questions relating to time spent being physically active in the last seven days during activities at work, house chores, outside of the house, to get from place to place, and in their spare time for recreation, exercise or sport.¹³¹ The IPAQ has been shown to be a valid and reliable tool for surveillance of physical activity in adults.¹³² Test-retest reliability showed that the IPAQ produced repeatable data.¹³² Comparable data was found from both the long form (Spearman's correlation coefficients clustered around 0.8 [95% CI: 0.79–0.82]) and the short form (Spearman's correlation coefficients was 0.76 [CI: 0.73–0.77]) indicating good repeatability.¹³² Concurrent validity tests showed that the short and long forms showed reasonable agreement.¹³² The pooled coefficients for comparison between the short and long form were 0.67 (CI: 0.64–0.70) and for comparisons of different short instruments was 0.58 (CI: 0.51–0.64).¹³² The criterion validity of the IPAQ data against Computer Science and Applications, Inc. (CSA) accelerometers was assessed on total reported physical activity for both the long and short forms. There was fair to moderate agreement between the two measures, with pooled coefficients of 0.33 (CI: 0.26–0.39) for the long forms against the CSA and 0.30 (CI: 0.23–0.36) for the short forms and CSA.¹³² The IPAQ has been shown to be a valid and reliable tool when used in other South African languages.¹³³ The English, Afrikaans, and isiXhosa version of the IPAQ short-version was used for this study.

3.4.5 EQ-5D Health Related Quality of Life measure

The South African version of the European Quality of Life-5 Dimensions (EQ-5D) questionnaire was used to explore self-reported health-related quality of life (HRQoL). It uses five domains of function: mobility, self-care, usual activities which includes study, work, housework, family or leisure, pain or discomfort and lastly depression or anxiety.²¹² The EQ-5D health index score is scored across these five dimensions by combining different levels (no problems [1], moderate problems [2], severe problems [3]) from each dimension.^{212,270} Thus, a full health index set of “11111” would be equal to 1, a single score representing health status.²⁷⁰ The instrument also includes a visual analogue scale (VAS) on which participants can indicate their health status.²¹² The EQ-5D has been validated in a wide range of settings. Construct validity was explored by examining correlations between the EQ-5D and the Health Assessment Questionnaire (HAQ) and found moderate to high correlations with measures of impairment (Spearman $r=0.61$; $p<0.05$) and high correlations with disability measures (Spearman $r=0.78$; $p<0.05$).²¹³ Reliability was analysed and found acceptable agreement between responses with ICC of 0.70 (95% CI: 0.60-0.80) for EQ-5D VAS and ICC of 0.73 (CI: 0.63-0.83) for EQ-5D utility.²¹³

3.5 Procedure

3.5.1 Ethical Approval

Ethical approval was obtained from the Human Research Ethics Committee of the University of Cape Town (HREC REF: 856/2014) (see Appendix I). Following ethical approval, permission for commencement of this study was obtained from the Western Cape Department of Health (WCDoH) Research Committee (see Appendix II) as well as the facility manager of the Mitchells Plain community health centre (see Appendix III).

3.5.2 Training of Investigators

All research assistants were familiarised with each questionnaire and each question and outcome measure was explained. As data were collected using mobile tablets, each research assistant was also trained to use the device and mobile data collection application. A total of 14 investigators were trained to conduct interviews, with between two and five investigators present on each day of data collection. At least one research

assistant was proficient in English and IsiXhosa, and at least two were proficient in English and Afrikaans. Measurements of data for calculation of BMI and WHR were demonstrated and all research assistants had to practice these under supervision prior to data collection.

3.5.3 Pilot Study

A pilot study to assess the feasibility of this study, as well as participant comprehension of questionnaires, time to complete the discussed standardised outcome measures, and reproducibility of clinical measures, was conducted at a community health centre in the Cape Town Metropole area. The pilot study followed a similar procedure as described in this study but did not make use of mobile data collection technology and took place over one week (five hours per day). Feasibility criteria included:

- At least 83% (n=63) of participants responded to being able to participate per week (*main study needed to recruit a minimum of 75 participants per week to recruit 900 participants in 12 weeks*).
- At least 90% of participants (n=81) were able to complete all outcome measures and clinical tests.
- Participants were able to complete all outcome measures and clinical tests within 45 minutes (*main study required an average of 45 minutes for each participant in order to gather data of 900 participants over a 12 week period*).

Ninety-three (93) out of 105 eligible individuals that were approached consented to participate in the pilot study, making for a response rate of 88.6%. Seventy-five (75) (81%) were female and 17 (18%) were male, with 52% of females (n=39) and 59% of males (n=10) reporting having both MSD and CDL. Seventy-six participants in total (81%) completed all outcome measures, doing so in an average time of 27 minutes.

The results of the pilot study showed that two out of three criteria of the feasibility outcomes had been achieved. The primary feasibility outcome was the response rate of participants (89%). Thus, this study was feasible to conduct at the Mitchells Plain CHC. As data for the pilot study was collected at an alternative facility, results from the pilot study were not included in the final sample.

3.5.4 Data Management and Data Collection

Electronic versions of the outcome questionnaires and instruments were developed on the mobile data collection application Maggi by the DataDyne Group, LLC as a mobile form for use on tablets and mobile devices. On the days of data collection, researchers approached adult males and females waiting in queues and waiting areas at the pharmacy and outside various consulting rooms at the CHC, explained the purpose of the research study and obtained informed written consent. A target of 150 participants in each of the six identified age groups was required, therefore research assistants approached potential participants to fill these quotas. Once consent and agreement to participation was given, the participant was ensured that their place in the waiting queue at the CHC would not be forfeited as a research assistant would wait in the place of the participant until all the testing procedures had been completed. The same researcher administered and assisted with the self-reported questionnaires. Participants were then escorted to a separate room where weight, height, waist and hip circumference were measured by a different researcher. WiFi and 3G enabled tablets were used to gather, record, and send data to a central database and the data were exported to Microsoft Office Excel spreadsheets for data analysis. The data files were password protected and stored on a server and backed up by an external hard drive. Both were firewall protected.

3.6 Data Analysis

In order to discuss the outcomes of this study, an analysis of the statistics was required. Statistics encompass the methods of collecting, summarising, presenting, analysing and drawing conclusions from observations on variables of interest.²⁷¹ These variables are either categorical (each individual belongs to one of a number of distinct categories) or numerical (the values are continuous).²⁷¹ Biostatistics refers to the application of statistics to a wide range of topics within the health sciences. Statistica [Dell Inc. (2015). Dell Statistica (data analysis software system), version 13. software.dell.com] and the Centres for Disease Control and Prevention's (CDC) Epi Info 7.1.5.2™ statistical software was used for statistical analysis.

3.6.1 Descriptive Statistics

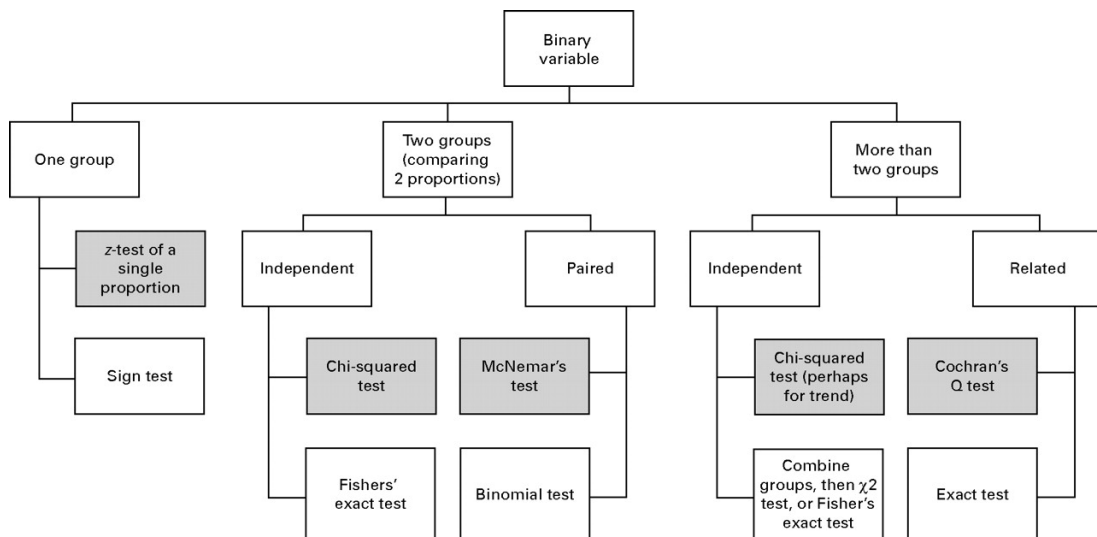
Descriptive statistics were used to summarize and describe the characteristics of the sample, the prevalence and management of MSD and CDL, risk factors, and HRQoL across six age categories (i.e. 18 -29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years, and 70 years and older) within the sample. This description includes reports on frequency distribution and proportion for categorical nominal and ordinal data as well as summary statistics for numerical data. The 95% CIs for proportions were calculated using Vassar Stats.²⁷² Summary statistics for numerical data include: median (“the observation which falls in the middle of the set of observations when they are arranged in increasing order of magnitude” [p.1125])²⁷¹ and range (“difference between the largest and smallest observations in the dataset” [p.1126])²⁷¹ for non-parametric (non-normally distributed) numerical data, and mean (the sum of all the observations divided by the number in the dataset)²⁷¹ and standard deviation (SD) for parametric (normally distributed) numerical data. SD can be calculated by obtaining the square root of the variance. Variance can be described as a measure of the degree of deviation from the mean. The lower the variance, the more likely it is that the sample is representative of the wider population.²⁷³

3.6.2 Inferential Statistics

Statistical testing of a hypothesis is an inferential process where the sample data is used to draw conclusions about one or more parameters of interest in the population.²⁷¹ Statistical inference is a mechanism that allows us to evaluate an observed finding relative to differences that may have occurred by chance alone, as there is observed variability in measurements.²⁷³ This inference allows us to make statements about an entire population without having to study every member of that population.²⁷³ The statistical tests determine the probability of a difference being a true difference instead of being observed under the null hypothesis (N_0) of no true underlying difference. “When this probability is small, it may be concluded that there is a real difference between the two populations that the samples represent” (p.1454).²⁷³ This is the meaning of the term significant.²⁷³ A p-value of less than 0.05 signifies that there is a true difference between two sample groups and allows us to reject a N_0 with more than 95% certainty.^{271,273} When a result has a p-value of less than 0.05 it is said to be statistically significant. Thus, the statistical level of significance (α) of $p < 0.05$ and a 95% CI was accepted for this study.

To test for normality, the one sample Kolmogorov-Smirnov test,²⁷⁴ Lilliefors²⁷⁴ probabilities, and the Shapiro Wilk W test²⁷⁵ was used. It is noted that the Shapiro Wilk test has been shown to be the more powerful test for normality.²⁷⁶ If the d or W statistic was found to be significant, the hypothesis that the respective distribution is normal was rejected.

Relationships and associations were estimated between gender and age categories and variables such as MSD and CDL, risk factors such as obesity and physical activity, and HRQoL. Gender was described using frequency distribution and proportions. Differences between genders for various outcome measures were estimated using the Chi-Squared test. Differences between the MSD group and no MSD group were also calculated using the Chi-Squared test for nominal and ordinal categorical data (Figure 2). Tests in the shaded boxes require relevant assumptions to be satisfied.²⁷¹



(Tests in the shaded boxes require relevant assumptions to be satisfied).

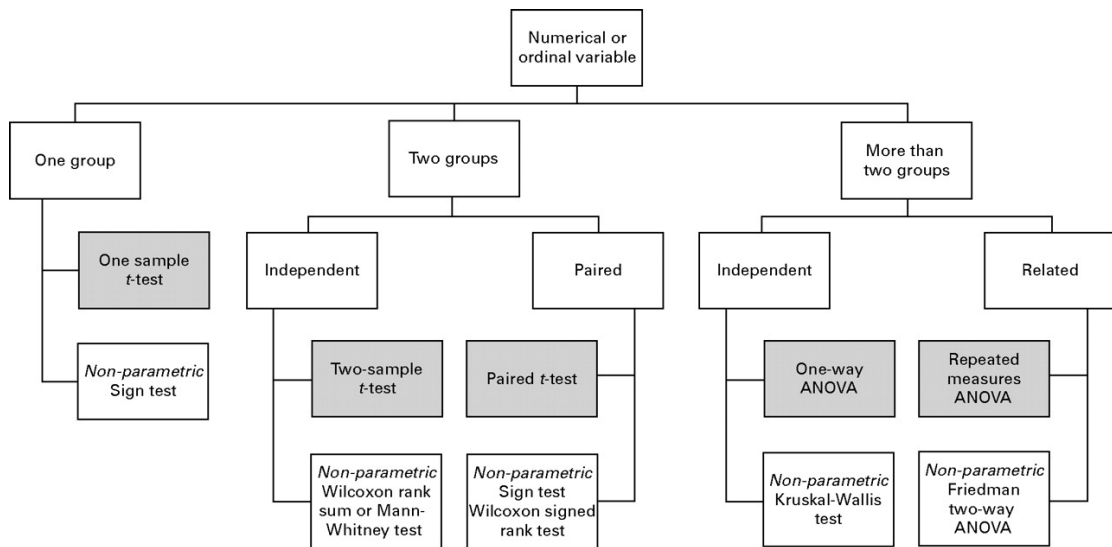
Petrie A. *Statistics in orthopedic papers. The Journal of Bone & Joint Surgery (Br)* 2006; 9:1121-1136.²⁷¹

(Tests in the shaded boxes require relevant assumptions to be satisfied).

Petrie A. *Statistics in orthopedic papers. The Journal of Bone & Joint Surgery (Br)* 2006; 9:1121-1136.²⁷¹

Figure 2: Flowchart indicating choice of test for binary/categorical data

Differences between groups of numerical data were calculated using independent t-tests by variables or by groups (Figure 3). For these continuous numerical variable histograms are used to illustrate the frequency distribution.



(Tests in the shaded boxes require relevant assumptions to be satisfied) (ANOVA=analysis of variance).

Petrie A. Statistics in orthopedic papers. *The Journal of Bone & Joint Surgery (Br)* 2006; 9:1121-1136.²⁷¹

Figure 3: Flowchart indicating choice of test for numerical data

However, due to the large sample size (i.e. N=1 115), the central limit theorem²⁷⁷ was used for all analysis. The central limit theorem states that when a sample is very large, the means will follow the normal distribution even if the respective variable is not normally distributed in the population.²⁷⁷ Thus, parametric methods of data analysis, was appropriate for this large sample.

Selected relationships between two variables, where at least one variable is numerical, are also described using scatter plots. If the variables are not related, the points on the scatter plot form an irregular “cloud”. Linear relationships were assessed using the Pearson’s Correlation Coefficient (r), which ranges from -1 to 1. If r is a positive number the slope of the line will be upwards, while if r is a negative number the slope of the line will be downward. If r = 0, there is no linear relationship. Relationships between ordinal or non-parametric variables were calculated using the Spearman’s Correlation Coefficient which also ranges from -1 to 1.²⁷¹ Correlations were interpreted as weak (-0.29 to -0.1 and 0.1-0.29), moderate (-0.49 to -0.3 and 0.3 to 0.49), and strong (-1.0 to -0.5 and 0.5 to 1.0).²⁷⁸

The Chi-Squared statistic was calculated to test the association between categorical variables. CHAID (Chi-Squared IBM® SPSS® Automatic Interaction Detector) is a statistical, multi-way tree algorithm that presents data quickly and efficiently while building segments

and profiles of the desired outcome.²⁷⁹ The CHAID algorithm builds non-binary trees, where more than two branches can attach to a single root or node, which is well-suited for the analysis of larger datasets.²⁷⁹ CHAID was used to identify which factors were associated with MSD and the results are presented in a classification tree with percentages and graphs. Four models were developed: the first included MSD and CDL; the second included MSD, CDL and age category as it was clear that age would confound any association as most conditions increased with age; the third included MSD and risk factors; and the final model included MSD, risk factors and age category.

A summary of the statistical analysis and tests used to address each objective of this study are shown in Table 6 below.

Table 6: Summary of research questions and statistical tests for this study

Objective	Outcome Measure	Type of Data Obtained	Descriptive Measures	Significance Tests used for Data Analysis
Were the demographic characteristics and outcome measures normally distributed?	All	Various		Kolmogorov-Smirnov one sample test Lillifors Probability Shapiro Wilk Test
What are the proportions of people with MSD and CDL across different age categories occurring in the sample?	COPCORD BPI	Categorical (Nominal & Ordinal) Numerical Non-Parametric Numerical Parametric	Frequency Proportions (%) Median (Range) Mean \pm SD	Chi-Squared Fishers exact Spearman's Correlation t-test Kaplan-Meier estimator
What is the association between risk factors, such as age, gender, obesity, occupations, and social habits such as smoking, MSD and CDL occurring in the sample?	COPCORD Anthropometric Measurements	Categorical/Nominal Ordinal Numerical	Frequency Proportions (%) Median (Range) Mean \pm SD	Chi-Squared CHAID Fishers exact Spearman's Correlation t-test Kaplan-Meier estimator
What is the physiotherapy and medical management and treatment of MSD at a CHC in Cape Town, South Africa?	COPCORD	Categorical/Nominal Ordinal	Frequency Proportions (%) Median (Range)	Chi-squared Fishers exact Spearman's Correlation t-test Kaplan-Meier estimator
What are the HRQoL and health index scores of people with and without MSD and CDL in the sample?	EQ-5D	Categorical/Nominal Ordinal Numerical	Frequency Proportions (%) Median (Range) Mean \pm SD	Chi-squared Fishers exact Spearman's Correlation t-test Kaplan-Meier estimator

Objective	Outcome Measure	Type of Data Obtained	Descriptive Measures	Significance Tests used for Data Analysis
What is the association between the HRQoL and health index scores and MSD and CDL across the different age categories in the sample?	COPCORD EQ-5D	Categorical/Nominal Ordinal Numerical	Frequency Proportions (%) Median (Range) Mean \pm SD	Chi-squared Fishers exact Spearman's Correlation t-test Kaplan-Meier estimator
What is the self-reported level of physical activity in the population with MSD?	IPAQ	Categorical/Nominal Numerical	Frequency Proportions (%) Mean \pm SD	Chi-squared Fishers exact Spearman's Correlation t-test Kaplan-Meier estimator
Are self-reported physical activity levels associated with MSD and CDL in a population at a CHC in Cape Town, South Africa?	COPCORD IPAQ Anthropometric measurements	Categorical/Nominal Ordinal Numerical	Frequency Proportions (%) Median (Range) Mean \pm SD	Chi-squared CHAID Fishers exact Spearman's Correlation t-test Kaplan-Meier estimator

MSD=Musculoskeletal disease; CDL=Chronic Diseases of lifestyle; SD=Standard Deviation; CHC=Community Health Centre; HRQoL=Health Related Quality of Life; COPCORD=Community Orientated Program for Control of Rheumatic Disease; EQ-5D=European Quality of Life–5 Dimensions; IPAQ=International Physical Activity Questionnaire; CHAID=Chi-Squared IBM® SPSS® Automatic Interaction Detector

3.7 Ethical Considerations

The study conformed to the principles of the Declaration of Helsinki²⁸⁰ throughout its duration, following the principles of justice, autonomy, beneficence, and non-maleficence.²⁸¹

3.7.1 Risk to Participants

As participants responded to questionnaires and had clinical measurements done to determine BMI and waist-hip ratio, there was minimal to no risk to the participants, ensuring non-maleficence. Those who decided not to participate in the study were reassured that their decision would not affect their future treatment or access to care, ensuring autonomy.

3.7.2 Benefit to Participants

There were no direct benefits for participating in this study. Participants were advised and encouraged to contact the researcher and the CHC should they be interested to see the results of this study, thus gaining knowledge into MSD and CDL, ensuring beneficence. Participants were also made aware that the results of the study might be published in an accredited health care journal to create an awareness of the profile of the disadvantaged population with MSD and CDL and will potentially also have positive impacts on management strategies, service delivery and policy. Participants with severe pain were reported to the resident physiotherapist for further management and referral.

4 RESULTS

4.1 Introduction

Chapter 4 presents the results of this study. The sample will first be described by presentation of the descriptive data. Data obtained pertaining to musculoskeletal disease (MSD) and chronic diseases of lifestyle (CDL) will then be presented, followed by the estimated associations between these conditions, and possible risk factors. A description of the self-reported health-related quality of life (HRQoL) of the sample is also presented.

4.2 Response Rate and Sampling Process

One thousand two hundred and forty-two (1242) patients that attended the Mitchells Plain Community Health Centre (CHC) were approached to participate in this study. One hundred and twenty-two (122) patients did not consent to participate; therefore 1120 participants were recruited for this study resulting in a response rate of 90.2%. Five (5) participants did not meet the inclusion criteria as one was pregnant and four were under the age of eighteen years. Thus, a final sample of 1115 participants was eligible to continue with the study. A summary of the sampling process is shown in Figure 4 below.

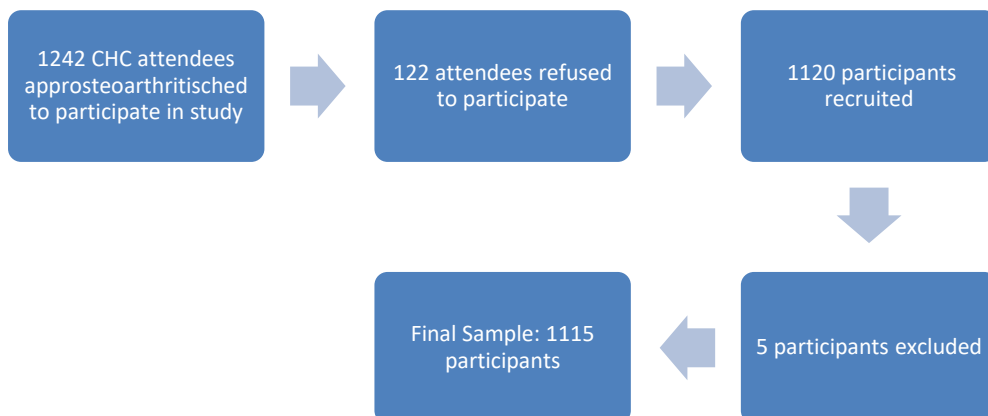


Figure 4: The sampling process

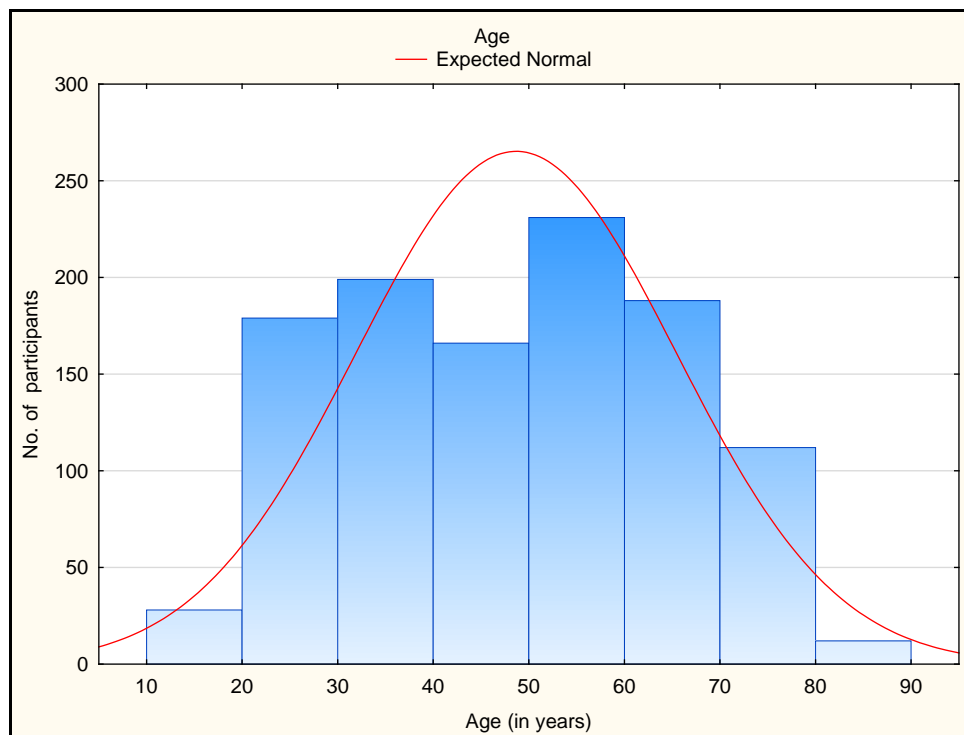
The anthropometric measurements, were taken from 992 (89.0%) to calculate body mass index (BMI), while 1004 (90.0%) completed measurements needed to calculate waist-hip

ratio (WHR). All participants did not complete these measurements as some were called into their scheduled appointments or did not want to leave the client queues.

