THE ASSOCIATION BETWEEN PHYSICAL ACTIVITY AND BODY MASS INDEX, QUALITY OF LIFE, LIFE-SPACE MOBILITY AND SUCCESSFUL AGING IN OLDER ADULTS

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Preface

The research work in this dissertation was conducted in fulfilment of the requirements for the degree of Masters in Sport Science in the Discipline of Biokinetics, Exercise and Leisure Sciences, School of Health Science, College of Health Sciences, Westville campus, University of Kwazulu-Natal, Durban, South Africa. The research was conducted in the Chatsworth area Durban, South Africa from September 2018 to October 2018. The research topic for this study is entitled: **"The association between physical activity and body mass index, quality of life, life-space mobility and successful aging in older adults"** under the supervision of Dr. Jeanne Martin Grace. This dissertation includes five chapters: The first chapter is the introduction including a problem statement, chapter two, the literature review, chapter three the methodology, chapter four the results, and the last chapter is the discussion with conclusions and recommendations.

This work has not been submitted in any form for any degree or diploma to any other university, where use has been made of the work of others, it is duly acknowledged in the text.

Jacqueline Naiker ____Date _________________

Dr. Jeanne Martin Grace ____Date _________________

As the candidate's supervisor I agree to the submission of this dissertation.

Declaration

I Jacqueline Naiker, declare that:

1. The research reported in this dissertation, except where otherwise indicated, is my original work.
2. This dissertation has not been submitted for any degree or examination at any other university.
3. This dissertation does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.
4. This dissertation does not contain other persons' writing unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:
    a) their words have been re-written, but the general information attributed to them has been referenced;
    b) where their exact words have been used, their writing has been placed inside quotation marks, and referenced.

Signature:______________________________ Date:________________________________

Dedication

The work presented in this masters dissertation is dedicated to the loving memory of my late father and grandmother:

Mr. Ivan Naiker, the first Indian firefighter at Benoni Fire Department in 1990, an unsung hero to a nation and my superhero and Mrs. Adilutchmee Naiker, my inspiration and biggest supporter who both succumbed to cardiovascular disease.

Ivan Naiker (30 November 1962-15 August 2011)

Adilutchmee Naiker (10 June 1944-14 July 2015)

Jeremiah 29:11 For I know the plans I have for you declares the Lord, plans to prosper you and not to harm you, plans to give you hope and a future.

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- God, my Saviour Jesus Christ who granted me with this opportunity to enhance my field of expertise with such a special group of people. Without your grace, none of this would have been possible.

  Psalms 9:1 - I will give thanks to you Lord, with all my heart. I will tell of all your wonderful deeds.

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List of Acronyms

Acronyms	Title of acronyms
GPAQ	Global Physical Activity Questionnaire
HRQoL	Health-Related Quality of Life
SF-36	Short Form-36
LSQ	Life-Space Mobility Questionnaire
SAS	Successful Aging Scale
BMI	Body Mass Index
MVPA	Moderate-Vigorous Physical Activity

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Abstract

The biggest threat to healthy aging is sedentary living with the golden years of most individuals being affected by disorders that are exacerbated by unhealthy lifestyles. Helping people age better is important and it can be achieved through participation in regular physical activity. Monitoring population levels of physical activity using subjective and objective measures is an important part of a public health response. This study aimed to determine the physical activity and body composition levels of older adults and the association of physical activity on body composition with health-related quality of life, life-space mobility and successful aging of life of older adults in Chatsworth, KwaZulu-Natal Province. A total of 210 older adults were randomly selected, both male and females, participated in the study and completed the Global Physical Activity Questionnaire, RAND Medical Outcomes Study 36-Item Health Survey, Life-Space Mobility Questionnaire and the Successful Aging Scale. BMI (kg/m^2) was determined and step count was tracked for 7 days with the Omoron Pedometer. There were positive correlations between the participants actual physical activity and self-reported physical activity levels (r=0.183, p=0.008). The majority of the participants were overweight (51%, n=107). There was no significant relationship between BMI (r=0.63, p=0.366) and actual steps taken as well as no significant correlation with SF-36 and the average number of steps in 7 days of the participants (r=-0.112, p=0.107). A significant correlation between total LSQ (r=0.224, p=0.001) and SAS (r=-0.152, p=0.027) with the average number of steps in 7 days of the participant was noted. It was concluded that there is a positive relationship between self-reported physical activity and actual activity and life-space mobility and successful aging of life in older adults, but such relationship is not meaningfully predictive in this population. Strategies to improve physical inactivity in the elderly need to be implemented to ensure successful aging and quality of life in the elderly.