4.3 Demographic, Socio-economic, and Clinical Characteristics

4.3.1 Demographic Characteristics

The age distribution of the sample is shown graphically in Figure 5 below. The mean age was 48.7 years with a standard deviation (SD) of 16.8 years (Range: 18-89 years). As stratified sampling was used, a minimum of 150 respondents in each of the six identified age groups were recruited.



N=1115

Figure 5: Histogram of participant age

Table 7 illustrates the number of participants recruited across gender and six age categories. Over 70% of the participants recruited were female, and the highest proportion (20%) of respondents were between the ages of 50 and 59.

Table 7: Frequency of specific age groups and gender of study sample

Age Category	Frequency of total sample (N)	% of total sample	Frequency Female (N)	% Female	Frequency Male (N)	% Male
18-29	190	17.0	138	17.2	52	16.7
30-39	184	16.5	132	16.4	52	16.7
40-49	179	16.1	126	15.7	53	17.0
50-59	223	20.0	171	21.3	52	16.7
60-69	188	16.9	137	17.1	51	16.3
70+	151	13.5	99	12.3	52	16.7
<i>Total</i>	1115	100	803	100.0	312	100.0

The demographic characteristics of the sample can be seen in Table 8. The majority of participants spoke Afrikaans (38.4%) as their first language, followed by isiXhosa and English. Almost half of the participants were married with the majority having four children or less. More than one quarter of the participants did not surpass the primary level of schooling (i.e. grade 7) and 16.0% completed grade 12 (not shown) while 2.5% obtained a post-school qualification.

Table 8: Demographic characteristics of study sample

Demographic Characteristic	Frequency of total sample	% of total sample	Mean	SD	Median	Range
Age			48.7	16.8	50	18-89
Home Language						
Afrikaans	428	38.4				
isiXhosa	366	32.8				
English	301	27.0				
Other	18	1.6				
Undisclosed	2	0.2				
Marital Status						
Married	485	43.5				
Single	420	37.7				
Widowed	133	11.9				
Separated/Divorced	73	6.5				
Partner	4	0.4				
Number of Children			2.7	1.9	3	0-12
0	143	12.8				
1	184	16.5				
2	226	20.3				
3	227	20.3				
4	145	13.0				
5 or more	189	16.9				
Undisclosed	1	0.1				
Highest Level of Education (Number of years in school)			8.7	2.9	9	0-13
No formal schooling	15	1.35				
Attended Primary School	278	24.8				
Attended Secondary School	647	58				
Post-school qualification	28	2.5				
Undisclosed	147	13.2				

*SD=Standard Deviation
N=1115*

Table 9 shows a summary of the reasons for visitation to the CHC by the study sample within the data collection period. Most of the participants (31%) attended the CHC awaiting a consultation with a medical practitioner (including nursing staff), whereas 28.3% were attending to collect prescribed medication for CDL and other medical conditions. Four percent (4%) were attending physiotherapy services.

Table 9: Reasons for CHC visits of study sample

Reason for visit to CHC	Frequency of total sample	% of total sample
Medical Practitioner	346	31.0
Initial CDL Assessment	123	11.0
Other Problems	223	20.0
Pharmacy	315	28.3
CDL Medication	147	13.2
Medication - Other Problems	168	15.1
Other	107	9.6
Chronic Disease Clubs	59	5.3
Physiotherapy	42	3.7
Initial Assessment	8	0.7
Osteoarthritis Group	6	0.5
Other Problems	28	2.5
Undisclosed	246	22.1

*CHC=Community Health Centre; CDL=Chronic Disease of Lifestyle
N=1115*

4.3.2 Socio-Economic Characteristics

Over one third of the sample reported being unemployed (Table 10). Of those that were unemployed, 52% were not looking for current employment. The highest percentage of unemployed participants had completed grade twelve (16.3%), grade ten (16.1%), and grade nine (13.5%) and 2.1% did not have any type of formal schooling. Of those unemployed or retired, 215 (35.0%) had stopped work due to injury or illness.

More than one quarter reported some form of paid employment or other source of income, while 16.4% were retired from working. More than half of the sample reported to be the primary breadwinner for the household, with 48% earning a monthly income of R1001-2000 (R=South African rand).

Table 10: Socio-economic characteristics of study sample

Socio-economic Characteristic	Frequency of total sample	% of total sample	Frequency Female	% Female	Frequency Male	% Male
Current Employment						
Unemployed	431	36.6	291	36.3	140	45.0
Housewife	199	19.7	199	24.8	0	0.0
Retired	183	16.4	119	14.8	64	20.6
Manual Work	103	9.2	62	7.7	41	13.2
Small Business/ Retail	74	6.7	43	5.4	31	10.0
Other	70	6.3	46	5.7	24	7.7
Administration	33	3	23	2.9	10	3.2
Education	10	0.9	10	1.2	0	0.0
Healthcare	7	0.6	7	0.9	0	0.0
Police and Military	3	0.3	2	0.2	1	0.3
Undisclosed	2	0.2	1	0.1	1	0.3
Total	1115	100	803	100	312	100
Household Breadwinner						
Yes	567	50.8	355	44.3	212	68.2
No	546	49	447	55.7	99	31.8
Undisclosed	2	0.2	1	0.1	1	0.1
Monthly Income (in South African Rands)						
0-1000	334	29.9	249	31.0	85	27.3
1001-2000	536	48.1	376	46.9	160	51.4
2001-3000	106	9.5	77	9.6	29	9.3
3001-5000	56	5	40	5.0	16	5.1
5001-7000	26	2.3	16	2.0	10	3.2
>7000	18	1.6	11	1.4	7	2.3
Undisclosed	39	3.5	34	4.0	5	1.6
State-Issued Special Grants						
Government Pension	276	24.8	184	22.9	92	29.6
Child Care Grant	174	15.6	174	21.7	0	0.0
Permanent Disability Grant	148	13.3	111	13.8	37	11.9
Temporary Disability Grant	82	7.3	67	8.4	15	4.8
Foster Care Grant	2	0.2	2	0.2	0	0.0
Other Grant	9	0.8	5	0.6	4	1.3
Total Grants	691	62	543	67.7	148	47.6

N=1115

4.4 Musculoskeletal Disease

This section describes current and previous occurrences of musculoskeletal pain or injuries of both the acute and chronic nature within the sample. This includes sites of pain as well

as management strategies used within the primary health care system for treatment of musculoskeletal pain.

4.4.1 Prevalence

The primary outcome measure to determine the prevalence of MSD were the COPCORD questions relating to pain. Those who reported having pain for seven days or less were categorised as having acute MSD, whereas those reporting pain for three months or more were categorised as having chronic MSD. Information relating to the nature of the MSD was missing for both acute and chronic pain in 11 cases and thus the denominator for calculating the prevalence rate was reduced to 1104. The prevalence of acute MSD was 371 (33.6%; 95% CI: 30.1-36.5%) and that of chronic MSD was 478 (43.3%; CI: 40.4-46.3%). The number with both acute and chronic MSD was 344 (31.2%; CI: 28.5-34.0%) and the overall prevalence of both combined was 478 (all yes) and 27 (yes for acute) = 505 (45.7%; CI: 42.8-48.7) (see Table 11).

Table 11: Prevalence of acute and chronic MSD

	Acute MSD	Chronic MSD Yes	Chronic MSD No	Missing Data	Total
Frequency	Yes	344	27	0	371
% of total sample		31.2	2.4	0.0	33.6
Frequency	No	123	572	1	696
% of total sample		11.1	51.8	0.1	63.0
Frequency	Missing	11	26	*	37
% of total sample		1.00	2.36	*	3.35
Frequency	All Groups	478	625	0.1	1104
Total %		43.3	56.1		

*MSD=Musculoskeletal Disease
n=1104, *11 missing from both acute and chronic and excluded*

Gender was associated with both chronic MSD (45.8% of females and 36.9% of males [Chi-Square=7.26; p=0.007]) and acute MSD (43.4% of females and 13.6% of males [Chi-Square=86.0; p<0.001]).

4.4.2 History of Previous Injuries

Previous musculoskeletal injuries, including the type and mechanism of these injuries and the result thereof at the time of questioning, are shown in Table 12 below. Almost one quarter (23.6%) of the sample reported previous injuries. A history of previous injury was found to be significantly associated with chronic MSD ($p < 0.001$).

Table 12: Reported previous injuries, injury mechanisms, and injury results in participants with chronic MSD

Variable	Frequency Previous Injuries	Previous Injuries % of total sample (n=1104)	Previous Injuries Frequency chronic MSD	Previous Injuries % chronic MSD
Previous Injuries	263	23.6	186	70.7
Lower limb fracture	18	6.8	12	66.7
Lower limb joint/ligament	30	11.4	12	40.0
Lower limb muscle/tendon	20	7.6	13	65.0
Spinal joint	19	7.2	11	57.9
Spinal muscle	7	2.7	6	85.7
Spinal fracture	5	1.9	3	60.0
Upper limb joint/ligament	24	9.1	13	54.2
Upper limb muscle/tendon	10	3.8	7	70.0
Upper limb fracture	12	4.6	8	66.7
Unspecified	118	44.9	101	85.6
Previous Injury Mechanism	263		186	70.7
Fall	55	20.9	48	87.3
Industrial	2	0.8	2	100.0
Vehicle	21	8.0	17	81.0
Violence	2	0.8	1	50.0
Other	23	8.8	21	91.3
Unspecified	160	60.8	97	60.6
Previous Injury Result	265		187	7.6
Chronic pain	87	32.8	74	85.1
Cured	102	38.5	61	59.8
Deformity	3	1.1	2	66.7
Disabled	20	7.5	16	80.0
Joint stiffness	34	12.8	23	67.7
Other	16	6.0	9	56.3
Unspecified	3	1.1	2	66.7

4.5 Chronic Diseases of Lifestyle

Approximately three quarters of the sample (75.3% of the female and 77.2% of the male participants) reported being diagnosed with at least one of the CDL listed in Table 13. Hypertension was the most prevalent condition (47.8%; CI: 44.8-50.7%), followed by type 2 diabetes mellitus (21.4%; CI: 19.1-23.9%) and hypercholesterolaemia (20.2%; CI: 17.9-22.6%). A high proportion (30%) of “other” CDL was reported as well. Unfortunately, no further investigation was done to determine what “other” CDL could have been. This is a limitation of this study. Furthermore, it is noted that higher proportions of these common CDL were reported by females. Significant associations were found between gender and hypertension ($p<0.001$), type 2 diabetes mellitus ($p=0.024$), and hypercholesterolaemia ($p=0.005$).

Significant associations were also found between chronic MSD and hypertension ($p<0.001$), cardiovascular disease ($p<0.001$), type 2 diabetes mellitus ($p=0.002$), hypercholesterolaemia ($p<0.001$) and chronic obstructive airway disease (COAD) ($p<0.001$), as seen in Table 14 below.

Table 13: Self-reported chronic diseases of lifestyle by gender

Chronic Disease of Lifestyle	Frequency	% of total sample (N=1115)	Frequency Females with condition (n)	*Females with condition %	Frequency Males with condition (n)	**Males with condition %	Chi-Square	p
Hypertension	533	47.8	422	52.6	111	35.6	25.951	<0.001
Cardiovascular disease	74	6.6	55	6.9	19	6.1	0.209	0.647
Hypercholesterolaemia	225	20.2	179	22.3	46	14.7	7.947	0.005
Type 2 diabetes mellitus	239	21.4	186	23.2	53	17.0	5.089	0.024
COAD	122	10.9	97	12.1	25	8.0	3.814	0.05
Mental Illness	28	2.5	18	2.2	10	3.2	0.852	0.356
Other CDL	335	30.0	243	30.3	92	29.5	0.064	0.8

COAD=Chronic Obstructive Airway Disease; CDL=Chronic Disease of Lifestyle

*Females with condition out of total female sample (803)

**Males with condition out of total female sample (312)

df=1

Table 14: Self-reported chronic diseases of lifestyle with and without chronic MSD

Chronic Disease of Lifestyle	Frequency	% of total sample (1115)	Frequency Comorbid MSD (n)	*Comorbid MSD %	Frequency No MSD (n)	**No MSD %	Chi-Square	p
Hypertension	533	47.8	296	55.9	233	44.1	65.912	<0.001
Cardiovascular disease	74	6.6	48	65.7	25	34.3	15.998	<0.001
Hypercholesterolaemia	225	20.2	148	66.4	75	33.6	60.378	<0.001
Type 2 diabetes mellitus	239	21.4	123	52.1	113	47.9	9.43	0.002
COAD	122	10.9	78	65.0	42	35.0	25.734	<0.001
Mental disorders	28	2.5	14	50.0	14	50.0	0.519	0.471
Other CDL	335	30.0	136	41.0	196	59.0	1.089	0.297

MSD=Musculoskeletal Disease; COAD=Chronic Obstructive Airway Disease; CDL=Chronic Disease of Lifestyle

**Comorbid MSD out of total MSD sample n=478*

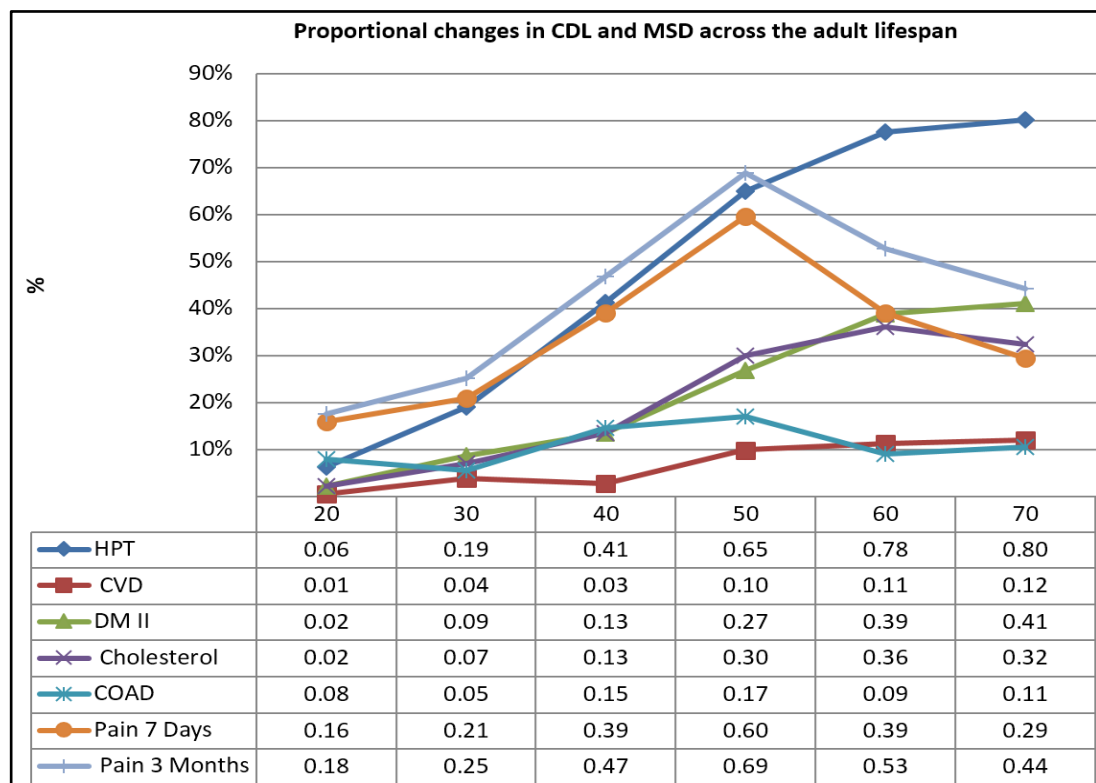
***No comorbid MSD out of no MSD sample n=625*

df=1

4.6 Changes in Musculoskeletal Disease and Chronic Diseases of Lifestyle over the Adult Lifespan

This section illustrates, by six age categories, the frequency and proportion of participants with MSD and CDL. The change in proportion of these conditions across the adult lifespan is also shown.

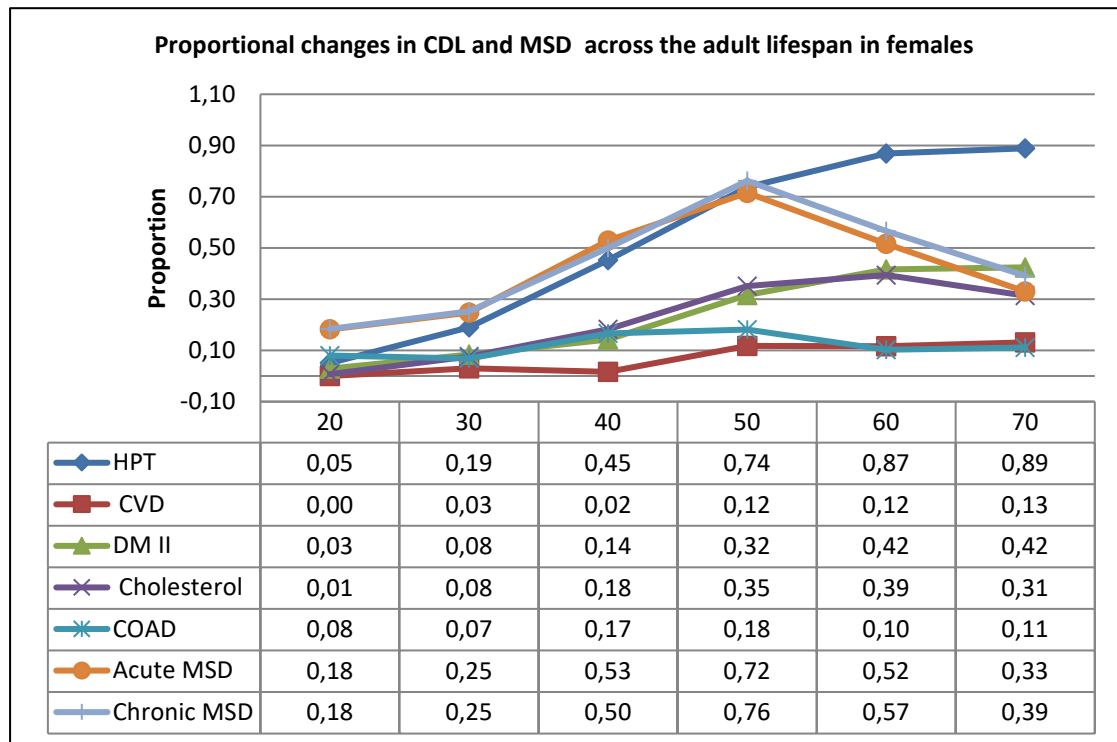
Figure 6 below displays the proportion of both acute and chronic MSD and CDL within six age categories. All chronic diseases except COAD continually increased with age, while COAD and both acute and chronic MSD peaked around the 50-59 year old age category and then decreased with age. Acute and chronic MSD were the most prevalent conditions in the youngest age group (16-18%). The prevalence of hypertension increased linearly and tracked the MSD prevalence until it diverged in the 50-59 age group.



N=1115; 20=20-29 yrs; 30=30-39 yrs; 40=40-49 yrs; 50=50-59 yrs; 60=60-69 yrs; 70=70 yrs and older

Figure 6: Proportion of respondents reporting presence of chronic diseases in each age category

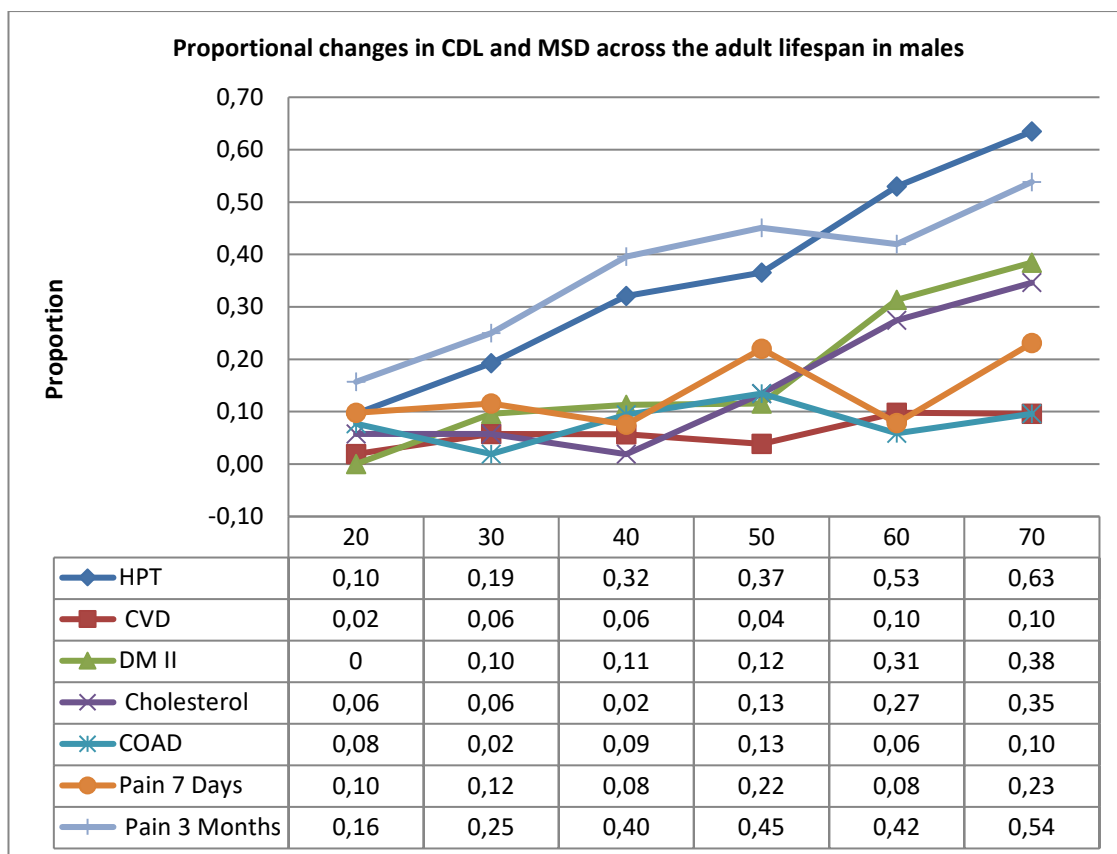
Similar proportional changes in MSD and CDL were illustrated in females where all chronic diseases, except COAD, continually increased with age, while COAD and both acute and chronic MSD peaked around the 50-59 year old age category and then decreased with age (Figure 7).



n=803; 20=20-29 yrs; 30=30-39 yrs; 40=40-49 yrs; 50=50-59 yrs; 60=60-69 yrs; 7 =70 yrs and older

Figure 7: Proportion of female respondents reporting health conditions in each age category

In males, the proportion of participants with MSD and CDL continually increased with age, but, COAD, acute MSD, and chronic MSD dropped at the 60-69 age group and then increased once more (Figure 8).



n=312; 20=20-29 yrs; 30=30-39 yrs; 40=40-49 yrs; 50=50-59 yrs; 60=60-69 yrs; 70=70 yrs and older.

Figure 8: Proportion of male respondents reporting presence of chronic diseases in each age category

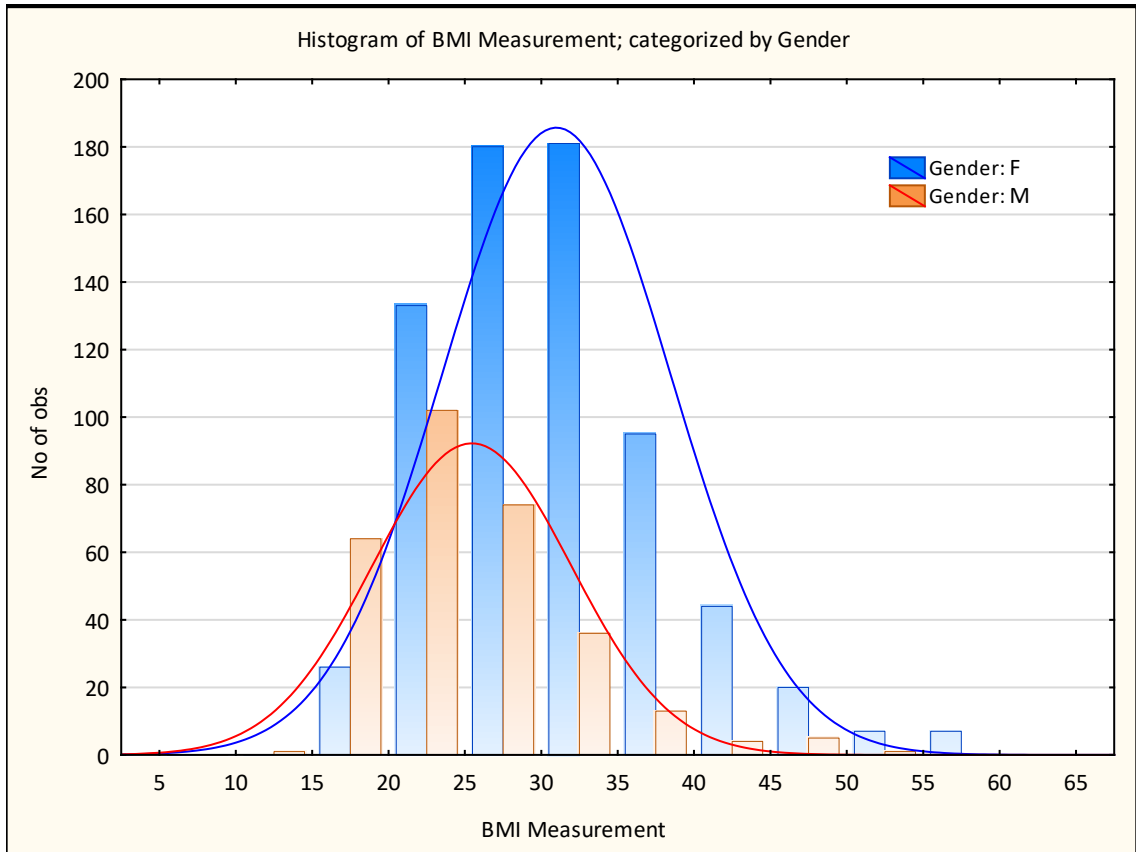
4.7 Lifestyle Risk Factors for Musculoskeletal Disease

Data on relevant risk factors, as deduced from previous literature, for MSD and CDL are presented here.

4.7.1 Obesity

This section presents data collected as determinants for the classification of obesity. Constituents of BMI, i.e. weight and height, and waist-hip ratio, i.e. waist and hip circumference, are presented, followed by relationships shown between these factors and chronic diseases of lifestyle and musculoskeletal disease.

Figure 9 presents BMI measurements of participants, categorized by gender. The mean BMI of the total sample was 29.2kg/m² (SD=7.6kg/m²).



Females n=693; Males n=300; Missing n=23

Figure 9: Histogram of BMI categorised by gender

Classification of participants' BMI is shown below in

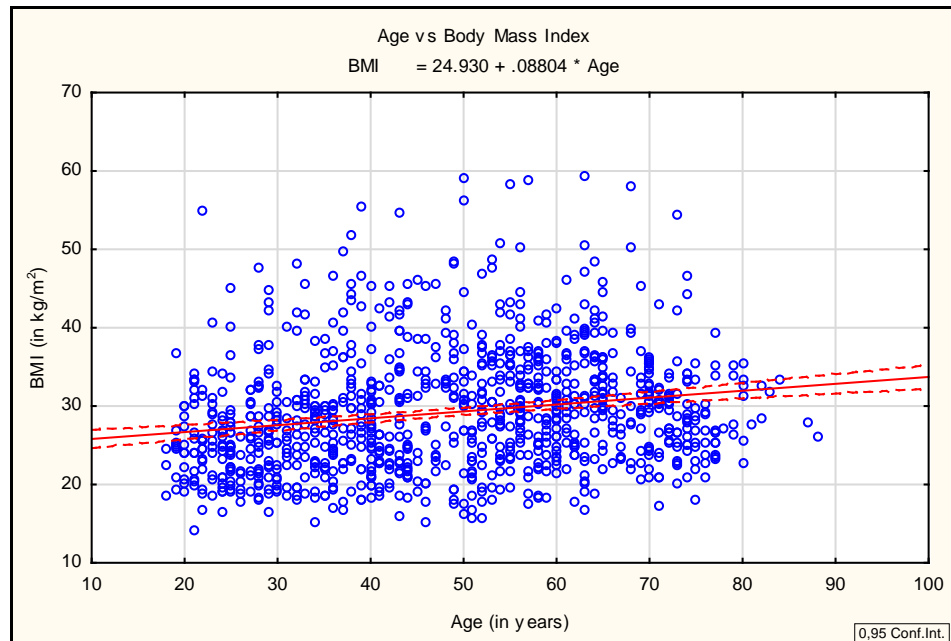
Table 15. Most participants ranged within the 'normal' (29.1%) and 'overweight' (26%) categories, with the highest proportion of females (50%) being "obese" and of males being "normal" (45.7%).

Table 15: Body mass index categories of participants

BMI Category	Frequency of sample	% of sample	Frequency Female (n)	% Female (n=693)	Frequency Male (n)	% Male (n=300)
Underweight	36	3.6	7	1.0	29	9.7
Normal	289	29.1	152	21.9	137	45.7
Overweight	258	26.0	182	26.3	76	25.3
Obese 1	209	21.0	175	25.3	34	11.3
Obese 2	113	11.4	99	14.3	14	4.7
Obese 3	87	0.1	78	11.3	9	3.0

Females n=693, Males n=300, Missing n=22

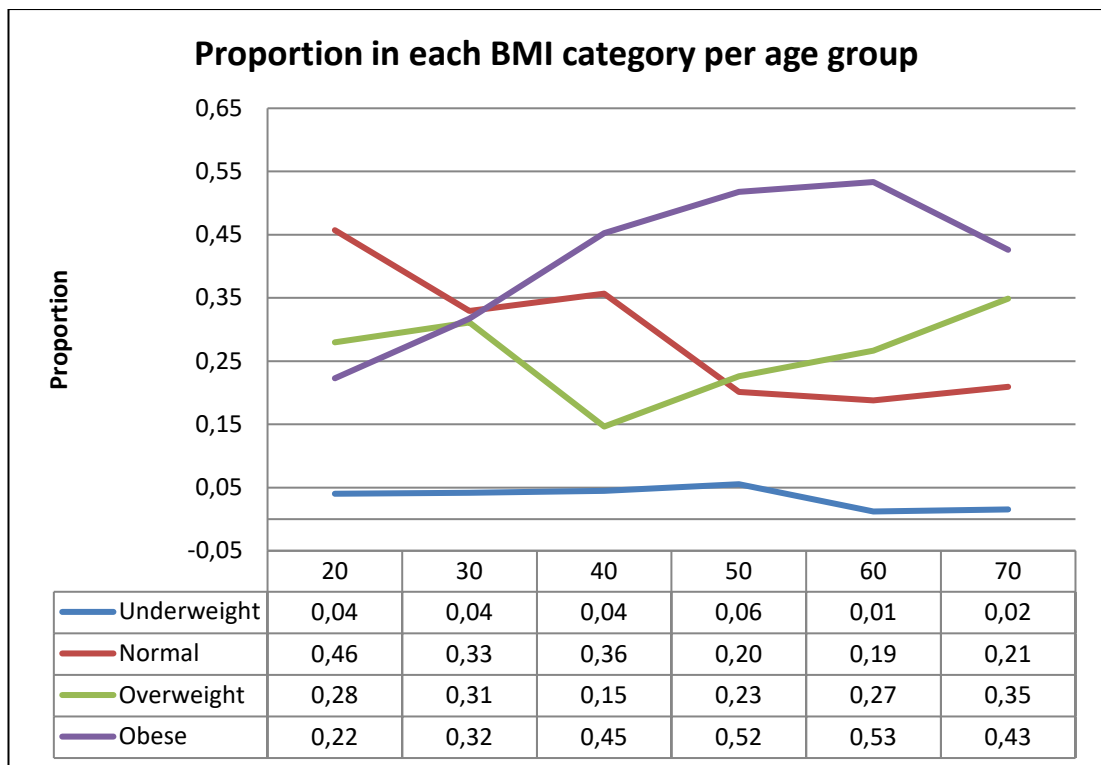
A scatter plot correlating age and BMI is shown in Figure 10, with $r=0.19$. This displays a positive, weak (0.1-0.3) linear correlation between age and BMI.



$n=993$; Missing=22

Figure 10: Scatter plot of linear correlation between age and BMI

Figure 11 below illustrates the proportional changes in BMI category of the study sample. "Obese 1", "obese 2", and "obese 3" were classified under "obese" for this illustration. The "obese" category is the only category to increase with age until the 60-69 year mark is reached. The "overweight" category shows a steady increase from age 40.



n=993; Missing n=22; 20=20-29 yrs; 30=30-39 yrs; 40=40-49 yrs; 50=50-59 yrs; 60=60-69 yrs; 70=70 yrs and older. "Obese 1", "obese 2", and "obese 3" were classified under "obese".

Figure 11:Proportional changes in BMI over the adult lifespan

BMI category was associated with MSD ($p<0.001$) with 73% of those with MSD being overweight or obese and 27% of the sample being extremely obese (see Table 16). There were significant differences in BMI between those with and without hypertension ($p<0.001$), hypercholesterolaemia ($p<0.001$), and type 2 diabetes mellitus ($p<0.001$) (see Table 17).

Table 16: BMI categories in those with and without chronic MSD

Chronic MSD	Frequency of total sample	Underweight Frequency	Underweight %	Normal Frequency	Normal %	Overweight Frequency	Overweight %	Obese 1 Frequency	Obese 1 %	Obese 2 Frequency	Obese 2 %	Obese 3 Frequency	Obese 3 %
Yes	425	15	3.5	96	22.6	106	24.9	95	22.4	60	14.1	53	12.5
No	564	20	3.5	192	34.0	152	27.0	114	20.2	53	9.4	33	5.9
Total	989	35	3.5	288	29.1	258	26.1	209	21.1	113	11.4	86	8.7

*MSD=Musculoskeletal Disease
Chi-Square=28.8; df=5; p<0.001*

Table 17: BMI categories in those with and without CDL

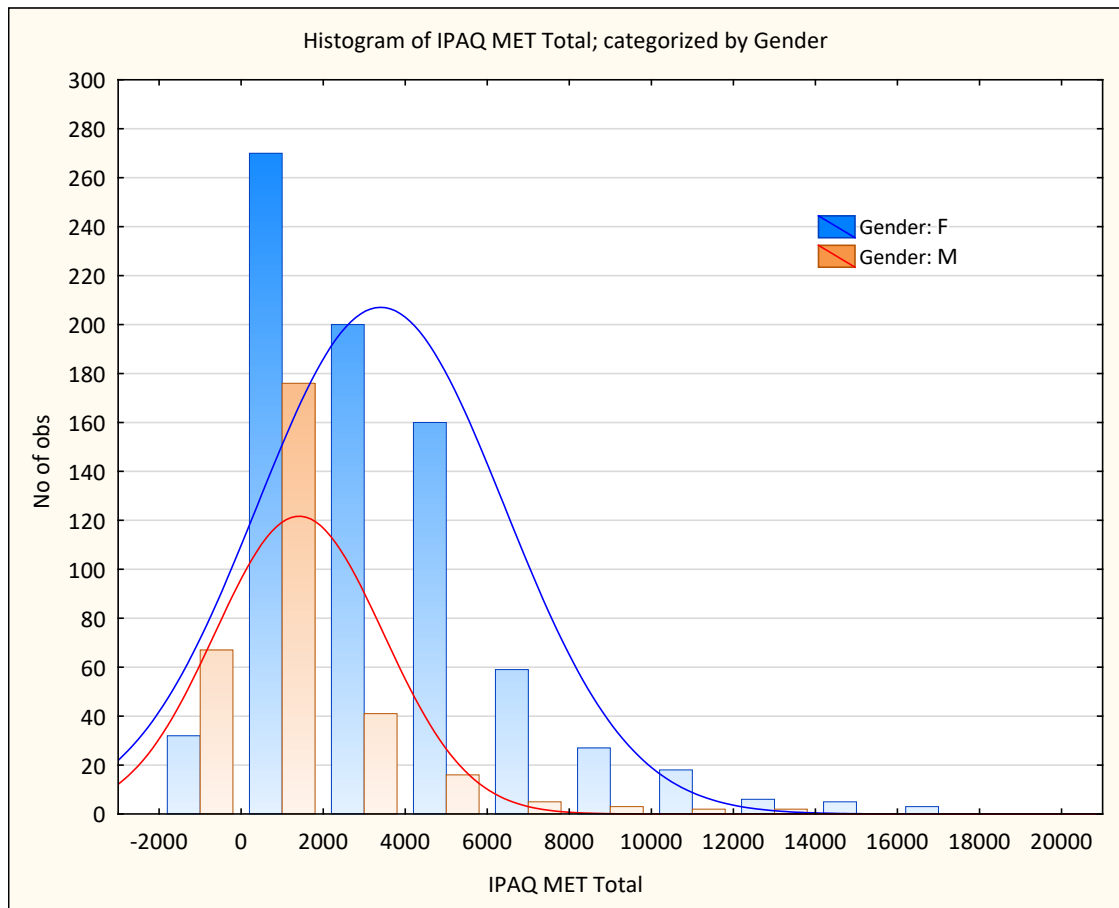
Variable	Frequency of total sample	Underweight Frequency	Underweight %	Normal Frequency	Normal %	Overweight Frequency	Overweight %	Obese 1 Frequency	Obese 1 %	Obese 2 Frequency	Obese 2 %	Obese 3 Frequency	Obese 3 %
Hypertension*	462	6	1.3	79	17.1	119	25.7	122	26.4	77	16.7	59	12.8
No Hypertension	530	30	5.7	210	39.6	139	26.2	87	16.4	36	6.8	28	5.3
CVD	69	1	1.4	16	23.2	14	20.3	19	27.5	12	17.4	7	10.1
No CVD	923	35	3.8	273	29.6	244	26.4	190	20.6	101	10.9	80	8.7
HCL*	200	0	0	28	14.0	59	29.5	53	26.5	35	17.5	25	12.5
No HCL	792	36	4.5	261	32.9	199	25.1	156	19.7	78	9.8	62	7.8
Type 2 DM*	201	1	0.5	28	14.0	48	24.0	72	36.0	30	15.0	22	11.0
No Type 2 DM	791	35	4.4	261	33.7	210	26.5	137	17.3	83	10.5	65	8.2
COAD	107	5	4.7	26	24.3	28	26.2	18	16.8	14	13.1	16	14.9
No COAD	885	31	3.5	263	29.7	230	26.0	191	21.6	99	11.2	71	8.0
Mental Illness	25	1	4.0	11	44.0	2	8.0	7	28.0	2	8.0	2	8.0
No Mental Illness	967	35	3.6	278	28.7	256	26.5	202	20.9	111	11.5	85	8.8

CVD=Cardiovascular Disease; HCL=Hypercholesterolaemia; DM=Diabetes Mellitus; COAD=Chronic Obstructive Airway Disease

**df=5; p<0.001*

4.7.2 Physical Activity Levels

This section presents data collected as determinants for classification of physical activity (PA) level via the International Physical Activity Questionnaire (IPAQ) short version. The proportional changes in physical activity levels across the adult lifespan are illustrated. Physical activity levels in participants with MSD and CDL are also described. The mean total MET-minutes was 2805.1 (SD=2905.8) (Figure 12).



n=1092, Missing n=23, Female n=780, Male n=312

Figure 12: Histogram of Total MET-minutes categorised by gender

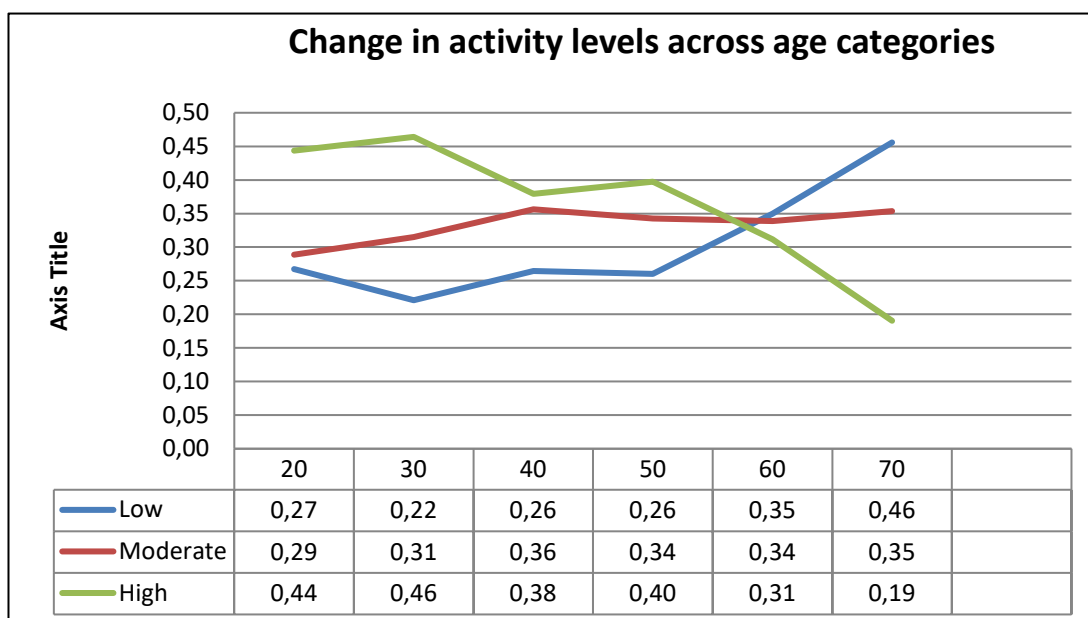
Classification of participants reported physical activity level is shown below in Table 18. Most females reported to be highly physically active (46.0%) while males reported mostly low physical activity levels (47.8%). An association between gender and physical activity level was shown (Chi-Square=109.389; df=2; $p<0.001$).

Table 18: Physical activity level categories of participants

Level of Physical Activity	Frequency of total sample	% of total sample	Frequency Female	% Female	Frequency Male	% Male
Low	324	29.7	175	22.4	149	47.8
Moderate	362	33.2	245	31.4	117	37.5
High	405	37.1	359	46.0	46	14.7

n=1091

Figure 13 illustrates the proportional changes in physical activity level over the adult lifespan of the study sample. Around the 50-59 year old age group the proportion of participants with a 'high' physical activity level decreases while that of participants with a 'low' physical activity level increases at the same age group.



n=1091; Females n=780; Males n=312; Missing n=22; 20=20-29 yrs; 30=30-39 yrs; 40=40-49 yrs; 50=50-59 yrs; 60=60-69 yrs; 70=70 yrs and older

Figure 13: Change in percentage of activity levels across age categories

In participants reporting acute MSD, most had 'moderate' (33.2%) or 'high' (33.2%) levels of physical activity, whereas 34.1% of those reporting chronic MSD had a 'low' level of physical activity. A significant association (Chi-Square=13.833; df=2; p=0.001) was found between chronic MSD and physical activity levels. No significant association was found between acute MSD and physical activity levels (Chi-Square=2.007; df=2; p=0.37). A higher

proportion of those without MSD reported high levels of physical activity (41% compared to 32%) (Table 19).

Table 19: Physical activity levels in participants with and without chronic MSD

Chronic MSD	Frequency Low PA Level Frequency	% Low PA Level	Frequency Moderate PA Level	% Moderate PA Level	Frequency High PA Level	% High PA Level
Yes	163	35.0	154	33.1	149	32.0
No	159	25.6	208	33.4	255	41.0
Total	322	29.6	362	33.3	404	37.1

*MSD=Musculoskeletal Disease; PA=Physical Activity
n=1088; Chi-Square=13.8; df=2; p=0.001*

A higher proportion of those with CDL reported high levels of physical activity (43.8% compared to 35%) (Table 20).

Table 20: Physical activity levels in those with and without CDL

CDL	Frequency Low PA Level	% Low PA Level	Frequency Moderate PA Level	% Moderate PA Level	Frequency High PA Level	% High PA Level
Yes	67	25.1	83	31.1	117	43.8
No	257	32.1	279	33.9	288	35.0
Total	324	29.7	362	33.2	405	37.1

*CDL=Chronic Disease of Lifestyle; PA=Physical Activity
n=1091; =Pearson Chi-square 7.2; df=2; p=0.026*

No correlation was found between total MET-minutes and BMI ($r=0.044$; $p=0.171$) (Table 21).

Table 21: Comparison of total MET between those with and without chronic conditions

Variable	Frequency Yes	Mean Yes	SD Yes	Frequency No	Mean No	SD No	t separate variances	df	p
Chronic MSD	467	2318.0	2347	622	3176.0	3218	-5.09	1086	<.001
Hypertension	522	2547.3	2567	570	3041.0	3168.1	-2.841	1074.3	0.0046
Hypercholesterolaemia	218	2289.0	2314	874	2934.0	3023	-3.45	422.0	0.001
Cardiovascular disease	73	1773.0	1929	1019	2879.0	2950	-4.53	97.96	<.001
Type 2 DM	234	2177.0	2105	858	2976.0	3067	-4.62	532.4	<.001
COAD	119	2650.0	2581	973	2824.0	2944	0.617*	1090	0.537
Mental Illness	26	1828.0	2856	1066	2829.0	2904	-1.74*	1090	0.083

SD=Standard Deviation; MSD=Musculoskeletal disease; hypertension=Hypertension; DM II=Diabetes Mellitus Type II; COAD=Chronic Obstructive Airway Disease

**Not tested with separate variances*

4.7.3 Other Lifestyle Risk Factors

Participants reported on the history of smoking and consuming alcoholic beverages (Table 22). Over a quarter (29.9%) of the participants reported to be currently smoking and 15% reported that they were consuming alcohol at the time of data collection. A lower proportion of females reported current smoking (22%) and consuming alcohol (13%) compared to males (49% and 20% respectively).

Table 22: Current and past smoking and alcohol use of participants

Variable	Frequency of total sample	% of total sample	Frequency Female	% Female	Frequency Male	% Male
Smoking						
Never smoked	670	60.1	531	66.2	139	44.7
Previously smoked	116	10.4	95	11.8	21	6.8
Current Smoker	327	29.9	176	21.9	151	48.6
Undisclosed	2	0.2	1	0.08	1	0.3
Total	1115		802		311	
Alcohol Use						
Never consumed alcohol	813	72.9	598	74.6	215	69.1
Previously consumed alcohol	133	11.9	100	12.5	33	10.6
Currently consume alcohol	167	15.0	104	13.0	63	20.3
Undisclosed	2	0.2	1	0.08	1	0.3
Total	1115		802		311	

N=1115

The percentage of previous smokers was highest in the respondents with COAD (32%) and hypercholesterolaemia (22.7%) (Table 23). The percentage of current smokers ranged from 24-38% in all those with chronic conditions and in those without conditions. The one exception was those with COAD (19%).