Key words: Actual physical activity, Aging, Self-reported physical activity, Pedometer

Chapter One: Problem Statement

1.1 Introduction

The biggest threat to healthy aging is sedentary living (Clark, 2011), with the golden years of most individuals being affected by ailments that are exacerbated by unhealthy lifestyles. Helping people age better is an important aspect for health professionals, and one way this can be achieved is through regular participation in physical activity. Clark (2011) highlights that being physically active is one of the best lifestyle choices that can enhance an individual's health and enable a longer and healthier life. Physical activity has a great advantageous influence on many bodily functions, therefore assisting in preventing and managing many long-term health conditions. The Aged and Care Group (2013) makes it clear that no matter the age of an individual, one is never too old to participate in physical activity and can be adjusted to accommodate a person's abilities and any health problems. This chapter presents the contextual to the study, indicates the issue being addressed in the study area, the aim and associated objectives, and defines the terms used in this research. It concludes by outlining the significance of the study and the structure of the remaining four chapters.

1.2 Background

Bull *et al*. (2009) explain that worldwide, elevated levels of sedentary living contribute significantly to the problem of chronic disease, resulting in high medical expenses for individuals, society and the government. A standardized protocol is used to monitor a population levels of physical activity. This is an imperative facet to health response when dealing with existing concerns vis-à-vis levels of physical inactivity and obesity. Kimokoti and Hamer (2008) explain that sub-Saharan Africa (SSA) carries a high rate of chronic diseases, and that the older inhabitants in this area is predicted to elevate from 36.6 million to 141 million by the year 2050. Peltzer and Mafuya (2012) highlight that there is limited scientific research on physical activity and its related factors among older adults in Africa.

The South African Demographic and Health Survey (2012) illustrates that a large proportion of South Africans have an unhealthy lifestyle, with no or insufficient physical activity. These findings correspond with the high levels of obesity, as well as the development of chronic diseases observed among adults and children. More specially, KwaZulu-Natal Province has the highest level of physical inactivity for both males (66%) and females (81%).

The Bill of Rights in the Constitution of South Africa (1996) states that every older adult is allowed to have adequate healthcare and access to information. Additionally, the Older Persons Act 13 of 2006 backs ups the Constitution of South Africa by declaring the privileges of older adults as well as the importance of community-based healthcare that ensures that older adults can stay in their own residences, if possible (South African Human Rights Commission,1996).
The World Health Organization (2015) advises that due to the great effect of chronic diseases on the health-related quality of life in older people, effective approaches need to be instituted in order to resolve the challenges experienced by the aged. Chronic illness is at an increase, yet individuals worldwide are living longer but are experiencing a great decrease in general well-being which is sure to become a major universal health challenge.

Bull *et al*. (2009) highlight that in large populations physical activity is determined usually using self-reported recall. Self-reported recall is done via a questionnaire conducted either telephonically or can be a household interview. When using a reliable format of self-reported recall over a period of time, it provides valuable information that provides an understanding of trends of physical activity in different populations. An example of self-reported recall method is in a form of surveys. These are a useful instrument due to their low cost, ease of administration and adaptability. Bull *et al*. (2009) further highlight that given the importance of physical activity, the unfortunate state of measurement and absence of comparable data internationally and nationally indicates that there is a crucial need for a standardized measure of physical activity. Furthermore, there is a great need in countries such as South Africa (SA) for such a measure that is reliable, effective and suitable for use in health care systems. SA currently has a number of health surveillance systems, such as the World Health Organisation STEPwise approach, which has been adopted to rapidly survey non-communicable and infectious diseases in the general population. However, there is need for a reliable and valid health surveillance system to be developed especially for older adults (Maimela *et al*., 2016).

A South African study conducted by Rabie and Klopper (2015) suggest in order to maintain the high number of older persons, the health sector needs to assist seniors to reside in their own households for as long as they possibly can. This should be done via health advancement activities that focus on self-care. The term self-care denotes to the ability to persistently take care of oneself however, the inability to do this possibly leads to unintentional self-neglect, which results in a decrease quality of life. Self-care support groups need to be implemented in order to provide proper guidelines for older adults that will avert unintentional self-neglect thus enhancing one's quality of life. Social support is vital in assisting seniors to preserve normal functioning and quality of life. Unfortunately, older adults are less expected to incorporate any self-care skills into their lives if they live alone or feel isolated in their communities (Rabie and Klopper, 2015).

An ageing world population refers to the progression by which the elder population becomes a proportionally greater component of the entire population. This is due to the changeover of a population's demographic from higher to lower levels of fertility and mortality. This means that there is an increase lifespan, which means a decline in deaths from chronic disease, due to improved health management and effective health interventions (Gerber *et al*., 2016).

Gerber *et al*. (2016) explain that an effective health intervention implemented at the right time can increase lifespan. According to statistics, the number of persons who are ≥60 years old will be more than children <5 years of age by the year 2020, and by year the 2050, the world's population aged ≥60 years is expected to total 2 billion, from 841 million today, with 80% living in low- and middle-income countries (Gerber *et al*. 2016). Therefore, there is a great need to investigate health and its association to aging in developing countries, such as South Africa, to bring awareness on this issue and to fill the gap in research.