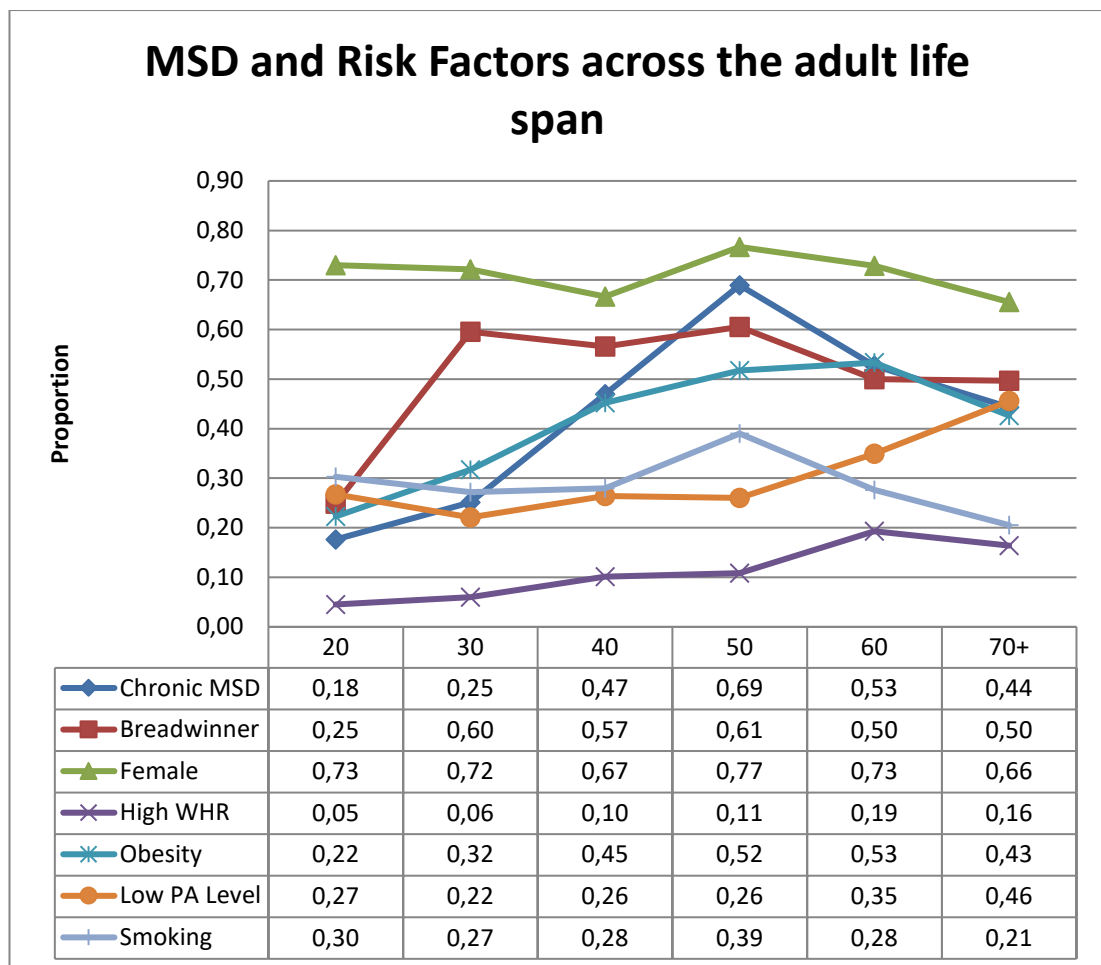
Table 23: Smoking in participants with MSD and/or CDL

MSD/CDL	Frequency of total sample	Frequency Never Smoked	% Never Smoked	Frequency Previously Smoked	% Previously Smoked	Frequency Current Smoker	% Current Smoker	Chi-square	df	p
Acute MSD	371	192	51.8	51	13.7	128	34.5	23.969	2	<0.001
Chronic MSD	478	247	51.7	69	14.4	162	33.9	27.711	2	<0.00
Hypertension	533	316	59.3	74	13.9	143	26.9	14.164	2	0.001
Cardiovascular disease	74	33	44.6	17	23.0	24	32.4	15.438	2	<0.001
Type 2 DM	239	147	61.5	35	14.6	57	23.8	8.461	2	0.015
Hypercholesterolaemia	225	102	45.3	51	22.7	72	32.0	51.577	2	<0.001
COAD	122	60	49.2	39	32.0	23	18.8	12.418	2	0.002
Mental Illness	28	17	60.7	1	3.6	10	35.7	1.687	2	0.430
Other CDL	335	210	62.7	25	7.5	100	29.9	4.557	2	0.102
No CDL	269	175	65.1	11	4.1	83	30.9	15.305	2	<0.001

MSD=Musculoskeletal Disease; CDL=Chronic Diseases of Lifestyle; DM= Diabetes Mellitus; COAD=Chronic Obstructive Airway Disease

4.8 Risk Factors and their association with Chronic Musculoskeletal Disease and Chronic Diseases of Lifestyle

The proportion of respondents in each age category reporting these risk factors were plotted across the adult life span (Figure 14). There was a trend of increasing obesity, high waist-hip ratio and low levels of physical activity with age. However, no risk factor seemed to track the plot of MSD.

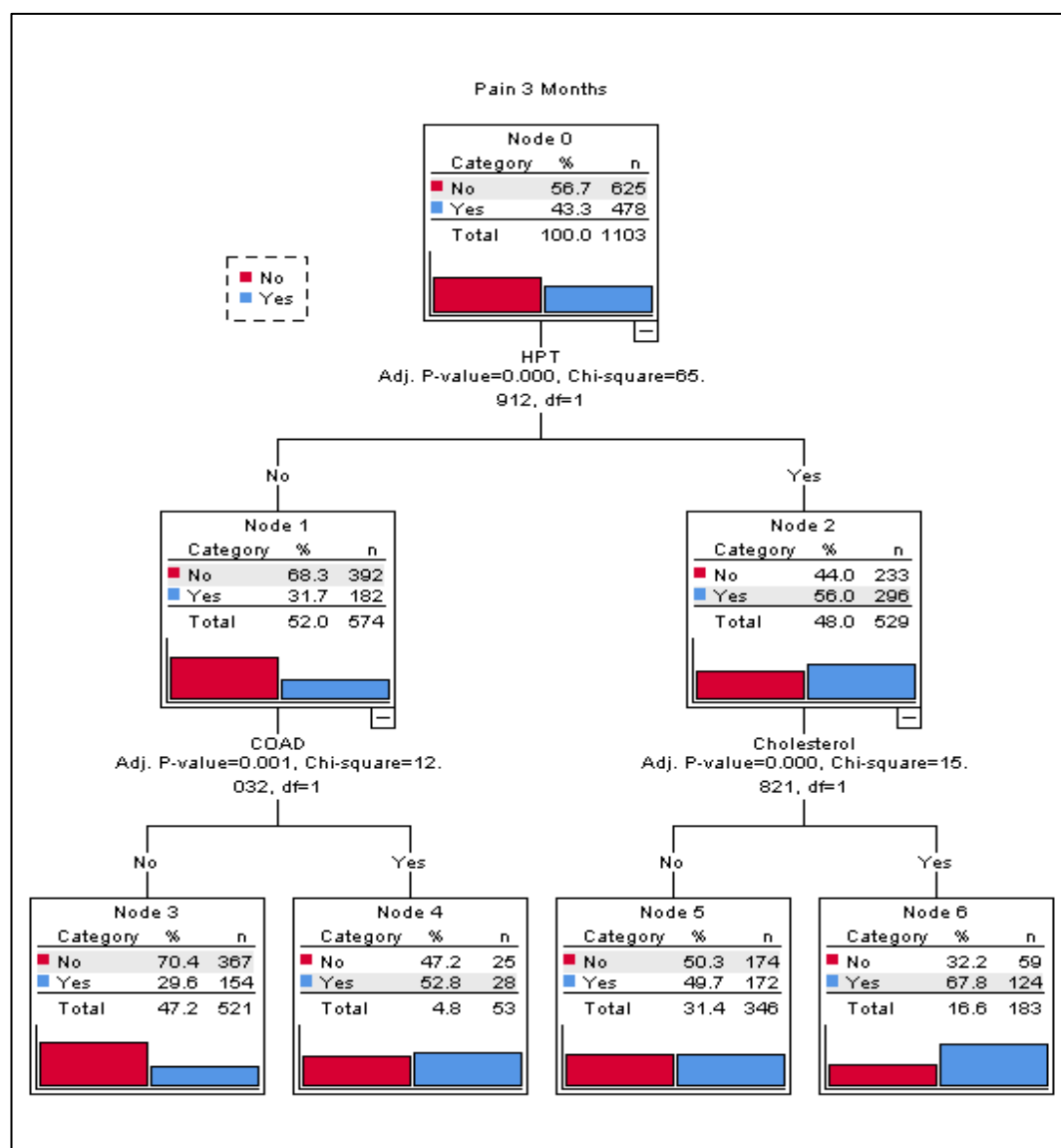


MSD=Musculoskeletal Disease; WHR=Waist-Hip Ratio; PA=Physical Activity

Figure 14: Proportional changes in chronic MSD and risk factors over the adult lifespan

4.9 Association between Presence of Musculoskeletal Disease, Chronic Diseases of Lifestyle, and Risk Factors

Chi-Square Automatic Interaction Detector (CHAID) was used to analyze the association of CDL and risk factors with the outcome variable of the presence or absence of chronic MSD (pain 3 months) (Figure 15). The outcome was the presence (blue bar) or absence (red bar) of chronic MSD and the variables entered into the first CHAID analysis were all the CDL, hypertension, hypercholesterolaemia (cholesterol), cardiovascular disease, type 2 diabetes mellitus, COAD and mental illness.

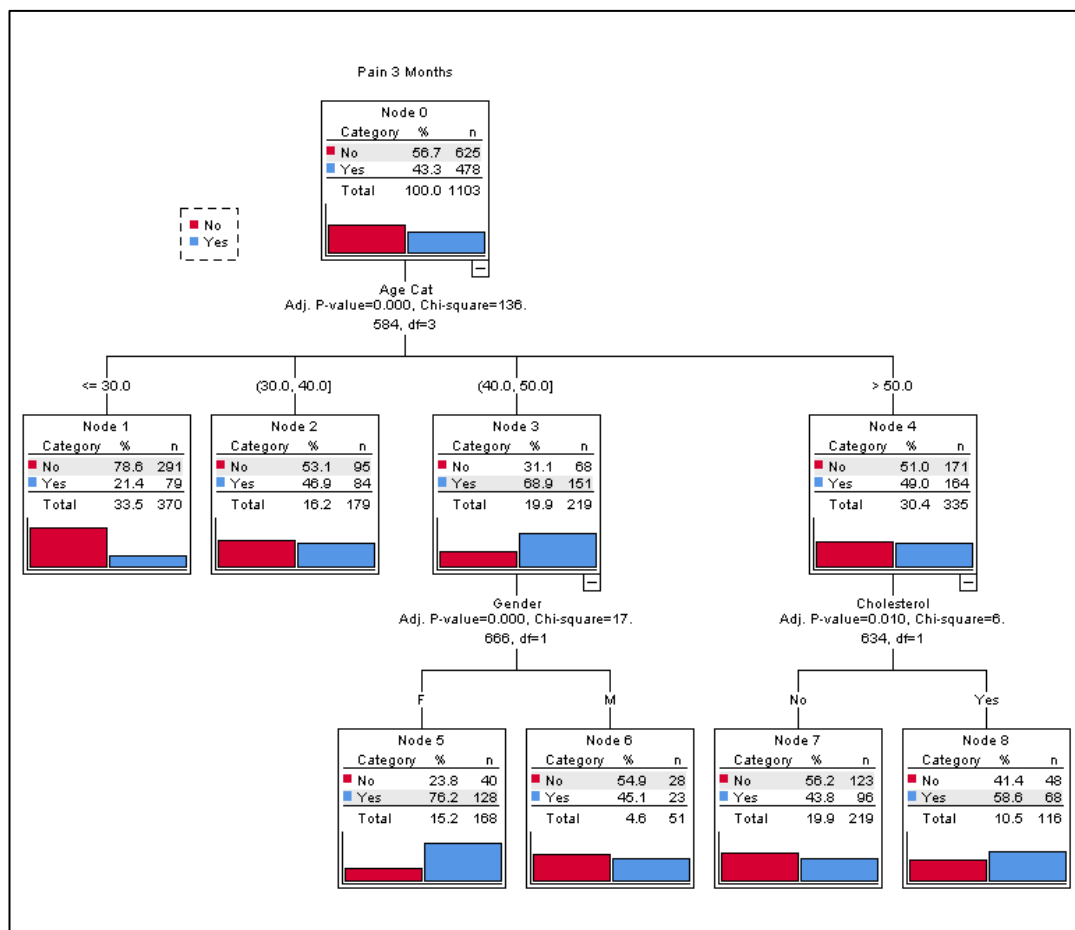


Pain 3 Months=Chronic Musculoskeletal Disease; HPT=Hypertension; COAD=Chronic Obstructive Airway Disease; Cholesterol=Hypercholesterolaemia
n=1103 with MSD; 12 missing

Figure 15: CHAID analysis of relationship between MSD and CDL

In this analysis, hypertension emerged as the being the most associated with MSD (Chi-Square=65.9; $p<0.001$) with 56.0% of those with hypertension also reporting chronic MSD, compared to 31.7% without hypertension reporting chronic MSD (blue bars). In those with hypertension, hypercholesterolaemia was most associated with MSD (67.6% of those with hypertension and hypercholesterolaemia had chronic MSD, compared to 50.3% of those who had hypertension but no hypercholesterolaemia). In those who did not have hypertension, COAD was most associated with 52.8% of those with COAD reporting chronic MSD, compared to 29.6% of those without COAD. The other CDL were not significantly associated with chronic MSD, in the presence of those included above.

As there was an almost linear increase in the proportion of CDL across the age categories, it was clear that age was an important factor and the second CHAID analysis included all the CDL as listed above, plus the age categories (Figure 16).



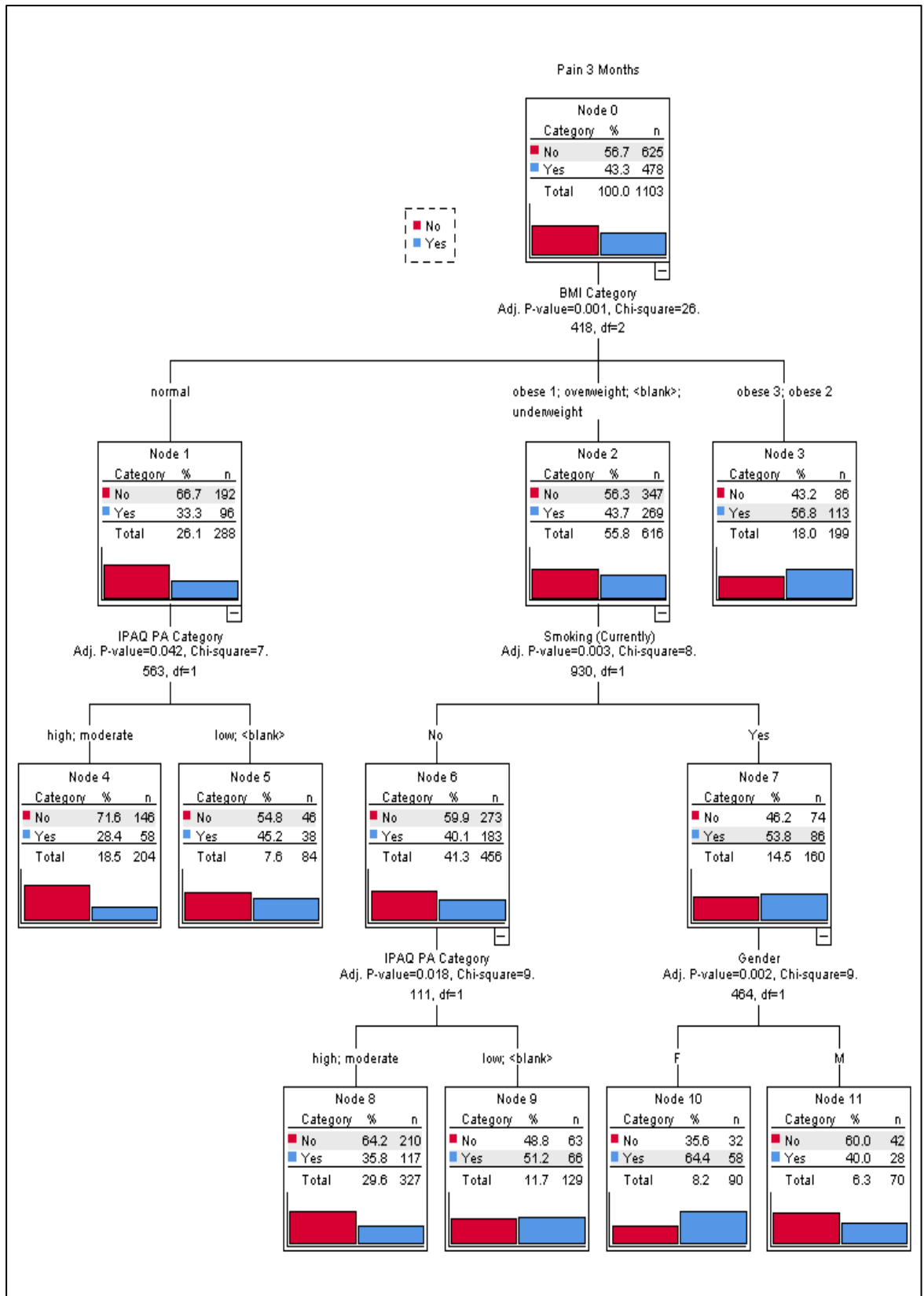
Pain 3 Months=Chronic Musculoskeletal Disease; Cholesterol=Hypercholesterolaemia

n=1103 with MSD; 12 missing; 20=20-29 yrs; 30=30-39 yrs; 40=40-49 yrs; 50=50-59 yrs; 60=60-69 yrs; 70=70 yrs and older

Figure 16: CHAID analysis of relationship between MSD and CDL with age included

Once age was included in the analysis (Figure 16), the relationship with most of the CDL fell away and it was apparent that age was most associated with MSD (Chi-Square=136.6; $p<0.001$), with the greatest percentage of those with chronic MSD in the 40-49 years of age category (68.9% of those in the category). As was seen when the proportion of MSD was plotted against age, those who were older than 50 years of age had a lower percentage of chronic MSD (49.0% of those in the category) which was similar to the 30-39 year old category. In those between 40-49 years of age, gender was associated with chronic MSD (Chi-Square=17.7; $p<0.001$) with 76.2% of females in this age group reporting chronic MSD, compared to 45.1% of males.

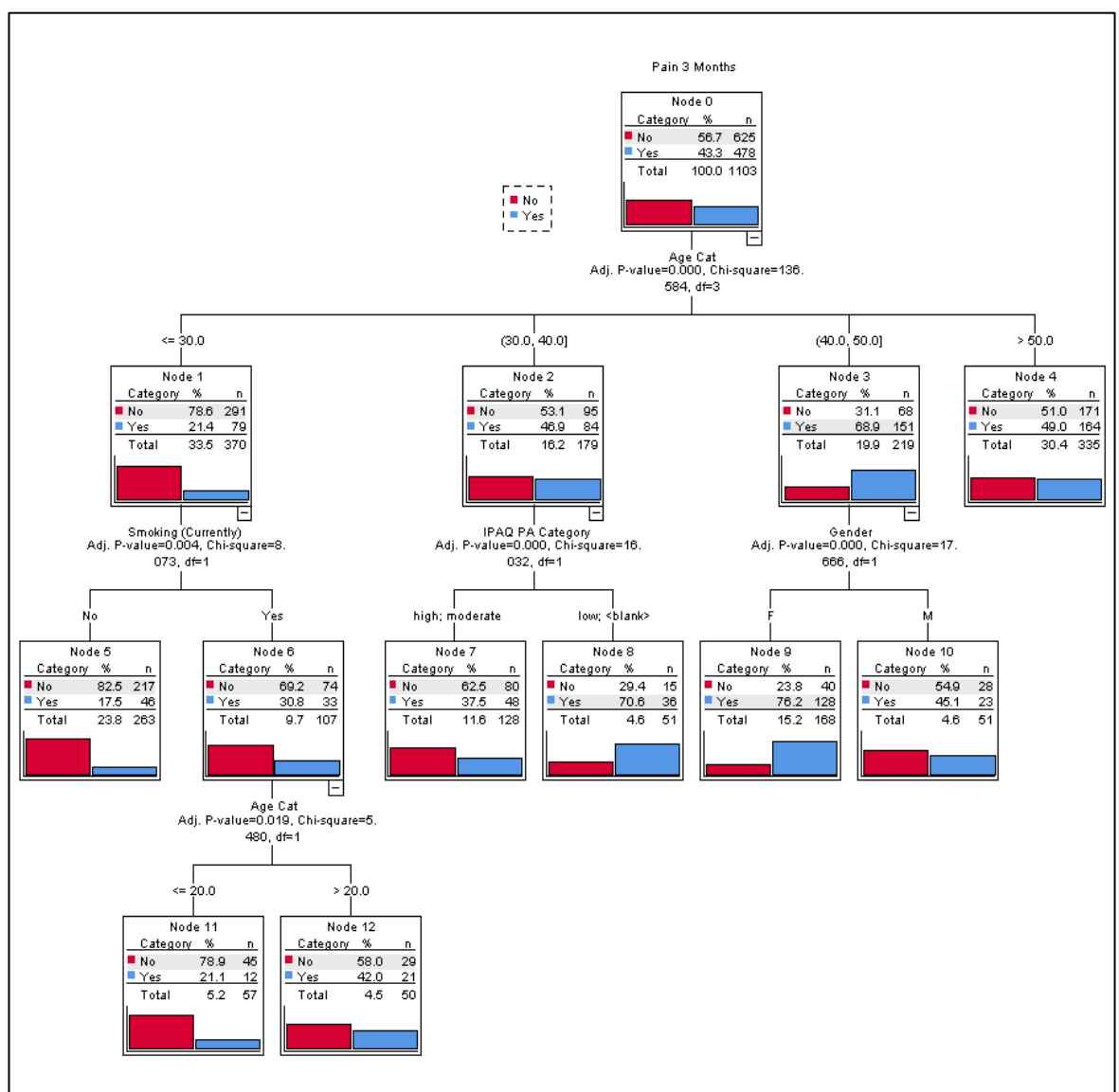
In the third CHAID analysis (Figure 17), the following risk factors were included: levels of physical activity, obesity categories, smoking, and alcohol use. Gender was also included as it appeared that gender might be associated with the different risk factors. BMI category emerged as being the most strongly associated with chronic MSD (Chi-Square=26.4; $p<0.001$), with 56.8% reporting chronic MSD in the "obese 2" and "obese 3" categories, compared to 33.3% in the normal weight category. physical activity was associated with chronic MSD in the normal BMI category, with a higher proportion of those with a low level of physical activity reporting MSD 53.8%, compared to 40.1% of non-smokers. In non-smokers there were more reporting MSD in the low physical activity category (51.2%) compared to the high category (35.8%). In smokers, gender was associated with chronic MSD, with 64.4% of women smokers reporting MSD compared to 40.0% of the males.



Pain 3 Months=Chronic Musculoskeletal Disease; IPAQ=International Physical Activity Questionnaire; PA=Physical Activity n=1103 with MSD; 12 missing

Figure 17: CHAID analysis of relationship between MSD and risk factors

The final analysis, which included age categories, yielded different results as age emerged as having the highest association (Chi-Square=136.6; $p < 0.001$) as reported in Figure 18. In the younger age group, smoking emerged as being a risk factor (30.8% of smokers had chronic MSD compared to 17.5% of non-smokers). In the smokers, being in an age category higher 20-29 was associated with an increased risk (42% compared to 21.1%). In the 30-39 and 40-49 age groups, low levels of physical activity were associated with chronic MSD (70.6% compared to 37.5% of those with high levels). Gender emerged as a factor in the 40-59 categories with 76.2% of females in this age category reporting chronic MSD compared to 45.1% of the males.



Pain 3 Months=Chronic Musculoskeletal Disease; IPAQ=International Physical Activity Questionnaire; PA=Physical Activity
 n=1103 with MSD; 12 missing

Figure 18: CHAID analysis of relationship between MSD and risk factors including age

4.10 Impact of MSD and CDL on Impairments and Health-Related Quality of Life

This section explores the impact on impairments associated with MSD, such as pain and stiffness, and on the HRQoL via the European Quality of Life-5 Dimensions (EQ-5D). Associations between gender, age and HRQoL will be presented, followed by analysis of the relationships between acute and chronic MSD and health index and health status scores as rated on the visual analogue scale (VAS).

4.10.1 Impairments of Function - Pain

As noted previously, prevalence of MSD was reported using the Community Orientated Program for Control of Rheumatic Diseases (COPCORD) questionnaire. The Brief Pain Inventory (BPI) was used to report on pain severity, using the pain severity score (PSS), and pain interference, using the pain interference score (PIS). Results obtained using the BPI for those reporting MSD is shown in Table 24. The mean PSS was 5.4 (SD=1.4) and the mean PIS was 5 (SD 2.2). The greatest interference was with sleep (5.8; SD=3.2).

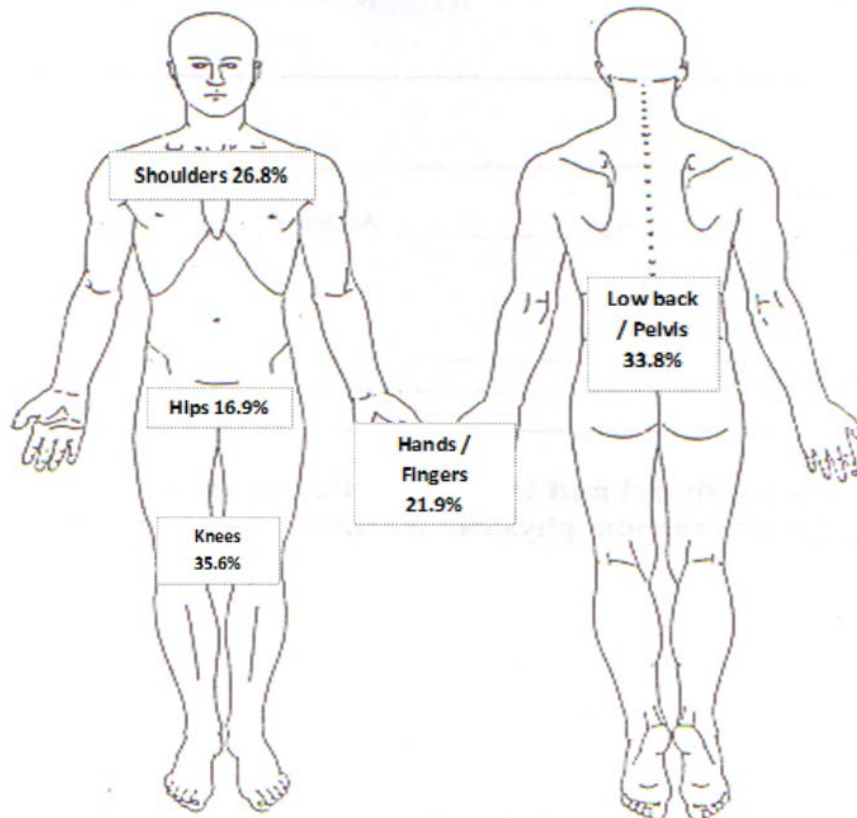
Table 24: Pain severity and pain interference scores reported by participants with MSD (Brief Pain Inventory)

Variable	Frequency	Mean	SD
BPI Worst	257	8.0	1.7
BPI Least	256	3.5	2.1
BPI Average	257	5.5	1.9
BPI Now	257	4.5	3.1
BPI Pain Severity Score	257	5.4	1.4
BPI General Activity	256	5.8	2.7
BPI Mood	256	5.4	3.3
BPI Walking Ability	256	5.4	3.2
BPI Normal Work	256	5.7	3.0
BPI People	254	2.7	3.0
BPI Sleep	255	5.8	3.4
BPI Life Enjoyment	255	3.9	3.2
BPI Pain Interference Score	256	5.0	2.2

BPI=Brief Pain Inventory; SD=Standard Deviation

Scale of 0 – 10; 0 = no pain/does not interfere and 10 = pain as bad as you can imagine/completely interferes

Common anatomical sites of MSD are shown in Figure 19 below. The most common sites of MSD amongst the study sample were the knees (35.6%; 95% CI: 31.5-39.9%), low back/pelvis (33.8%; CI: 29.8-38.0%), shoulders (26.8%; CI: 23.1-30.9%), and hands/fingers (21.9%; CI: 18.5-25.7%).



n=503 respondents; multiple sites

Figure 19: Most common painful anatomical sites reported in participants with MSD

Table 25 expands on the sites of MSD as reported by the study sample, as well as the time of onset of pain, the average duration of pain, and a description of the 24 hour behaviour of pain. Participants reported multiple sites of pain. In females, the most prevalent areas of reported pain were the knees, shoulders, and low back, while males reported a higher prevalence of MSD in the hips, wrists, and head/neck.

Table 25: Self-reported sites and description of MSD

Pain Characteristic		Frequency	% of total sample (N=1115)	% of those reporting any MSD (n=503)
Site (Multiple responses)	Lower limb			
	Knees	179	16.1	35.6
	Hips	84	7.5	16.9
	Ankles	72	6.5	14.3
	Feet/Toes	69	6.2	13.7
	Spinal			
	Low back	170	15.3	33.8
	Head/Neck	67	6.0	13.3
	Mid back	54	4.8	10.7
	Upper limb			
	Shoulders	135	12.1	26.8
	Hand/Fingers	110	9.9	21.9
	Wrists	72	6.5	14.3
	Elbows	66	5.9	13.1
Pain Onset (n=429, 76 missing data)	Last 7 days	29	2.6	6.8
	Last 3 months	62	5.6	14.5
	3-12 months ago	47	4.2	11
	>12 months ago	244	21.9	57
	Undisclosed	46	4.1	10.75
Pain Duration (n=429, 76 missing data)	Few hours	223	20.0	52
	Few days	106	9.5	24.7
	4-6 weeks	16	0.1	3.7
	6-12 weeks	2	0.2	0.5
	> 3 months	40	4.6	9.3
	Undisclosed	42	3.8	9.8
24 hour behaviour of pain (n=429, 76 missing data)	Morning	110	9.9	25.7
	During activity	82	7.4	19.2
	Night	172	0.2	40.2
	Stays the same	24	2.2	5.6
	Undisclosed	40	3.6	9.35

MSD=Musculoskeletal Disease

N=1115; Females n=803; Males n=312

MSD management strategies reported by the study sample are shown in Table 26 below.

The most common management strategy was the use of analgesia, both prescribed (52%)

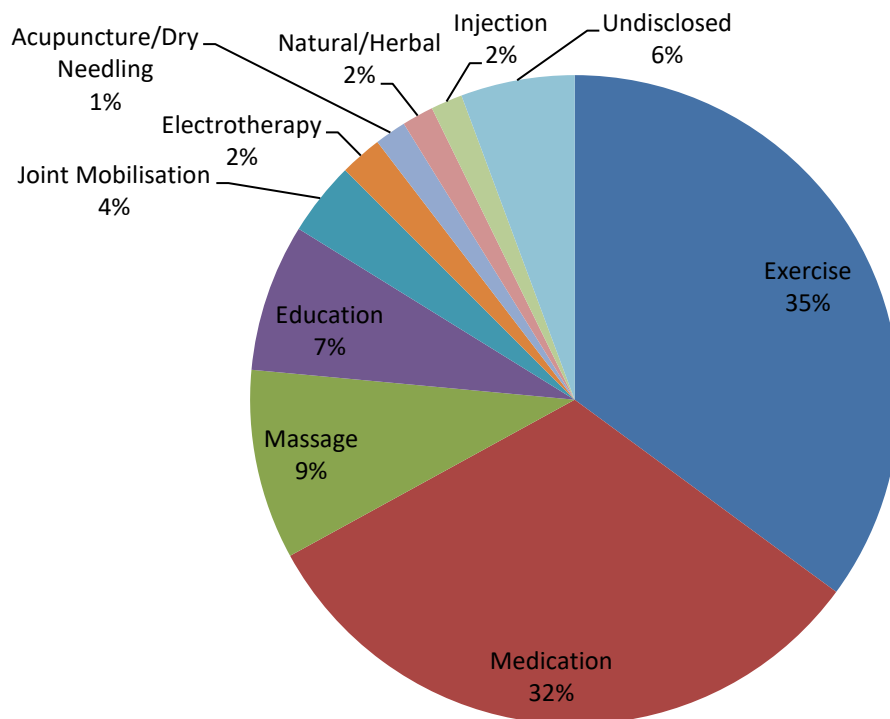
and used over-the-counter (25.7%). Dosages were not recorded. The most commonly used non-pharmacological management strategy reported was exercise (19.7%).

Table 26: Self-reported MSD management strategies

Pain Management Strategy	Frequency	% with MSD (n=505)	% of total sample (N=1115)
Medication (n=401)			
Prescribed oral analgesia	209	52.1	18.7
OTC analgesia	103	25.7	9.2
No medication	72	18.0	6.5
Prescribed oral NSAIDs	69	17.2	6.2
Natural remedies	20	5.0	1.8
Other medication	16	4.0	1.4
OTC NSAIDs	14	3.5	1.3
Injection	10	2.5	0.9
Undisclosed	11	2.7	1.0
Effect of Medication (n=332)			
Helped	272	81.9	24.4
Did not help	49	14.8	4.4
Undisclosed	11	3.3	1.0
Other Treatments (n=401)			
Only Medication	274	68.3	24.6
Exercise	79	19.7	7.1
Massage	31	7.7	2.8
Education	25	6.2	2.2
Joint mobilisation	19	4.7	1.7
Other treatment	15	3.7	1.35
Herbal/Natural Strategies	12	3.0	1.1
Electrotherapy	9	2.2	0.8
Acupuncture/Dry needling	7	1.75	0.6
Strapping /Bracing	3	0.75	0.3
Undisclosed	11	2.7	1.0

MSD=Musculoskeletal Disease; OTC= Over-the-counter; NSAIDs=Non-Steroidal Anti-Inflammatory Drugs

Participants further described which management strategy was most effective in reducing their MSD symptoms. A single response was required, and 191 participants responded to this question. As seen in Figure 20, 68 participants (35.6% of those responding) reported that exercise was the best management strategy for MSD, while 61 (32.0%) reported that oral medication provided the most relief. No participants reported strapping or bracing to be the best management strategy for their pain.



n=191

Figure 20: Self-reported best management strategy for MSD

4.10.2 Impairments of Function - Stiffness

A summary of characteristics of self-reported joint stiffness can be seen in Table 27. These characteristics include the site(s) of stiffness, morning stiffness, and whether movement relieves stiffness and any previous diagnosis of rheumatism recalled by the study sample. All participants were asked about stiffness.

The most common sites of stiffness were the knees (47%; 95% CI: 41.6-52.8%), low back (40%; CI: 34.7-45.8%), and shoulders (32.7%; CI: 27.7-38.3%). Of the 23.5% of the sample reporting joint stiffness (n=299), 84.6% reported that stiffness decreased with movement.

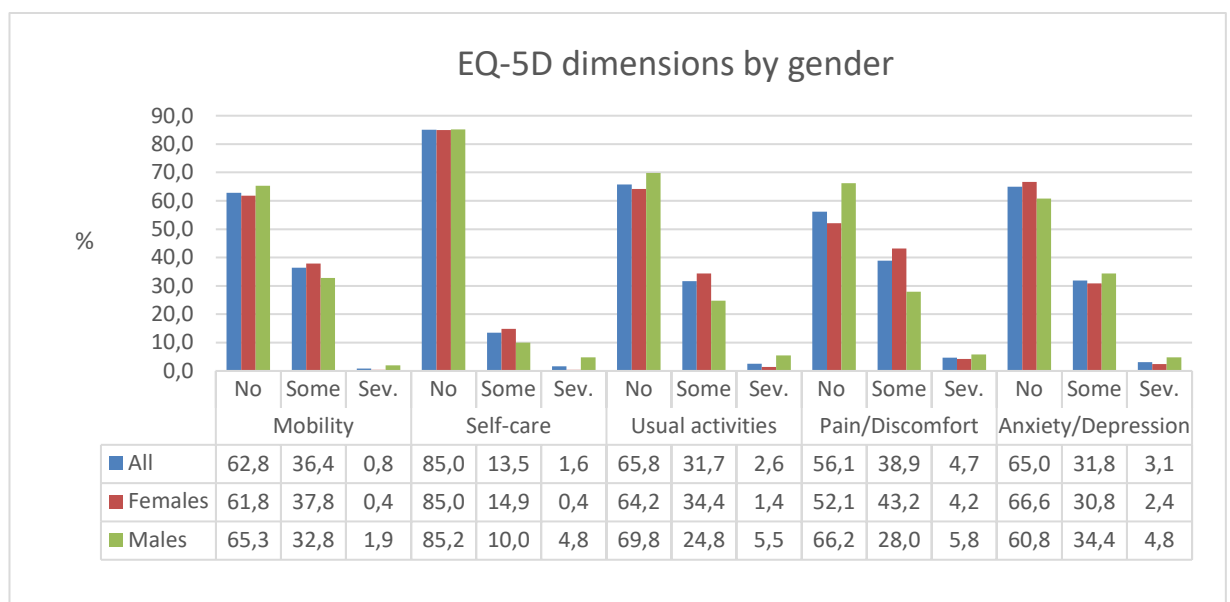
Table 27: Characteristics of self-reported joint stiffness

Joint Stiffness Characteristic	Frequency of sample	% of sample
Morning stiffness	299	27.8
Site of stiffness		
Neck	43	14.3
Mid back	29	9.7
Low back	120	40.0
Shoulder(s)	98	32.7
Elbow(s)	38	12.7
Wrist(s)	49	16.3
Hand(s)/Finger(s)	77	25.7
Hip(s)	70	23.3
Knees(s)	141	47.0
Ankle(s)	56	18.7
Feet/Toe(s)	27	9.0
Movement relieves stiffness	253	84.6

n=1076

4.10.3 Health-Related Quality of Life

A description of the five domains of the EQ-5D across gender is seen in Figure 21.



n=109; Female n=785; Male n=31; Missing n=19; Sev.=Severe

Figure 21: EQ-5D dimensions by gender

The dimension with the least problems overall was self-care (85% no problems) and the most problems were reported in the pain dimension (65% no problems). Females reported more problems in each dimension apart from anxiety/depression and there was a significant difference between females and males in the pain/discomfort ($z=3.71$; $p<0.001$) and anxiety/depression ($z=-2.05$; $p=0.041$) dimensions.

The mean EQ-5D health index score for females was 0.78 (SD=0.25), and for males was 0.76 (SD=0.31). No significant difference was found between gender and the health index score ($t=1.166$; $df=1088$; $p=0.244$). The mean health status VAS score for females was 69.9 (SD=21.9) and for males was 71.0 (SD=22.0). Again, no significant difference was found between gender and the health status VAS score ($t=-0.750$; $df=1094$; $p=0.453$).

4.10.3.1 Age and Health-Related Quality of Life

The EQ-5D health index and VAS scores of the sample are further described by age category in Figure 22 and Figure 23. The mean health index score ranges from 0.70 to 0.88 and display an almost linear trend, with the highest mean of 0.88 being found in the 18-29 age group and the lowest was in the 50-59 and over 70 age groups.

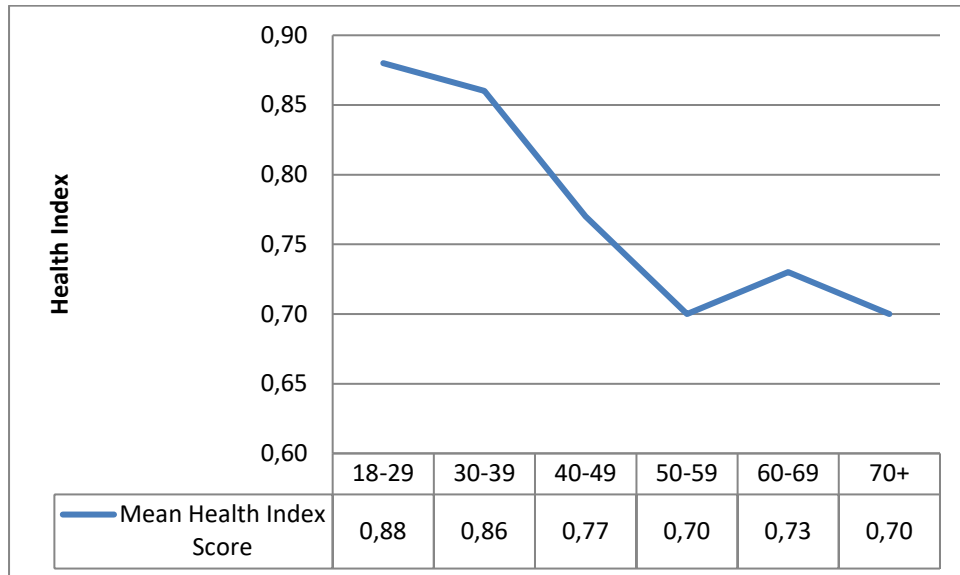


Figure 22: Mean EQ5D health index score by age group

The health index, which represents a preference based composite score of the dimensions, shows a linear downward trend until 60 years of age at which it appears to stabilise at around 0.7-0.73 (Figure 22).

The VAS, a measure of perceived global health, shows a similar linear downward trend until 60 years of age when it stabilises at 71% (Figure 23).

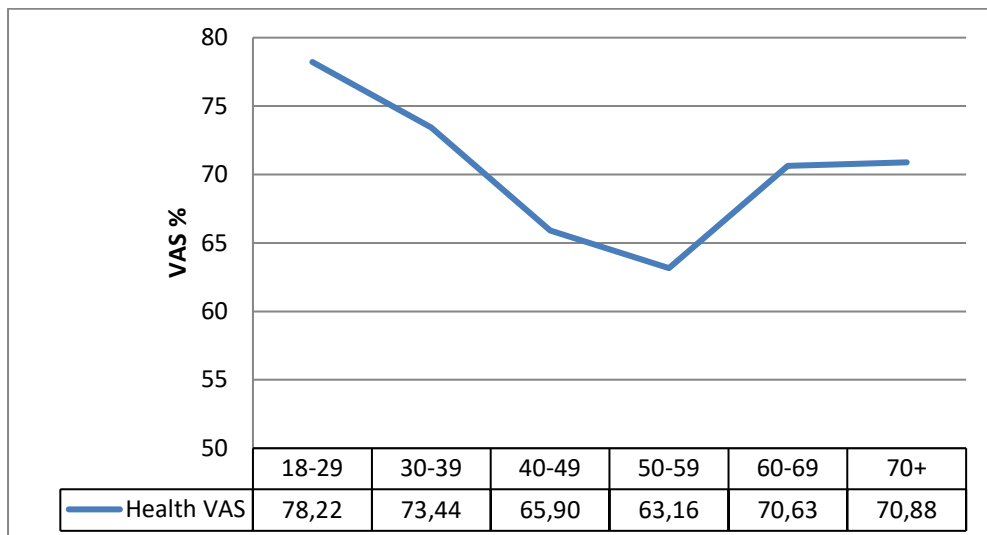


Figure 23: Mean EQ5D health VAS score by age group

4.10.3.2 MSD, CDL and Health-Related Quality of Life

A description of the five domains of the EQ-5D of those with and without chronic MSD is seen in Figure 24.

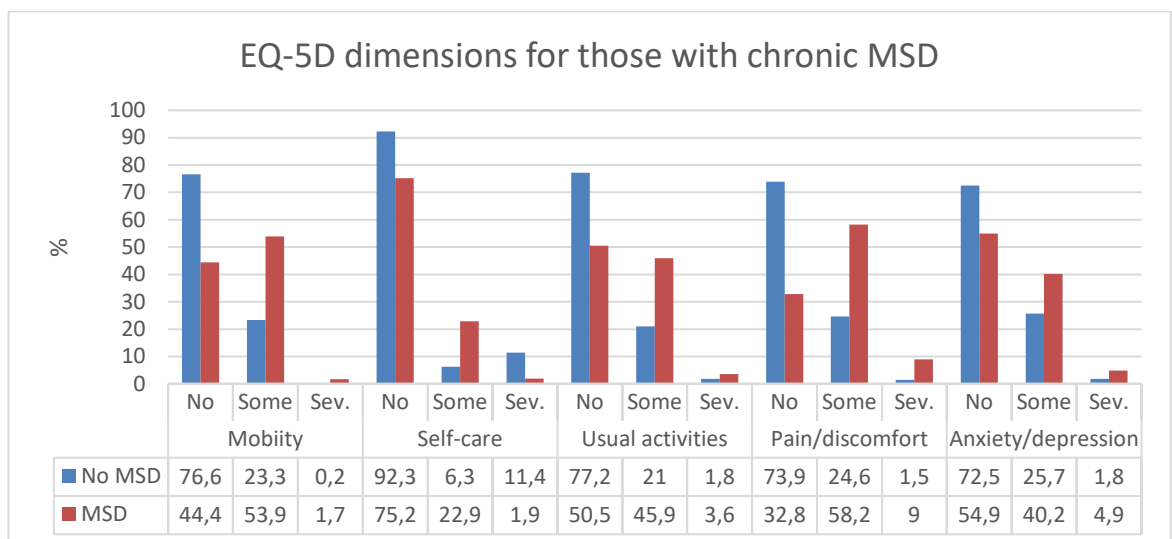


Figure 24: Percentage responses to the EQ-5D dimensions for chronic MSD

Those with chronic MSD reported having the most problems in the pain/discomfort and the mobility dimensions (33% and 44% reporting no problems respectively). In the usual activities and anxiety/depression dimensions, 50% and 55% reported no problems respectively. The least number of problems (75.2% no problems) was experienced in the self-care dimension.

As can be seen in Table 28, the poorest self-perceived health was in those with mental illness (VAS=56% and Health Index=0.6). Hypertension seemed to have the least impact on HRQoL (VAS =67% and Health Index=0.72). In every condition, the VAS and Health Index scores were significantly less in those reporting the health condition and the differences in scores was greatest for those with mental illness (VAS=15 % and Health Index=0.18) and chronic MSD (VAS=12% and Health Index=0.20).

Table 28: Comparison of the EQ-5D Index and VAS scores between those with and without chronic health conditions.

Condition		Yes n	Yes Mean	Yes SD	No n	No Mean	No SD	t-value	df	p	Dif
Chronic MSD	VAS	470	63.5	21.5	623	75.2	20.7	9.1	1091	<0.001	11.70
	Index	469	0.66	0.3	619	0.86	0.21	12.48*	813.5	<0.001	0.20
Hypertension	VAS	525	67.4	20.0	571	72.7	23.2	4.02	1089	<0.001	5.30
	Index	523	0.72	0.3	567	0.82	0.27	6.38	1059	<0.001	0.10
Cardiovascular disease	VAS	73	64.1	21.2	1023	70.6	21.9	2.5	1094	0.014	6.50
	Index	73	0.69	0.21	1017	0.80	0.27	2.8	1088	0.005	0.11
Hypercholesterolaemia	VAS	221	63.5	21.5	875	71.8	21.7	5.1	1094	<0.001	8.30
	Index	219	0.66	0.3	871	0.80	0.25	6.42*	296.8	<0.001	0.14
COAD	VAS	119	61.3	21.6	977	71.2	21.7	4.7	1094	<0.001	9.90
	Index	120	0.70	0.3	970	0.78	0.27	2.69*	141.7	0.008	0.08
Mental illness	VAS	26	55.6	28.8	1070	70.5	21.6	2.62*	25.69	0.010	14.90
	Index	27	0.60	0.4	1063	0.78	0.37	2.46*	26.69	0.020	0.18

MSD=Musculoskeletal Disease; COAD=Chronic Obstructive Airway Disease

*tested with separate variances.

4.11 Summary of Results

This section summarises the main results and emphasises those that are related to the objectives of the study as outlined in the Introduction.

There were 1115 participants who were interviewed, with a mean age of 48.7 (SD=16.8) years. Pain persisting for longer than the last three months (chronic MSD) was reported in 43.3% (95% CI: 40.4-46.3) of participants. A significant association was found between gender and chronic MSD, with a higher proportion of females reporting pain.

More than three quarters of the sample reported at least one CDL. hypertension was the most prevalent condition (47.8%; CI: 44.8–50.7%), followed by type 2 diabetes mellitus (21.4%; CI: 19.1-23.9%), and hypercholesterolaemia (20.2%; CI: 17.9-22.6%). Higher proportions of these common CDLs were reported by females. The prevalence of all chronic diseases except COAD increased with age. However, both acute and chronic MSD peaked around the 50-59 year old age category and then decreased thereafter.

Female gender was associated with a higher prevalence of hypertension, hypercholesterolaemia, and type 2 diabetes mellitus. In bivariate analysis, significant associations were found between chronic MSD and hypertension ($p<0.001$), cardiovascular disease ($p<0.000$), type 2 diabetes mellitus ($p=0.002$), and hypercholesterolaemia ($p<0.001$). A significant association (Chi-Square=13.833; df=2; $p=0.001$) was found between chronic MSD and physical activity levels, with a higher proportion of those reporting no pain having higher levels of physical activity. Similarly, bivariate analysis detected significant associations between smoking and both acute and chronic MSD, and all CDL's except mental illness and other CDL. No significant association was found between alcohol use and MSD.

However, multivariate analysis with CHAID revealed that the associations with MSD were more complex and that age was the primary factor influencing MSD, with the lowest prevalence of MSD in those under 30 and the highest prevalence in those between 40-59 years of age. Once age was included, an association remained only with gender (females had a higher prevalence of MSD) in the 40-59 years age groups and presence of hypercholesterolaemia in the older respondents. With regard to association between MSD and risk factors, the inclusion of age similarly altered the relationships and the risk factors

varied considerably between age groups, with smoking emerging in those younger than 30, low levels of physical activity in the 30-49 age groups and gender in the 40-59 age groups (as in the analysis of MSD and CDL).

With regard to the impact of MSD on impairments of function, lower limb and spinal pain were reported by at least 34% of respondents. Upper limb pain was less prevalent but still reported by at least 27%. Treatment for MSD included medication in 80% of those with MSD while 20% had been given exercise, 8% massage and 5% joint mobilization. Exercise and medication were reported to be the most effective interventions. The BPI mean scores were approximately midway between no pain/no interference and worst imaginable pain/complete interference.

With the exception of self-care, 50% or more of those with MSD reported having some or severe problems in the dimensions of the EQ-5D. HRQoL showed a linear downward trend with age in the health index with the lowest point at 50-59 years. The VAS also decreased until 50-59 years but then showed an increase of about 7% and stabilized as that value. In every case those with a health condition reported significantly worse HRQoL in both the health index and the VAS, the greatest difference being between those with mental illness followed by chronic MSD.

5 DISCUSSION

The aims and objectives of this study were successfully addressed by the research and the results presented in the previous chapter will be discussed in this chapter.

The current study shows that among patients attending a community health centre (CHC), there was a high prevalence of chronic diseases of lifestyle (CDL), particularly hypertension (HPT). The prevalence of musculoskeletal disease (MSD) was also high (43.3%; CI: 40.4-46.3%), with a higher prevalence among females. The association between MSD and CDL, as well as MSD and risk factors, proved to be complex. The general linear increase in prevalence with increasing age gave rise to bivariate associations which then diminished once age was included in analysis.

Interestingly, the results showed that the trends in increasing prevalence reversed after 60 years of age with regard to chronic MSD, obesity and high levels of physical activity (PA). In addition, health-related quality of life (HRQoL) appeared to increase after 60 years of age. A further finding of interest is that there was no correlation between metabolic equivalent of a task minutes (MET-minutes) and body mass index (BMI) and that a large proportion of the respondents, despite the high prevalence of obesity (over 50% in females), reported high levels of physical activity (46%). Both the levels of obesity and physical activity were considerably lower in males.

5.1 Participant Characteristics

The characteristics of the participants in this study will be discussed below. The sample and response rate is firstly elaborated upon, followed by relevant descriptive, socio-economic and clinical characteristics of the sample.

5.1.1 Recruitment and Sample

A response rate of 90.2% was achieved for this study. Approximately 89% of the participants recruited completed the required anthropometric measurements. This is in keeping with previous studies also conducted in this study setting, as it is quite usual for the total number of respondents to not complete clinical tests required for some studies¹³³.

This occurs especially if clinical testing is done in a different room or building to where questionnaires or interviews are completed¹³³ as occurred in this study.

Over 70% of the participants recruited were female, with the highest proportion (20%) of respondents between the ages of 50 and 59 years. Previous literature has shown that females are generally more concerned about their health and will seek medical assistance more often than males.^{49,282,283} In addition to this, in the Mitchells Plain area there is a high percentage of unemployment amongst females due to not finding suitable employment, being housewives, or being retired. Therefore for socio-economic reasons, these females are forced to seek medical assistance at the state provided primary health care centres.²⁸⁴

Over one third of the sample reported being unemployed. This is supported by data supplied by Statistics South Africa in the 2011 census where 68% of the work force in the Mitchells Plain health district were reported to be employed.²² According to the International Labour Organisation (ILO), the 2017 rate of employment in global developing countries is 93.8%, while in Sub-Saharan Africa and South Africa the employment rate is 92.8% and 74% respectively.²⁸⁵ A monthly income of R1001-R2000 was reported by almost half of the sample of this study. This is also supported by the 2011 census where 61% of households reported to have a monthly income of R3200 or less.²² The 2011 census also found that 32% of those aged 20 years and older have completed Grade 12 or higher.²² This was found to be higher than the results in this study where more than one quarter of the participants did not surpass the primary level of schooling (i.e. grade 7), and 15.9% completed grade 12 and 2.5% completed tertiary studies.

Socioeconomic status (SES) is described in three categories (high SES, middle SES, and low SES).²⁸⁶ This describes how the families or individuals are categorised.²⁸⁶ When selecting the appropriate category income, education, and occupation are assessed.²⁸⁶ Based on the results of this study, Mitchells Plain would be deemed to have a low SES, which is in keeping with previous statistics.²⁸⁷ Earlier research has found that there is a weak correlation ($r=0.22$) between SES and academic achievement.²⁸⁸ The low socioeconomic status of the sample could also be attributed to the fact that services at the CHC are free of charge and specifically cater for the low-income population.²³

A large proportion of the participants were attending the CHC for management of a chronic condition, which is in keeping with research and estimates for Mitchells Plain CHC.²³ In South Africa, 84% of the population is dependent on public health services,²⁸⁹ which at

primary healthcare level are nurse-led, and up to 86% of consultations are by nurses.²⁸⁹ Thus, the number of patients awaiting a medical practitioner consultation at Mitchells Plain CHC could be high, although they could have been referred by nursing staff.

5.2 Musculoskeletal Disease

In the following section results regarding MSD found in this study are discussed. This includes both acute and chronic MSD and joint stiffness. Possible risk factors and their associations with MSD are also discussed here.

5.2.1 Prevalence and Risk Factors of Musculoskeletal Disease

A prevalence of 43.3% (95% CI: 40.4-46.3%) of chronic MSD was found in the sample which corresponds with an earlier prevalence study done in rural South Africa where 42.9% (95% CI: 37.4%-47.1%) of 392 adult participants reported chronic musculoskeletal pain.⁴³ Data were collected during face-to-face interviews using undisclosed structured questionnaires, while a smaller sample size of 394 participants was used.⁴³ This quantitative cross-sectional study was carried out in the rural village of Baziya in the Transkei region of the Eastern Cape province of South Africa.⁴³ Baziya has a small estimated population of 6 000 at the time of study, with most residents aged 50 years or older.⁴³

The prevalence of chronic MSD found in this study is also similar to other previous South African literature where a prevalence rate of chronic MSD of 45.8%⁴² and 41%⁴⁴ was found. A 2013 quantitative cross-sectional study was conducted at the Manguang University of the Free State Community Partnership Program Community Health Centre in Bloemfontein in the Free State province of South Africa to determine the prevalence and functional impact of MSD.⁴² This CHC services between 19000 and 22000 patients per month,⁴² approximately half of those seen at the Mitchells Plain CHC. Three hundred and twenty-six (326) participants were included in this study, where the COPCORD and Stanford Health Assessment Questionnaires (HAQ) were completed.⁴² Similarly, another 2013 quantitative cross-sectional study conducted in the city of Tshwane (formerly known as Pretoria) in the Gauteng province of South Africa inspected the prevalence of chronic MSD.⁴⁴ A strength of this study is that it was conducted at four healthcare institutions (two CHCs and two hospitals) and 1066 adult participants were interviewed using the Brief Pain Inventory.⁴⁴

A lower prevalence of chronic MSD was found in Brazil, also classified as an upper middle income country as South Africa is, where the prevalence varied between 9.4% and 39.6%.³⁹ However, it must be noted that this research was conducted on an elderly population where the most prevalent sites of chronic MSD were the spine and lower limb. The aforementioned South Africa studies also found that the back and knees were the most commonly reported sites of MSD.^{42,44} The current study found that the most prevalent sites of chronic MSD were the knees (35.6%; 95% CI: 31.5-39.9%), low back/pelvis (33.8%; CI: 29.8-38.0%) and shoulders (26.8%; CI: 23.1-30.9%). This suggests that intervention strategies for chronic MSD should target the spine and lower limbs as these are the most common areas of pain. Compared to the global prevalence of chronic MSD of around 34.5%,³⁸ as well as of that in countries of similar socioeconomic status, the prevalence of chronic MSD within the context of this CHC is higher.

As previously stated, the suburb of Mitchells Plain has a low socioeconomic status. Literature has suggested that socioeconomic differences between countries affect MSD with a higher prevalence where there is more poverty.²⁹⁰⁻²⁹⁴ Individuals classified into the low socioeconomic status have been shown to experience an almost threefold increase in the risk of chronic MSD.²⁹³ This could be attributed to health behaviours such as smoking, physical inactivity, poor diet, and substance abuse which are closely linked to both socioeconomic status and health outcomes.²⁸⁶ Higher risks have also been shown for those with lower levels of education.²⁹⁵ In the current study, 78% of the participants earned less than R2000 per month which is well below the South African minimum wage of R20 per hour or R3500 per month as of January 2019.²⁹⁶ This supports the low socioeconomic status of the Mitchells Plain community and, together with the high prevalence of chronic MSD, highlights the link between low socioeconomic status and risk of chronic MSD in this sample.

The findings of this study supports previous evidence that the prevalence of MSD is higher among females and increasing with age.^{33,2,46} Furthermore, in previous literature, after controlling for CDL, age and socioeconomic status have been found to be statistically significant and positively associated with obesity among females, while higher education was associated with obesity in males.^{41,113} For both genders, those who were single and never married were found to be less likely to be obese than those who were married.¹¹³

A recent six-country study found an MSD prevalence of 38.5% (95% CI: 34.9-42.2%) in those older than 50 years of age in South Africa.²⁷ This study, however only looked at pain

reported in the 30 days prior to questioning. The study also found that females (34.9%; 95% CI: 33.0-36.9%), and those living in rural areas (31.5%; CI:29.2-33.8%) had a higher prevalence of pain.²⁷ Females may be more pain sensitive and have a less efficient internal pain inhibitory capacity compared to males.¹⁰⁴ Other factors such as expectancies, conditioning, and ovarian hormones, which can change the neurophysiology of pain, could also attribute to the difference in the reporting of pain between males and females.⁵⁰ In older females, factors such as BMI, systolic blood pressure (SBP), and depressive symptoms have also been found to be associated with MSD.²⁹⁷ Also, pertinent to the context of South Africa, a socially and culturally diverse country, are the findings that socio-cultural beliefs about femininity and masculinity have also been determined to have an effect on different gender pain responses. This is because it is generally more socially acceptable among females to express pain than among males.¹⁰⁷ This may lead to biased reporting of pain.¹⁰⁷

5.2.2 Management of Musculoskeletal Disease

The most common treatment for MSD-related pain at the CHC was oral analgesia, of which almost three quarters of those using medication reported that it did not reduce their pain. Interesting, only 191 participants provided an answer to the best management of their MSD. This could be due to participants using alternative methods of pain relief that were not listed as possible management strategies. Strategies such as traditional medicine were not listed in the questionnaires as they were considered out of the scope of this dissertation. This could be a possible limitation of the current study. Another possible reason could be attributed to the interpretation that none of the listed management strategies improved the MSD. However, over 37% of participants with MSD reported that exercise was more helpful than oral medication in managing their pain. Exercise had been shown to increase pain thresholds and tolerance.^{298,299} This could be attributed to the endogenous opioid system as well as an increase in mood post exercise due to the release of mood enhancing neurotransmitters.

This study found that various forms of Paracetamol were being used by 8% of the sample, making it the most prescribed analgesic. Despite the findings that a large proportion of respondents reported exercise to be more beneficial than oral medication, pharmacological intervention of MSD has still been found to be first line of management within the primary health care sector of South Africa.³⁰⁰

5.3 Chronic Diseases of Lifestyle

This section addresses the objective to determine the proportion of people with CDL occurring in an adult population attending medical services at a CHC in Cape Town, South Africa.

This study found that more than three quarters of the sample reported being diagnosed with at least one of the CDL. Hypertension was the most prevalent condition in both genders, followed by type 2 diabetes mellitus and hypercholesterolaemia. This has been found in South African literature where hypertension (13.1%³⁰¹-63%¹³) is the most common CDL encountered at primary healthcare level. This is followed by type 2 diabetes mellitus (3.9%),³⁰¹ and COAD (0.6%).³⁰¹ Hypertension has also been found to most commonly occur in conjunction with type 2 diabetes mellitus.³⁰¹ In South Africa, it has been shown that the risk of developing hypertension is twofold in those that are obese.¹⁶⁶ As over half of the participants in this study were overweight or obese, this could be a possible contributing factor to the high prevalence of hypertension.

The prevalence of mental illness found in this study was less than the global prevalence.²⁹ However, it has been shown that the prevalence of mental disorders is less in developing than developed countries.³⁰² This could be attributed to the increased stigma and various cultural views around mental disorders in developing countries.⁴¹ A high proportion (30%) of other CDL was reported as well. Unfortunately, no further investigation was done to determine what "other" CDL could have been. Within the South African context, it may be presumed that a large portion of the "other" CDL may be attributed to HIV/AIDS (Human Immunodeficiency Virus/Acquired Immunodeficiency Virus). Currently, in South Africa, the estimated total number of people living with HIV has increased from 4,25 million in 2002 to 7,52 million in 2018 and therefore, for 2018, it is estimated that 13,1% of the population is HIV positive.³⁰³

5.4 Changes and Associations between Musculoskeletal Disease, Chronic Diseases of Lifestyle, and Risk Factors over the Adult Lifespan

The proportional changes in CDL and MSD across six age categories within the study sample is discussed here. All chronic diseases except chronic obstructive airway disease (COAD) continually increased with age, while COAD and both acute and chronic MSD peaked around the 50-59 year old age category and then decreased with age. The proportional increase in chronic MSD with age has been widely shown in previous research.⁴¹ This trend was found in both developed and developing countries,⁴¹ which leads to the deduction that socioeconomics, demographics, and culture may not play a big role in the development of chronic MSD and confirms that chronic MSD is quite prevalent in the global general population.

Similar proportional changes in MSD and CDL were illustrated in females where all chronic diseases except COAD continually increased with age, while COAD and both acute and chronic MSD peaked around the 50-59 year old age category and then decreased with age. In males, the proportion of participants with MSD and CDL, continually increased with age. Again, the findings on prevalence and gender distribution of MSD in this study is quite consistent with that of previous literature.⁴¹

Multivariate analysis using Chi-Square Automatic Interaction Detector (CHAID) indicated that the association between chronic MSD and CDL fell away once age categories were entered into the analysis. Thus, the primary association was with age. However, although not associated once age is factored in, all the CDLs were present and increased with age. Whilst the highest initial prevalence rate of chronic MSD was found in the 50-59 group (69%), with multivariate analysis, the 40-49 age group displayed the highest prevalence of chronic MSD (69%). As a further gender association was shown in this age group, it can be deduced that, within this study context, females aged between 40 and 59 years have a higher prevalence of chronic MSD. This finding should inform the development of culturally appropriate intervention strategies for the management of chronic MSD.

The prevalence of chronic MSD decreased after the age of 60. This correlates with a decrease in obesity and breadwinner status, also after the age of 60, as well as a decrease in physical activity level. Most employed participants partook in vocations that were not

sedentary. Also, within a low socioeconomic status community, the population is more likely to utilise public transport, where walking to various terminals is common. Where public transport cannot be afforded, walking long distances to places of employment is also common. Thus, the decrease in the level of physical activity after age 60 could be attributed to employment being ceased as retirement age was reached, as well as a reduced prevalence of chronic MSD.

In those with a normal BMI and those in the 30-49 age group, a higher proportion of those with a low level of physical activity reported MSD (53.8% and 42% respectively). A recent 2017 study, in a similar population, found no significant difference between the self-reported physical activity levels of those with chronic MSD compared to matched controls.¹²⁶ This was most likely due to the small sample size (24 participants) in comparison to the current study. Significant differences were however found in objective physical activity measures, with the chronic MSD group scoring lower than the matched controls on the repeated sit-to-stand test (RSST) (17.9sec [11.83–105] vs 7.85sec [5.5–11.5]; U=0; p<0.01), the 6 minute walk test (6MWT) (335m [30–430] vs 680m [430–795]; U=0.5; p<0.01), mean daily pedometer readings (2985.1 [32.8–13785.4] vs 6409.4 [4207.1–15313.6]; U=35; p<0.03), and total pedometer readings (20896 [229–96526] vs 44865.5 [29450–107195]; U=35; p<0.03).¹²⁶ Although found more objectively, this supports the findings of the current study where participants with chronic MSD had significantly lower physical activity levels than those without chronic MSD. This result was expected and is in keeping with other previous literature.^{304,305} Those with chronic MSD have been found to take 29% fewer steps than those without chronic MSD.³⁰⁴ Also, the manner in which these steps were accumulated was found to be different,³⁰⁴ with less intense movement,³⁰⁶ and more time spent lying down (47.0 [10.2]% vs 34.3 [5.6]%; p=0.000)³⁰⁶ compared to those without chronic MSD. These suggest changes in pain behaviour. A possible reason for not engaging in physical activities, outside of normal work duties, could be fear-avoidance of physical activity.¹⁰¹ The fear-avoidance model hypothesises that those with chronic pain believe that physical activity will increase their pain and therefore physical activity is avoided.³⁰⁷ Fear and anxiety lead to physiological, behavioural, and cognitive responses such as increased muscle reactivity, avoidance behaviour and hypervigilance, and catastrophizing thoughts.³⁰⁷ Those with pain may thus develop fear of pain, moving, re-injury, or work-related activities.³⁰⁷ Thus, altered patterns of movements¹²⁶ may be adopted to avoid these fears or anxieties, but could restrict the normal use of injured tissue and allow for further deterioration of the condition/injury.

In this study, more than 70% of those with chronic MSD were overweight or obese. In South Africa obesity has been found to be more prominent in females, ranging from 28% to 41%, whilst among males, obesity steadily increases with socioeconomic status from 6% to 18%.¹¹³ Increased physical activity has been found to be associated with low obesity in women.¹¹³ Smoking has been found to negatively correlate with obesity in males as well as females, although among males, smoking has been found to be more an attribute of the poor.¹¹³ Conversely, physical exercise and smoking have been found to be positively correlated in females.¹¹³ This would imply that these activities occur more among wealthy females. Other notable contributors toward obesity inequalities among males have been shown to be age (8.5%) and employment (6.6%), while living in a rural area (20.3%), physical activity (-28.6%) and smoking (-11.4%) contributed significantly to the obesity inequality among females.¹¹³ However, no correlation was found between obesity and age, or between obesity and MET-minutes/level of physical activity. Thus, diet may be the behavioural determinant of obesity³⁰⁸ within this study context, instead of level of physical activity. It has been shown that in the low socioeconomic context of Cape Town, unhealthy foods outnumber healthy ones by a ratio of 2:1, with a high content of sugar and refined foods.³⁰⁹

Smoking was found to be associated with chronic MSD in younger participants. However, the numbers of those who smoked and had MSD was small. No significant difference was found in the alcohol use of those reporting MSD and those without MSD. This could be due to the analgesic effects of alcohol as it results in a small increase in pain threshold.³¹⁰ However, the greater the use of alcohol the greater the analgesic effect, which could provide potential addiction and dependence in those with pain.³¹⁰

The bivariate association between chronic MSD and hypertension displayed in this sample is in keeping with similar research where a higher prevalence of MSD was reported in those with hypertension,³¹¹ although this was limited to males with uncontrolled hypertension.³¹¹ The association between MSD and type 2 diabetes mellitus has also been well documented. In participants with type 2 diabetes mellitus, 'low' and 'moderate' physical activity levels were both reported as the most common (35.1%) categories. Significant differences were found between physical activity levels and type 2 diabetes mellitus ($p=0.004$), and cardiovascular disease ($p=0.004$). This link to low levels of physical activity could attribute for the associations between these conditions and MSD.

It was hypothesised that there is a cycle in which chronic MSD may result in reduced physical activity and this, in turn, would increase BMI and the increased BMI would result in increased MSD. However, there was no evidence of any of the factors preceding or trailing each other. From the results of this study, as well as from previous literature, it has been shown that, in order to decrease the burden of disease of chronic MSD, it is of importance to include a focus on promoting physical activity,¹²⁶ as well as to target the barriers to physical activity³¹² in the management of chronic MSD. Intervention components that address fear avoidance and self-efficacy may thus be more effective in reducing long-term disability.³¹²

5.5 Health-Related Quality of Life

In this study, a mean European Quality of Life-5 Dimensions (EQ-5D) health index score for the total sample of 0.8 ± 0.3 was found, with no significant difference found between gender and the health index score and scores on the visual analogue scale (VAS). This is supported by previous literature, in the culturally and socially diverse South African context, which found that gender had no influence on self-reported quality of life.³¹³

The mean health index score decreased with age, with the lowest score in the 50-59 and over 70 age categories. Age has been found to be a major determinant of self-reported HRQoL in South Africa³¹³ while in China, also an upper middle-income country, health status was found to decline with advancing age.³¹⁴ This included a decrease in mean VAS score as well as an increase in problems in each EQ-5D dimension.³¹⁴ This could be attributed to the rise in chronic MSD and CDL with age and is in keeping with global HRQoL trends.

Research has suggested that there is a positive relationship between chronic pain, disability and low quality of life, especially in the case of non-specific pain.³¹⁵ The relationship between intensity of pain and quality of life, however, has not been as well researched.³¹⁵ In this study, participants reporting acute MSD and chronic MSD reported a lower health index and VAS scores than those with no MSD. This is supported by literature stating that individuals in Brazil with chronic MSD, such as in osteoarthritis, were more likely to have lower VAS scores, while those with hypertension and COAD were not.³¹⁶

It has been found that the worst HRQoL patterns were found for those with osteoarthritis of the hip, osteoporosis, rheumatoid arthritis (RA), and fibromyalgia, while those with multiple sites of chronic MSD were found to have the poorest HRQoL.³¹⁷ Globally, individuals with chronic MSD have also reported lower quality of life.³¹⁵ The results in this study therefore follow the global trend, as well as that for upper middle-income countries for chronic MSD and HRQoL. The effect of chronic MSD on HRQoL could be attributed to the reduced physical ability or function reported with disease,³¹⁷ as well as pain interfering with everyday interactions and activities of daily living.³¹⁵ Thus, interventions for chronic MSD that address disability and HRQoL, including educational programmes, may be more effective in the management of chronic MSD than conventional pharmacological management alone.³¹⁸

Another factor affecting HRQoL in this study may be the low socioeconomic status and the stress that accompanies it. It has been found that stress in populations of low economic status may adversely affect health.³¹⁹ This is supported by the findings of a negative relationship between socioeconomic status and the prevalence of health problems³¹⁶ and the association between socioeconomic status and HRQoL.³¹⁴ This may be suggestive of health inequality that favours the wealthy,³¹⁶ but this was not explored in this study.

5.6 Limitations and Recommendations

There are several limitations to this study.

As the sample was limited to adults attending a CHC, the results of this study may not be generalisable to adults in the community who do not attend the CHC. The prevalence of MSD and CDL is likely to be higher in this study than in the general population. However, as these are the adults who are likely to access intervention for MSD, the choice of sample is defensible.

As this is a cross-sectional study, no conclusions may be drawn on causal relationships of MSD or CDL. Therefore, it is unclear which conditions influence MSD and, conversely, which conditions are influenced by MSD. These causal relationships are recommended to be expanded upon in further research which would need to be longitudinal to better examine the development of the different conditions over the adult life span.

No further investigation was done to determine what “other” CDL could have been. With the South African context, a large contribution could be attributed to HIV/AIDS due to its high prevalence in sub-Saharan Africa.

The results of this study suggest that more holistic, self-management driven interventions, for both MSD and CDL, should be implemented within the primary health care sector of South Africa. This should focus on preventing and managing risk factors identified in this study. Good quality intervention studies need to be implemented to pilot such management strategies to determine its effectiveness and feasibility before implementing it across primary health care centres in South Africa.

The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines²⁶⁷ were used as a benchmark for evaluating study limitations. The guideline criteria are presented below in Table 29, indicating how these were addressed in the study.

Table 29: Evaluation of this study in relation to STROBE guidelines for cross-sectional studies

Item	Item No	Recommendation	Section where this is addressed
Title and abstract	1	Indicate the study's design with a commonly used term in the title or the abstract	Abstract
		Provide in the abstract an informative and balanced summary of what was done and what was found	
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Section 1.1
Objectives	3	State specific objectives, including any prespecified objectives	Section 1.3.2
Methods			
Study Design	4	Present key elements of study design early in the paper	Section 3.2
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Study setting is described in Section 1.5 Periods of recruitment and data collection are described in Sections 3.5 and 3.6
Participants	6	Give the eligibility criteria, and the sources and methods of selection of participants	Section 3.3
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Section 3.6
Data sources/measurements	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Section 3.6
Bias	9	Describe any efforts to address potential sources of bias	N/A

Item	Item No	Recommendation	Section where this is addressed
Study size	10	Explain how the study size was arrived at	Section 3.3.1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Section 3.6
Statistical methods	12	Describe all statistical methods including those used to control for confounding	Section 3.6
		Describe any methods used to examine subgroups and interactions	Section 3.6
		Explain how missing data were addressed	N/A
		If applicable, describe analytical methods taking account of sampling strategy	N/A
		Describe any sensitivity analyses	N/A
Results			
Participants	13*	Report numbers of individuals at each stage of study – e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in study, completing follow-up, and analysed	Section 4.2
		Give reasons for non-participation at each stage	Section 4.2
		Consider use of a flow diagram	Section 4.2
Descriptive data	14*	Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders	Section 4.3
		Indicate number of participants with missing data for each variable of interest	Section 4
Outcome data	15*	Report numbers of outcome events or summary measures	Section 4
Main results	16	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g. 95% confidence interval). Make clear which confounders were adjusted for	Section 4

Item	Item No	Recommendation	Section where this is addressed
		and why they were included	
		Reported category boundaries when continuous variables were categorized	Section 4
		If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done – eg analyses of subgroups and interactions, and sensitivity analyses	Section 4
Discussion			
Key results	18	Summarise key results with reference to study objectives	Section 4.11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	Section 5.6
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from the similar studies, and other relevant evidence	Section 5
Generalisability	21	Discuss the generalisability (external validity) of the study results	Section 5 and 6
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based.	Abstract

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Brief Description of the Study and the Most Important Results

There is inadequate South African evidence regarding the inter-relationships between musculoskeletal disease (MSD), chronic diseases of lifestyle (CDL), obesity and physical activity levels. This highlights a gap in research as management may not be targeted appropriately at risk factors and thus may not reduce the high prevalence rates of MSD.

The main aim of this study was thus to determine the patterns of onset of MSD, CDL and risk factors across gender and six age categories (i.e. 18-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years, and 70 years and older), in patients receiving medical services at a community health centre (CHC) in Mitchells Plain, South Africa.

A descriptive, cross-sectional, analytical study design was used at primary health care level at a CHC in Cape Town, South Africa. All males and females, aged 18 years and older, except those who were pregnant or unable to answer the English, Afrikaans, or isiXhosa versions of questionnaires, were eligible to participate. The outcome measures were the Community Orientated Program for Control of Rheumatic Diseases (COPCORD) questionnaire, the Brief Pain Inventory (BPI), the European Quality of Life-5 Dimensions (EQ-5D) questionnaire, the International Physical Activity Questionnaire (IPAQ), and anthropometric measures of weight, height, and waist and hip circumference. Data were collected via interview and responses were captured by online questionnaires on mobile devices using mobile data collection application Magpi by DataDyne Group, LLC. Anthropometric measurements were taken as well. Data were exported to Microsoft Office Excel spreadsheets for descriptive and inferential statistical analysis. Ethical permission was obtained from the University of Cape Town.

This study recruited 1115 participants, with a mean age of 48.7 ± 16.8 years. A prevalence rate of 33.3% for acute MSD and 42.9% for chronic MSD was found, with a significant association found between gender and MSD ($p < 0.01$). The most common sites of chronic MSD were knees (35.6%), low back/pelvis (33.8%), shoulders (26.8%), and hands/fingers (21.9%). Of those with MSD, exercise was reported as the best management strategy for MSD (37.4%). Hypertension was the most prevalent CDL in both genders, followed by type

2 diabetes mellitus and hypercholesterolaemia. All chronic diseases except chronic obstructive airway disease (COAD) continually increased with age, while COAD and both acute and chronic MSD peaked around the 50-59 year old age category and then decreased with age. Significant differences ($p < 0.01$) were found between anthropometric measurements of those with MSD and those without.

Multivariate analysis using Chi-Square Automatic Interaction Detector (CHAID) indicated that the association between MSD and other CDL fell away once age categories were entered in to the analysis. In fact, the primary association was with age. In other words, the comorbidity appears to be due almost entirely to the aging process, rather than the mutual influence that MSD and other CDL (such as type 2 diabetes mellitus or hypertension) might have. The reason that bivariate associations were detected is because they all become more prevalent with age. Thus, given the cross-sectional nature of this study we were not able to infer causation and it is clear that “correlation does not imply causation” in this study.

With regard to risk factors, it was hypothesised that there was a cycle in which MSD might result in reduced physical activity and this, in turn, would increase BMI and the increased BMI would result in increased MSD. However, there was no evidence of any of the factors preceding or trailing each other or even displaying an association with MSD (apart from hypercholesterolaemia). With regard to risk factors, smoking was associated with MSD in the younger participants. However, the numbers who smoked and had MSD were small. Of interest, physical activity was only associated with MSD among those in the 30-49 years of age categories and low levels of physical activity were associated with MSD. This is the group that has a prevalence of 41%, compared to the prevalence of 69% in the 40-59 age bracket. There might thus be a window of opportunity and increasing physical activity levels in this group might result in a decrease in the rate of MSD in the older age group. However, although it is not possible to determine if this was due to reduced activity due to pain, it is important to increase activity in this group as there is evidence that increased activity can reduce pain in chronic MSD.

The only factor that emerged as being predictive in the group with the highest prevalence, the 40-59 categories was gender. Although gender is clearly not modifiable, this finding should inform the development of culturally appropriate intervention strategies.

6.2 Recommendations

6.2.1 Management

Although it was not possible to detect any evidence supporting causation, the co-existence of chronic MSD, comorbid CDL and risk factors, such as high BMI and low physical activity, does highlight the need for holistic care to address the multiple problems that the adults, and specifically older patients, who attend community health centres experience. The impact of chronic MSD is large, both in terms of prevalence and impact on health-related quality of life (HRQoL).

The small number reporting non-pharmaceutical intervention indicates that there is a need to provide multi-disciplinary care, including physiotherapists and dietitians. It would appear that physiotherapists have a pivotal role in the management of MSD and CDL.

The primary target groups with chronic MSD at community health centres are females, between the ages of 40-59 years and, to a lesser extent, males above the age of 40 years. About one third will have low physical activity levels, while three quarters will be overweight or obese and nearly a quarter extremely obese. They are likely to have comorbid hypertension, type 2 diabetes mellitus, hypercholesterolaemia, and, to a lesser extent COAD. They have moderate levels of pain and the chronic MSD is reducing their HRQoL considerably.

Interventions that are tailored to meet the profile of those with chronic MSD should be designed. The patients are likely to be drawn from reduced socio-economic backgrounds and the cost of travel to and from the clinic and the opportunity cost of attending multiple clinics needs to be considered. The management of chronic MSD should thus focus on the most effective and affordable intervention strategies and healthcare systems and coherent policies for dealing with chronic MSD should be developed. This management should not only be based on a pharmacological model but on biopsychosocial integration emphasising self-management. A programme developed within a community health centre in the Free State³²⁰ which consisted of a weekly educational programme utilising a workbook, discussion group and exercise class could serve as a model.

6.2.2 Research

There were several limitations to the current study, including the recruitment of participants who had already accessed the health system through the community health centre. Another shortcoming was that the study was cross-sectional and not longitudinal which limits the conclusions that can be drawn from the data. As MSD and CDL are contributing increasingly to the burden of disease, both in terms of prevalence and impact on HRQoL, large scale epidemiological research is warranted to further understand the complex relationships between the comorbidities and the risk factors. It is thus recommended that future research should use a longitudinal design which would help to unravel the issue of causality and correlation. In addition, the research should be community-based rather than facility-based to obtain a true estimate of the prevalence of these conditions within the wider community.

The decrease in prevalence and decrease in decline of HRQoL after the age of 60 also needs to be investigated. This study was not able to identify the reasons for the improvement at this age and it might be useful to investigate this further.

Although there has been at least one culturally appropriate intervention study trialled in South Africa, the sample size was small.^{13,320} Although a positive effect was reported on HRQoL, the study was underpowered to detect other changes that might have taken place. Further research into appropriate models of holistic care need to be undertaken within CHCs to establish which intervention strategies are cost-effective.

6.2.3 Policy

The implications of these findings at a policy level include the need to consider chronic MSD as a CDL and that the management of CDL and MSD should be offered as part of a horizontal rather than vertical programme which encompasses more than simply the prescription of medication. CDL clinics should be structured to provide integrated holistic care, which includes management of the symptoms, such as pain and reduced mobility, as well as pharmacological treatment.

There is need to employ more physiotherapists and other disciplines, such as dietitians, at the community health centre level so that culturally appropriate and effective programmes can be developed and implemented.

6.3 Conclusion

This study highlights the effect of the aging process on the development of MSD and CDL. The prevalence of chronic MSD is high, especially in females between the ages of 40 and 59 years. The co-existence of chronic MSD, comorbid CDL, and risk factors highlight the need for holistic care to address the multiple problems that the adults, and specifically older patients, who attend community health centres experience. The management of chronic MSD should focus on the most effective and affordable intervention strategies and healthcare systems, and coherent policies for dealing with chronic MSD should be developed. This management should not only be based on a pharmacological model but on biopsychosocial integration emphasising self-management.

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8 APPENDICES

8.1 Appendix I: Letter of Ethical Approval



UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee



Room E52-24 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6338 • Facsimile [021] 406 6411
Email: shuretta.thomas@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

14 January 2015

HREC REF: 856/2014

Ms C Hendricks
Physiotherapy
Health & Rehab
F-floor, OMB

Dear Ms Hendricks

PROJECT TITLE: AN INVESTIGATION INTO THE RISK FACTORS OF MUSCULOSKELETAL DISEASES AND THE ASSOCIATION BETWEEN CHRONIC DISEASES OF LIFESTYLE IN AN UNDER-RESOURCED AREA OF THE CAPE TOWN METROPOLE (MSc candidate- Ms C Britz)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30th January 2016.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

Please quote the HREC REF in all your correspondence.

We acknowledge that the student, Carmen Britz will also be involved in this study.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Yours sincerely

signature removed to avoid exposure online

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637.

Institutional Review Board (IRB) number: IRB0001938

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP) and Declaration of Helsinki guidelines.

HREC 856/2014

The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

8.2 Appendix II: Letter to WCDOH Research Committee

Western Cape Department of Health

Western Cape Health Research Committee

To whom it may concern:

RE: Requesting permission to conduct a research study

I, Carmen Britz, am currently doing my MSc in Physiotherapy at the Department of Health and Rehabilitation Sciences at the University of Cape Town. I would like to inform you about the research study that I wish to conduct in people with musculoskeletal disease (MSD) and chronic diseases of lifestyle (CDL) attending community health centres (CHCs) in Cape Town.

Background:

Musculoskeletal disease is the most common cause of severe chronic pain, functional limitations and physical disability, affecting 20-50% of adults and is becoming even more prevalent over time. Literature highlighted that subjects with MSD have been diagnosed with chronic diseases of lifestyle (CDL) such as diabetes mellitus (type 2), hypertension and heart disease (Parker and Jelsma, 2010). Even though the interactions between MSD and CDL are not well understood in a South African context, it is currently a huge health problem for health professionals and the government, highlighting the need for further investigation.

Thus, the title of my study is:

“A cross-sectional investigation into the risk factors of musculoskeletal diseases and the association between chronic diseases of lifestyle in an under-resourced area of the Cape Town Metropole”

The **research questions** are therefore:

- What is the prevalence and types of MSD in adult males and females across six age categories (i.e. 18-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years, and 70 years and older) attending a CHC in Cape Town?
- What comorbidities and risk factors occur in the population?

- At which age is the onset of MSD and CDL?
- Are these comorbidities associated with MSD?
- What are the management and treatment strategies for MSD and CDL?
- What is the health-related quality of life in population with MSD and/or CDL?
- What is the impact and association of MSD and CDL on health-related quality of life across various age categories?
- What is the self-reported level of physical activity in the population with MSD?
- Is the self-reported level of activity associated with MSD and/or identified comorbidities?
- What is the self-reported level of physical activity in the population with MSD?
- Is the self-reported level of activity associated with MSD and/or identified comorbidities?

The aim for this project is to determine the patterns of onset of musculoskeletal diseases, chronic diseases of lifestyle and risk factors across six age categories (i.e. 18-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years, and 70 years and older), in patients attending medical services at a community health centre in Cape Town, South Africa.

The specific **objectives** of the study are:

- To determine proportions of people with musculoskeletal diseases and chronic diseases of lifestyle across different age categories ranging from 18 years and older at a community health centre in Cape Town, South Africa, to establish how these change over the adult lifespan.
- To determine the proportion of people with musculoskeletal diseases and pain related to chronic diseases of lifestyle in men and women aged 18 years and older, attending medical services at a community health centre in Cape Town, South Africa, using the Brief Pain Inventory (BPI) and an adapted version of the COPCORD questionnaire.
- To determine the proportion of people with chronic diseases of lifestyle such as hypertension, diabetes mellitus type II and cardiovascular disease occurring in a population attending medical services at a community health centre in Cape Town, South Africa.
- To determine the association between risk factors, such as age, gender, obesity, occupations, and social habits such as smoking, musculoskeletal diseases and

chronic diseases of lifestyle occurring in a population attending a community health centre in Cape Town, South Africa.

- To determine the physiotherapy and medical management and treatment of MSD and CDL in a population with musculoskeletal diseases and chronic diseases of lifestyle at a community health centre in Cape Town, South Africa.
- To determine the health-related quality of life and health index score, using the EQ5D, of people with and without MSD and CDL in a population attending a community health centre in Cape Town, South Africa.
- To determine the association between the health-related quality of life and health index score and MSD and CDL across the different age categories in a population attending a community health centre in Cape Town, South Africa.
- To determine whether self-reported physical activity levels are associated with MSD and chronic diseases of lifestyle through investigating the level of self-reported physical activity, using the IPAQ (International Physical Activity Questionnaire), in a population at a community health centre in Cape Town, South Africa.
- To explore the relationships between musculoskeletal diseases, chronic diseases of lifestyle and identified risk factors by establishing whether there are clusters of chronic diseases in a population at a community health centre in Cape Town, South Africa.

Stratified age sampling will be used to recruit males and females, aged 18 years and older, attending the medical services at the selected CHC's. The first person in waiting area will be approached, informed about the study, and asked to disclose their age. This will continue until the quota per age group, as aforementioned, has been reached. They will be required to give informed consent and understand English, Afrikaans or isiXhosa to participate in the study. Participants who are pregnant or who are unable to complete either the English, Afrikaans, or isiXhosa versions of the questionnaires will be excluded.

Assessments:

The following outcome measures will be used when collecting data:

- Brief Pain Inventory (BPI) and adapted COPCORD questionnaires to screen for MSD and CDL.
- EQ-5D as a self-report of health-related quality of life.

- International Physical Activity Questionnaire (IPAQ) as a self-report of physical activity.
- Anthropometric measures of weight (in kilograms) and height (in metres) for calculation of body mass index (BMI); waist and hip circumference, relevant for classification of obesity, a possible risk factor.

Ethical Considerations

The study will conform to the principles of the Declaration of Helsinki (Fortaleza, Brazil, 2013). Ethical approval has been obtained from the Faculty of Health Sciences, University of Cape Town. All information obtained from the primary health care facilities and participants will be kept confidential and their identity will be anonymous and will only be used for statistical analysis and writing of results. All stakeholders will be acknowledged with all publications and conference proceedings. The findings of the study will be disseminated to you and respective departments.

I would like to request permission to access the community health centres in the Cape Town Metropole region from May 2014 up until December 2015. This is only an estimated timeframe for data collection, but should my study be completed before hand, a notification will for forwarded to your department. Annual reports on the progress of my study will be forwarded to all stakeholders involved. I also would like to request permission to obtain medical information from the folders of the participants involved in the study to confirm the self -reported information about the medical history and treatment received at the CHC. Lastly, I would like to request permission to make use of the resources (examination rooms to do baseline testing) available at the CHC to conduct my study. Please be advised that the intention of my study is not to affect service delivery negatively but to assist in establishing the burden of chronic diseases in order to develop a comprehensive rehabilitation model of care for MSD and CDL. As principle investigator, I will ensure the smooth running of services provided at the facility by managing all researchers and data collection processes. I have attached a copy of my research proposal if you require any additional information regarding my study.

I look forward to hearing from you and your assistance is greatly appreciated.

Sincerely

Ms Carmen Britz (MSc candidate)

Email: carmenbritzphysio@gmail.com

Supervisors:

Ms Candice Hendricks: candice.hendricks@uct.ac.za

Prof J Jelsma: jennifer.jelsma@uct.ac.za

Prof. M Blockman (Human Research Ethics Committee, Faculty of Health Sciences,)

marc.blockman@uct.ac.za

Tel: 021-406-6626

8.3 Appendix III: Letter to Facility Manager at CHC

Community Health Centre X

Facility Manager

To whom it may concern:

RE: Requesting permission to conduct a research study

I, Carmen Britz, am currently doing my MSc in Physiotherapy at the Department of Health and Rehabilitation Sciences at the University of Cape Town. I would like to inform you about the research study that I wish to conduct in people with musculoskeletal disease (MSD) and chronic diseases of lifestyle (CDL) attending community health centres (CHCs) in Cape Town.

Background:

Musculoskeletal disease is the most common cause of severe chronic pain, functional limitations and physical disability, affecting 20-50% of adults and is becoming even more prevalent over time. Literature highlighted that subjects with MSD have been diagnosed with chronic diseases of lifestyle (CDL) such as diabetes mellitus (type 2), hypertension and heart disease (Parker and Jelsma, 2010). Even though the interactions between MSD and CDL are not well understood in a South African context, it is currently a huge health problem for health professionals and the government, highlighting the need for further investigation.

Thus, the title of my study is:

“A cross-sectional investigation into the risk factors of musculoskeletal diseases and the association between chronic diseases of lifestyle in an under-resourced area of the Cape Town Metropole”

The **research questions** are therefore:

- What is the prevalence and types of MSD in adult males and females across six age categories (i.e. 18-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years, and 70 years and older) attending a CHC in Cape Town?
- What comorbidities and risk factors occur in the population?

- At which age is the onset of MSD and CDL?
- Are these comorbidities associated with MSD?
- What are the management and treatment strategies for MSD and CDL?
- What is the health-related quality of life in population with MSD and/or CDL?
- What is the impact and association of MSD and CDL on health-related quality of life across various age categories?
- What is the self-reported level of physical activity in the population with MSD?
- Is the self-reported level of activity associated with MSD and/or identified comorbidities?
- What is the self-reported level of physical activity in the population with MSD?
- Is the self-reported level of activity associated with MSD and/or identified comorbidities?

The aim for this project is to determine the patterns of onset of musculoskeletal diseases, chronic diseases of lifestyle and risk factors across six age categories (i.e. 18-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years, and 70 years and older), in patients attending medical services at a community health centre in Cape Town, South Africa.

The specific **objectives** of the study are:

- To determine proportions of people with musculoskeletal diseases and chronic diseases of lifestyle across different age categories ranging from 18 years and older at a community health centre in Cape Town, South Africa, to establish how these change over the adult lifespan.
- To determine the proportion of people with musculoskeletal diseases and pain related to chronic diseases of lifestyle in men and women aged 18 years and older, attending medical services at a community health centre in Cape Town, South Africa, using the Brief Pain Inventory (BPI) and an adapted version of the COPCORD questionnaire.
- To determine the proportion of people with chronic diseases of lifestyle such as hypertension, diabetes mellitus type II and cardiovascular disease occurring in a population attending medical services at a community health centre in Cape Town, South Africa.
- To determine the association between risk factors, such as age, gender, obesity, occupations, and social habits such as smoking, musculoskeletal diseases and

chronic diseases of lifestyle occurring in a population attending a community health centre in Cape Town, South Africa.

- To determine the physiotherapy and medical management and treatment of MSD and CDL in a population with musculoskeletal diseases and chronic diseases of lifestyle at a community health centre in Cape Town, South Africa.
- To determine the health-related quality of life and health index score, using the EQ5D, of people with and without MSD and CDL in a population attending a community health centre in Cape Town, South Africa.
- To determine the association between the health-related quality of life and health index score and MSD and CDL across the different age categories in a population attending a community health centre in Cape Town, South Africa.
- To determine whether self-reported physical activity levels are associated with MSD and chronic diseases of lifestyle through investigating the level of self-reported physical activity, using the IPAQ (International Physical Activity Questionnaire), in a population at a community health centre in Cape Town, South Africa.
- To explore the relationships between musculoskeletal diseases, chronic diseases of lifestyle and identified risk factors by establishing whether there are clusters of chronic diseases in a population at a community health centre in Cape Town, South Africa.

Stratified age sampling will be used to recruit males and females, aged 18 years and older, attending the medical services at the selected CHC's. The first person in waiting area will be approached, informed about the study, and asked to disclose their age. This will continue until the quota per age group, as aforementioned, has been reached. They will be required to give informed consent and understand English, Afrikaans or isiXhosa to participate in the study. Participants who are pregnant or who are unable to complete either the English, Afrikaans, or isiXhosa versions of the questionnaires will be excluded.

Assessments:

The following outcome measures will be used when collecting data:

- Brief Pain Inventory (BPI) and adapted COPCORD questionnaires to screen for MSD and CDL.
- EQ-5D as a self-report of health-related quality of life.

- International Physical Activity Questionnaire (IPAQ) as a self-report of physical activity.
- Anthropometric measures of weight (in kilograms) and height (in metres) for calculation of body mass index (BMI); waist and hip circumference, relevant for classification of obesity, a possible risk factor.

Ethical Considerations

The study will conform to the principles of the Declaration of Helsinki (Fortaleza, Brazil, 2013). Ethical approval has been obtained from the Faculty of Health Sciences, University of Cape Town. All information obtained from the primary health care facilities and participants will be kept confidential and their identity will be anonymous and will only be used for statistical analysis and writing of results. All stakeholders will be acknowledged with all publications and conference proceedings. The findings of the study will be disseminated to you and respective departments.

I would like to request permission to access the community health centres in the Cape Town Metropole region from May 2014 up until December 2015. This is only an estimated timeframe for data collection, but should my study be completed before hand, a notification will for forwarded to your department. Annual reports on the progress of my study will be forwarded to all stakeholders involved. I also would like to request permission to obtain medical information from the folders of the participants involved in the study to confirm the self -reported information about the medical history and treatment received at the CHC. Lastly, I would like to request permission to make use of the resources (examination rooms to do baseline testing) available at the CHC to conduct my study. Please be advised that the intention of my study is not to affect service delivery negatively but to assist in establishing the burden of chronic diseases in order to develop a comprehensive rehabilitation model of care for MSD and CDL. As principle investigator, I will ensure the smooth running of services provided at the facility by managing all researchers and data collection processes. I have attached a copy of my research proposal if you require any additional information regarding my study.

I look forward to hearing from you and your assistance is greatly appreciated.

Sincerely

Ms Carmen Britz (MSc candidate)

Email: carmenbritzphysio@gmail.com

Supervisors:

Ms Candice Hendricks: candice.hendricks@uct.ac.za

Prof J Jelsma: jennifer.jelsma@uct.ac.za

Prof. M Blockman (Human Research Ethics Committee, Faculty of Health Sciences,)

marc.blockman@uct.ac.za

Tel: 021-406-6626

8.4 Appendix IV: Information Sheet for Participants

INFORMATION LEAFLET

ABOUT THE STUDY

University of Cape Town

Division of Physiotherapy

Department of Health and Rehabilitation Sciences

Dear Participant:

I am a physiotherapist, doing postgraduate studies at the Department of Health and Rehabilitation Sciences at the University of Cape Town. I am interested in finding out if you suffer from joint or muscle pain, and/or other chronic health problems (high blood pressure, sugar). People who have pain or stiffness may find it difficult to move around the house or at work. Sometimes these conditions can be the cause of gaining weight and can stop you from doing physical activities such as walking or participating in sport. I want to find out how these conditions are related, and at what age these conditions start to develop and impact your life. This information will help me and future researchers to understand the relationships between joint and/or muscle pain and some chronic health problems.

The topic of my study is:

“A cross-sectional investigation into the risk factors of musculoskeletal diseases and the association between chronic diseases of lifestyle in an under-resourced area of the Cape Town Metropole”

This study is being done on people older than 18 years who are attending the Mitchells Plain community health centre. The Mitchells Plain health district serves around 13.6 % of the Cape Town population and has been identified as an under-resourced area of the City. The community health centre attends to around 9230 patients per week, making it one of the busiest community health centres in the city. This is why I have decided to do this study here.

On the days when data are scheduled to be collected, the first person in waiting area will be approached, informed about the study, and asked their age. This will carry on until the total number of participants has been reached. Taking part is completely voluntary, so you do not have to take part if you don't want to.

If you volunteer to participate, you will be asked to complete three questionnaires which will determine if you have musculoskeletal and chronic diseases, the kind of physical activities you do during your week and questions about the pain you feel because of your chronic diseases. A researcher will help you with the questionnaires which you can answer in English, Afrikaans, or isiXhosa. The questionnaires are electronic and must be answered on tablets because they are on the internet in an application called Magpi. This application will help me to keep all information organised and will be very well protected. Only I will have access to the application. Once I have finished collecting all the information needed, I will transfer it to Microsoft Excel and it will then no longer be on the internet. This should take about 3-6 months.

After answering the questionnaires, a researcher will escort you to a room to measure your height, weight, waist and hip measures. These measurements must be done over your underwear or one layer of clothing, so you might have to undress. Someone will be sitting in your place to avoid losing your place in the queue. Your medical folder will only be checked to confirm any medical diagnosis. This study does require some time (30-45 minutes) from all participants.

There is no direct benefit to you for taking part in this study. I may be able to offer some physiotherapy advice on how to manage your health condition and improve function and refer you to the most applicable health professional if necessary.

There are no potential risks involved. All tests are safe and valid. Measurements and instruments are reliable. You will receive no money to take part in the survey and measurements.

Please feel free to ask any questions about the study. You have the right to withdraw at any time during the interview with no penalties (that means it will not negatively influence any current or future health care at the community health centre). Please remember that participation is voluntary.

Confidentiality and privacy of participants will be ensured. All your personal information will be coded with only general information such as gender, age and your health conditions being available to other researchers. I understand the importance of confidentiality and respect your privacy.

What if something goes wrong?

The University of Cape Town (UCT) has insurance cover for the event that research-related injury or harm results from your participation in the trial. The insurer will pay all reasonable medical expenses in accordance with the South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of the British Pharmaceutical Industry Guidelines

(ABPI) in the event of an injury or side effect resulting directly from your participation in the trial. You will not be required to prove fault on the part of the University.

By agreeing to participate in this study, you do not give up your right to claim compensation for injury where you can prove negligence, in separate litigation. In particular, your right to pursue such a claim in a South African court in terms of South African law must be ensured. Note, however, that you will usually be requested to accept that payment made by the University under the SA GCP guideline 4.11 is in full settlement of the claim relating to the medical expenses.

An injury is considered trial-related if, and to the extent that, it is caused by study activities. You must notify the study doctor immediately of any side effects and/or injuries during the trial, whether they are research-related or other related complications.

UCT reserves the right not to provide compensation if, and to the extent that, your injury came about because you chose not to follow the instructions that you were given while you were taking part in the study. Your right in law to claim compensation for injury where you prove negligence is not affected. Copies of these guidelines are available on request.

If you want to ask me anything before we start with the questions, or later on, please phone or text me, Ms Carmen Britz, at 081 336 1233, or my supervisors, who are also involved in the study.

Supervisors:

Ms Candice Hendricks: 021 406 6382

Professor Jennifer Jelsma: 021 406 6595

If you have any problems or want to know more about the study or want to report anything that you feel unhappy about, please contact:

Professor Marc Blockman, the chairperson of the Human Research Ethics Committee, Faculty of Health Sciences, University of Cape Town (contact number: 021 406 6411).

8.5 Appendix V: Informed Consent

CONSENT TO PARTICIPATE IN STUDY

University of Cape Town

Division of Physiotherapy

Department of Health and Rehabilitation Sciences

Topic of study:

“A cross-sectional investigation into the risk factors of musculoskeletal diseases and the association between chronic diseases of lifestyle in an under-resourced area of the Cape Town Metropole”

I _____ have been approached to take part in a research study.

I have been informed regarding the study by the researchers from the Division of Physiotherapy of the University of the Cape Town.

I may contact any of the following researchers if I have any queries/questions regarding the study:

Ms Carmen Britz – 081 336 1233

Supervisor: Ms Candice Hendricks – 084 751 6692

I may contact Prof Blockman at the Human Research Ethics Committee, Faculty of Health Sciences, University of Cape Town (contact number: 021 – 406 6411) if I have any queries regarding my rights as research participant.

Taking part in the study is purely voluntary and I will not be punished or lose benefits at the community health centre if I refuse to take part or decide to stop taking part.

If I agree to take part, I will be given a signed copy of consent to take part in the study, as well as the participant information sheet, which is a written summary of the research.

I hereby grant permission to take part in the study and for my height, weight, waist and hip measures to be taken by the researcher. I hereby grant permission for the researchers to view my personal records in my medical folder as well.

The research study, including the above information has been verbally described to me.

I understand what my involvement in the study means and I voluntarily agree to participate.

Signature of Participant

Date

Signature of Witness (if necessary)

Date

Signature of Researcher

Date

8.6 Appendix VI: Musculoskeletal Conditions and Chronic Disease Questionnaire (adapted from COPCORD)

This questionnaire is for anyone attending Community Health Centres.

This questionnaire is about chronic joint pain, obesity, hypertension and type 2 diabetes mellitus.

This questionnaire is completely voluntary. You may choose not to participate or not to answer any specific question.

This questionnaire is completely anonymous.

The data will be used to develop a health promotion programme.

INSTRUCTIONS

Select only one response unless instructed otherwise.

Please tick the appropriate answer e.g. ✓ or circle one correct answer where indicated.

Thank you very much for your co-operation.

ID code _____

Date: _____

Community Health Centre: _____

PHASE I:

(Q1 – Q7 are used for screening of MSD and CDL)

1. Age: _____ years old OR Date of birth: _____

2a. Do you have a diagnosed musculoskeletal problem in the joints or spine?

No Yes

2b. If yes, do you attend the rehabilitation/ exercise classes at physiotherapy?

No Yes

3a. Do you suffer from chronic diseases of lifestyle?

No Yes

- 3b. If yes, please tick the chronic diseases that you suffer from.
- Cancer
 - Sugar (Diabetes Mellitus Type I)
 - Cardio-vascular diseases (Coronary heart disease)
 - Depression
 - Chronic respiratory disease
 - High blood pressure (Hypertension)
 - Other
4. Do you attend the chronic care club at the day hospital?
- No
 - Yes
5. Literacy in home language:
- Read only
 - Read and write
 - None
6. Do you suffer from any of the following acute illnesses/ injuries today?
- cold/ flu
 - gastroenteritis,
 - diarrhoea
 - infection
 - acute musculoskeletal injuries (muscle pain, sprain)
7. Do you have any of the following conditions/ impairments:
- neurological conditions (stroke, spinal cord injury)
 - fractures
 - intellectual/ cognitive impairments

THE FOLLOWING QUESTIONS ASK ABOUT YOUR PERSONAL DATA AND MEDICAL HISTORY

DEMOGRAPHIC INFORMATION:

8. Gender

Male

Female

9. Home language:

Afrikaans

English

isiXhosa

Other

10. Marital status:

Single

Married

Separated / divorced

Widowed

Live with partner

11. Children:

None

1 child

2 children

3 children

More than 3 children

12. Highest level of education:

- No schooling
- Grades R to 3
- Grades 4 to 6
- Grades 7 to 9
- Grades 10 to 12
- College, university or technicon

13. Current job:

- Housewife
- Desk job
- Factory worker
- Military
- Retired
- Other
- Teacher
- Work at shop or business
- Domestic worker
- Police
- Unemployed

14. If you are working, describe the nature of your work:

- Light
- Moderate
- Heavy
- Other

15a. If you are not working, did you stop working due to any illness/ injury?

- No
- Yes

15b. If Yes, please specify:

- Musculoskeletal condition (stiff joints/ spine) Chronic diseases
- Accident/ traumatic Injury Physical disability
- Other Illness

16a. Have you changed work due to any illness/ injury?

- No Yes

16b. If Yes, please specify:

- Musculoskeletal condition (stiff joints/ spine) Chronic diseases
- Accident/traumatic Injury Physical disability
- Other Illness

17. Do you receive a government pension or grant?

- Yes No

18. Monthly income:

19. Are you the only provider for the family (breadwinner)?

- Yes No

20. History of smoking:
- Never smoked Stopped smoking
 - Currently smoke
 - If smoking, how many cigarettes per day? _____
 - If smoking, at what age did you start? _____

21. History of alcohol use:
- Never used alcohol Currently drinking alcohol
 - Stopped drinking alcohol
 - If drinking alcohol, how many times per week do you drink? _____
 - If drinking alcohol, at what age did you start? _____

THE FOLLOWING QUESTIONS ASK ABOUT YOUR HEALTH:

22. Have you been diagnosed with any of these chronic diseases?
- High blood (Hypertension) Sugar (Diabetes Mellitus Type 2)
 - Obesity (overweight) Cholesterol (hyperlipidaemia)

23. How long (months/years) have you been diagnosed with these conditions?

High blood _____ Sugar _____

Obesity _____ Cholesterol _____

24. Did you use medication for these chronic diseases in the last 3 months?

- Yes No

25. If yes, what medication did you use?

- Over the counter pain killers
- Prescribed medication for high blood pressure
- Prescribed medication for diabetes
- Prescribed medication for high cholesterol
- Natural remedies, herbs, supplements
- Other

26a. Do you use the prescribed medication on a regular basis as advised?

- Yes No

26b. If no, what is the reason for not taking the medication on time?

- I don't like taking too many pills
- I forget
- Some tablets make me feel sick, drowsy or sleepy
- Other reason

27a. Were you involved in a traumatic accident before?

- Yes No

27b. If yes, how did the accident occur?

- | | |
|-------------------------------------|--|
| <input type="checkbox"/> Vehicle | <input type="checkbox"/> Agriculture / Field |
| <input type="checkbox"/> Industrial | <input type="checkbox"/> Violence |
| <input type="checkbox"/> Fall | <input type="checkbox"/> Other |

28a. Nature of traumatic injury

- | | |
|------------------------------------|---------------------------------|
| <input type="checkbox"/> Fracture | <input type="checkbox"/> Sprain |
| <input type="checkbox"/> Paralysis | <input type="checkbox"/> Other |

28b. Result of traumatic injury

- | | |
|---------------------------------------|--|
| <input type="checkbox"/> Cured | <input type="checkbox"/> Disabled |
| <input type="checkbox"/> Chronic pain | <input type="checkbox"/> Joint stiffness |
| <input type="checkbox"/> Deformity | <input type="checkbox"/> Other |

29a. Has your doctor/ nurse ever told you to follow an exercise programme?

- | | | |
|------------------------------|-----------------------------|-----------------------------------|
| <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not sure |
|------------------------------|-----------------------------|-----------------------------------|

29b. If yes, have you followed an exercise programme yet?

- | | |
|------------------------------|-----------------------------|
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |
|------------------------------|-----------------------------|

30a. During the last 3 months have you experienced pain, aching, swelling, stiffness (tightness) in or around your joints or back which is not related to an injury / accident?

Yes

No

Not sure

30b. During the last 7 days have you experienced pain, aching, swelling, stiffness (tightness) in or around your joints or back which is not related to an injury / accident?

Yes

No

Not sure

ID code _____

Date: _____

Community Health Centre: _____

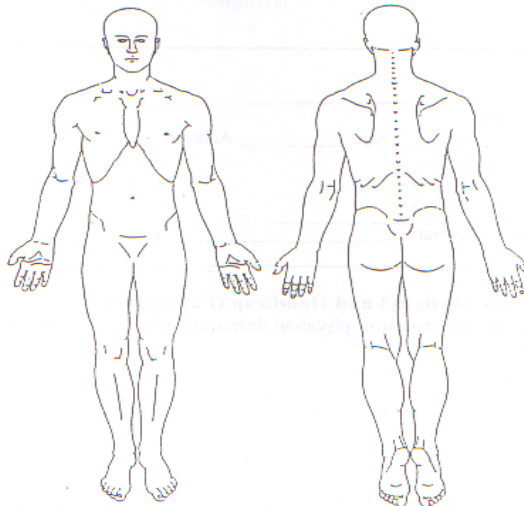
PHASE II:

**THE FOLLOWING QUESTIONS ASK ABOUT YOUR JOINT OR MUSCLE physical activityIN,
STIFFNESS / TIGHTNESS OR SWELLING AROUND YOUR JOINTS, OR LESS MOVEMENT IN
ANY JOINTS**

1a. Please indicate on the figure below, with a ✓ all the sites where you have experienced **pain** in the last 3 months and with a X all the sites where you have experienced **swelling**.

Front

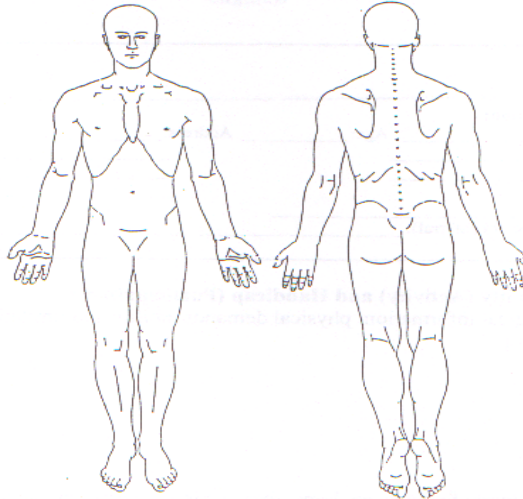
Back



- 1b. Please indicate on the figure below, with a ✓ all the sites where you have experienced pain in the last 7 days and with a X all the sites where you have experienced swelling.

Front

Back



2. When did your pain start?

- Less than 7 days ago In the last 3 months
 3 months to 1 year ago More than 1 year ago

3. How long does the episode of pain last?

- Few days 4 to 6 weeks
 6 to 12 weeks More than 3 months

4. When is the pain most intense?

- In the morning After an activity (doing something)
 While resting at night
 Other

5a. During the last year have you experienced stiffness in your joints in the morning after getting out of bed or after a long rest without movement?

- Yes No Not sure

5b. If yes, indicate the site/s of stiffness in the following joints

- Neck Upper Back Toes
 Shoulder Lower Back
 Elbow Hip
 Wrist Knee
 Fingers Ankle

6. Did the stiffness go away after exercise or movement of the joint?

- Yes No
 Not sure

7. Have you been diagnosed with arthritis or other joint diseases like rheumatism?

- Yes No

8. Have you been taking any medication for joint or back pain, not related to an injury, in the last 3 months?

- Yes No

9. If yes, what medication was used?
- Over the counter pain killers Natural remedies, herbs, supplements
 - Over the counter anti-inflammatory drugs (NSAIDS's)
 - Prescribed anti-inflammatory drugs (NSAID's)
 - Injection
 - Other
10. Did the medication reduce your joint pain or back pain?
- Yes No
11. Have you received any type of treatment, other than medication, for pain?
- Yes No
12. If yes, please specify the type of treatment that you received at the day hospital.
- Exercise Education
 - Massage Herbal/ natural
 - Acupuncture Electrotherapy machines
 - Joint mobilizations Strapping/ bracing
 - Other
13. Did the above treatment reduce your joint pain or stiffness?
- Yes No

14. Which treatment worked best in reducing your pain and stiffness?

- | | |
|--|--|
| <input type="checkbox"/> Exercise | <input type="checkbox"/> Education |
| <input type="checkbox"/> Massage | <input type="checkbox"/> Herbal/ natural |
| <input type="checkbox"/> Acupuncture | <input type="checkbox"/> Electrotherapy machines |
| <input type="checkbox"/> Joint mobilizations | <input type="checkbox"/> Strapping/ bracing |
| <input type="checkbox"/> Medication | <input type="checkbox"/> Injection |

15. Are you easily depressed or get anxious because of the pain/ joint stiffness?

- Yes No

16. Do you experience abnormal sleeping patterns because of the pain /joint stiffness?

- Yes No

17. Do you feel physically tired due to the pain / joint stiffness (not able to manage everyday tasks)?

- Yes No

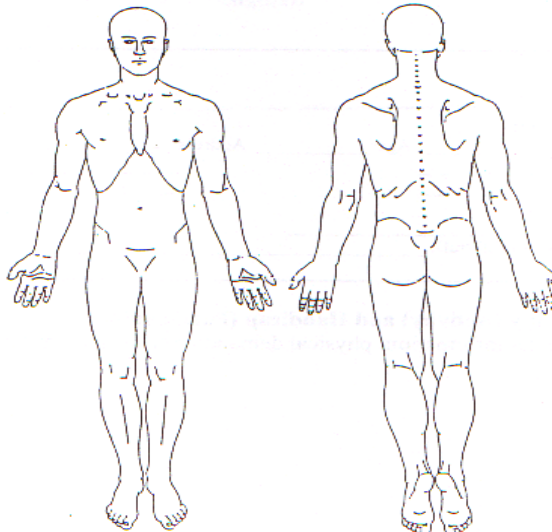
THANK YOU FOR TAKING THE TIME TO COMPLETE THIS QUESTIONNAIRE

8.7 Appendix VII: Brief Pain Inventory Questionnaire

1. Throughout our lives, most of us have had pain from time to time (such as minor headaches, sprains, and toothaches). Have you had pain other than these everyday kinds of pain during the last week?

Yes No

2. On the diagram, shade in the areas where you feel pain. Put an **X** on the area that hurts the most.



3. Please rate your pain by circling the one number that best describes your pain at its **worst** in the last week.

0 1 2 3 4 5 6 7 8 9 10

No Pain

Pain as bad as you can imagine

4. Please rate your pain by circling the one number that best describes your pain at its **least** in the last week.

0 1 2 3 4 5 6 7 8 9 10

No Pain

Pain as bad as you can imagine

5. Please rate your pain by circling the one number that best describes your pain on the **average**.

0 1 2 3 4 5 6 7 8 9 10

No Pain

Pain as bad as you can imagine

6. Please rate your pain by circling the one number that tells how much pain you have **right now**.

0 1 2 3 4 5 6 7 8 9 10

No Pain

Pain as bad as you can imagine

7. What treatments or medications are you receiving for your pain?

8. In the last week, how much **relief** have pain treatments or medications provided? Please circle the one percentage that most shows how much **relief** you have received.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

No Relief

Complete Relief

9. Circle the one number that describes how much, during the past week, **pain** has **interfered with** your:

A. General Activity

0 1 2 3 4 5 6 7 8 9 10

Does not interfere

Completely interferes

B. Mood

0 1 2 3 4 5 6 7 8 9 10

Does not interfere

Completely interferes

C. Walking Ability

0 1 2 3 4 5 6 7 8 9 10

Does not interfere

Completely interferes

D. Normal Work (includes both work outside the home and housework)

0 1 2 3 4 5 6 7 8 9 10

Does not interfere

Completely interferes

E. Relations with other people

0 1 2 3 4 5 6 7 8 9 10

Does not interfere

Completely interferes

F. Sleep

0 1 2 3 4 5 6 7 8 9 10

Does not interfere

Completely interferes

G. Enjoyment of life

0 1 2 3 4 5 6 7 8 9 10

Does not interfere

Completely interferes

8.8 Appendix VIII: European Quality of Life-5 Dimensions

EQ - 5D

Health Questionnaire

South African English version

By placing a tick in one box in each group below, please indicate which statements best describe your own state of health TODAY.

Mobility

- I have no problems in walking about
- I have some problems in walking about
- I am confined to bed

Self-Care

- I have no problems with self-care
- I have some problems washing or dressing myself
- I am unable to wash or dress myself

Usual Activities (*e.g. work, study, housework, family or leisure activities*)

- I have no problems with performing my usual activities
- I have some problems with performing my usual activities
- I am unable to perform my usual activities

Pain/Discomfort

- I have no pain or discomfort
- I have moderate pain or discomfort
- I have extreme pain or discomfort

Anxiety/Depression

I am not anxious or depressed

I am moderately anxious or depressed

I am extremely anxious or depressed

Compared with my general level of health over the past 12 months, my state of health today is:

Better PLEASE TICK

Much the same ONE

Worse BOX

To help people say how good or bad their state of health is, we have drawn a scale on which the best state you can imagine is marked 100 and the worst state you can imagine is marked 0.

We would like you to indicate on this scale, in your opinion, how good or bad your own health is today. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your state of health is today.

**Your own
state of health**

*Best imaginable
state of health*



*Worst imaginable
state of health*

Because all replies are anonymous, it will help us to understand your answers better if we have a little background data from everyone, as covered in the following questions.

- | | | | | |
|----|---------------------------------------|--------------------------|--------------------------|-------------------|
| 1. | Have you experienced serious illness? | Yes | No | PLEASE TICK |
| | <i>yourself</i> | <input type="checkbox"/> | <input type="checkbox"/> | APPROPRIATE BOXES |
| | <i>in your family</i> | <input type="checkbox"/> | <input type="checkbox"/> | |
| | <i>while caring for others</i> | <input type="checkbox"/> | <input type="checkbox"/> | |

2. What is your age in years ?

- | | | | | |
|----|-------------------------|--------------------------|--------------------------|-----------------|
| 3. | Are you male or female? | Male | Female | PLEASE TICK |
| | | <input type="checkbox"/> | <input type="checkbox"/> | APPROPRIATE BOX |

- | | | | |
|----|----------------------------|--------------------------|-----------------|
| 4. | <i>I smoke</i> | <input type="checkbox"/> | PLEASE TICK |
| | <i>I used to smoke</i> | <input type="checkbox"/> | APPROPRIATE BOX |
| | <i>I have never smoked</i> | <input type="checkbox"/> | |

- | | | | | |
|----|--------------------------------------|--------------------------|--------------------------|-----------------|
| 5. | Do you now, or did you ever, work in | Yes | No | PLEASE TICK |
| | health services or social welfare? | <input type="checkbox"/> | <input type="checkbox"/> | APPROPRIATE BOX |

If so, in what capacity?

6. Which of the following best describes your main activity?

PLEASE TICK

self employed

APPROPRIATE BOX

in formal employment

retired

homemaker/domestic worker

student

seeking work

other (please specify)

7. What was the highest grade that you attained at school?

Yes

No

PLEASE TICK

8. Do you have a diploma or equivalent?

APPROPRIATE BOX

9. If you know the area/suburb in which you stay, please write it here.....

8.9 Appendix IX: International Physical Activity Questionnaire (IPAQ) – Short Version

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. This is part of a large study being conducted in many countries around the world. Your answers will help us to understand how active we are compared with people in other countries.

The questions are about the time you spent being physically active in the last 7 days. They include questions about activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Your answers are important.

Please answer each question even if you do not consider yourself to be an active person.

THANK YOU FOR PARTICIPATING.

In answering the following questions,

- **vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal.
- **moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

- 1a. During the last 7 days, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

Think about *only* those physical activities that you did for at least 10 minutes at a time.

_____ **days per week** → go to question 1b

or

none → go to question 2a

- 1b. How much time in total did you usually spend on one of those days doing vigorous physical activities?

_____ **hours** _____ **minutes**

- 2a. Again, think *only* about those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week** → go to question 2b

or

- none** → go question 3a

- 2b. How much time in total did you usually spend on one of those days doing moderate physical activities?

_____ **hours** _____ **minutes**

- 3a. During the last 7 days, on how many days did you **walk** for at least 10 minutes at a time? This includes walking at work and at home, walking to travel from place to place, and any other walking that you did solely for recreation, sport, exercise or leisure.

_____ **days per week** → go to question 3b

or

- none** → go to question 4

- 3b. How much time in total did you usually spend walking on one of those days?

_____ **hours** _____ **minutes**

The last question is about the time you spent sitting on weekdays while at work, at home, while doing course work and during leisure time. This includes time spent sitting at a desk, visiting friends, reading travelling on a bus or sitting or lying down to watch television.

4. During the last 7 days, how much time in total did you usually spend *sitting* on a **week day?**

_____ hours _____ minutes

This is the end of questionnaire, thank you for participating.

8.10 Appendix X: Anthropometric Measurements

ID code _____

Date: _____

Community Health Centre: _____

Description	First	Second	Third	Average
Height (cm) – to nearest 0.1 cm				
Weight (kg) – accurate to 0.05 kg				
Body Mass Index (weight in kg ÷ height in cm ²)				
Waist measurement (cm) – to nearest 0.1 cm				
Hip measurement (cm) – to nearest 0.1 cm				
Waist-Hip Ratio (waist in cm ÷ hip in cm)				