Gerber *et al*. (2016) further explain that due to advancing age of individuals, healthcare treatment choices for the aged are made according to the several social, psychological and physical challenges they experience. When one is determining the quality of life and functioning in this age group, aspects such as resilience, self-efficacy and the perception of life should be considered. Older people should continue to live their life fully by getting involved in economic, social, cultural and political activities within their societies and should enjoy the process of aging. According to Unger (2012), there is a possibility that the method to healthcare for older adults will vary suggestively in the future, through the use of more technologically advance approaches such as self-care initiatives, e-health systems and patient-centred tactics, whereas Arai *et al*. (2012) recommend that enhancement in traditional healthcare services is vital for improved healthcare delivery for older adults to enhance their quality of life.

1.3 Problem statement

Extensive research into physical activity levels, as well as the relationship between physical activity with body composition, health-related quality of life, life-space mobility and successful aging of life have been conducted (Chodzko-Zajko et al.,2009) (Sylvia et al.,2014) (Dohrn, 2015). However, a large proportion of the research has been conducted internationally, with limited studies in South Africa. The few South African studies on physical activity levels of the elderly were conducted by Gerber *et al*. (2016) and Botes *et al*. (2018) using subjective, self-reported methods, with limited research indicating the association between physical activity through the use of objective measures, and body composition, health-related quality of life, life-space mobility and successful aging of life in older adults. Research conducted by Gerber *et al*. (2016)) was conducted in Bloemfontein, while there is extremely limited to no research being conducted on the elderly population in KwaZulu- Natal (KZN) Province, more particularly the Chatsworth residential area outside the city of Durban. There is a considerable need for more research data using subjective and objective methods, such as pedometers or accelerometers. Furthermore, there is lack of data on the association between physical activity and body composition, health-related quality of life, life-space mobility and successful aging of life in older adults.

Obtaining information of this nature is important and can be used to convince relevant government, schools and health professionals about the significance of the problem of physical inactivity in the elderly and the need to implement strategies to improve their quality of life. Therefore, information obtained from this present study could provide a scientific foundation in aid of the prevention and reduction of physical inactivity thus encourage healthy aging among South Africans.

1.4 Research questions

Given the above problem, the study attempted answering the following research questions:

1. What are the self-reported and actual physical activity levels of older adults in Chatsworth?
2. Will there be a correlation between self-reported versus actual physical activity levels of older adults in Chatsworth?
3. Is there an association between the Body Mass Index and actual physical activity levels of older adults in Chatsworth?
4. Is there an association between the health-related quality of life, life-space mobility and successful aging of life and actual physical activity levels of older adults in Chatsworth?

1.5 Research aims and objectives

The study aimed to determine the physical activity and body composition levels of older adults and the association of physical activity on body composition with health-related quality of life, life-space mobility and successful aging of life of older adults in Chatsworth, KwaZulu-Natal Province.

The study had the following objectives:

1. To determine the self-reported and actual physical activity levels of older adults.
2. To determine the correlation between self-reported versus actual physical activity levels of the older adults.
3. To examine the association between the body mass index of older adults to their actual physical activity levels.
4. To examine the association between health-related quality of life, life-space mobility and successful aging of life of older adults to their actual physical activity levels.

1.6 Scope of the study

The study employed a quantitative approach using a non-experimental descriptive, correlational research design. To qualify for inclusion to participate in the study, the individuals had to be an older adult, between 65-85 years of age, and reside in the Aryan Benevolent Homes or Aryan Benevolent West Sun Home for the Aged based in the Chatsworth area of KZN. The older adults had to be able to walk without a walking device, have no orthopaedic limitations and be free from any mental limitations. A total of 210 older adults, both male and females, qualified for inclusion and agreed to participate in the study. Six measuring instruments were used in the study, the first being the General Physical Activity Questionnaire (Appendix D), which was used to estimate levels of physical activity that are of a moderate to vigorous intensity. From this questionnaire, related information was collected to evaluate the effectiveness of physical activity interventions on a community or population level. The second instrument was the RAND Medical Outcomes Study 36-Item Health Survey (Appendix E), by means of which general health-related quality of life data was composed. The third was the Life-Space Mobility Questionnaire (Appendix F), by which data on the spatial extent of an older individual's mobility was collected. The fourth was the Successful Aging Scale questionnaire (Appendix G), which collected data about successful aging. The fifth was anthropometric assessment tools to determine height and weight, and to subsequently calculate BMI. Lastly, a pedometer the Omoron Pedometer Walking Style Pro 2.0 was used to track the steps of the participant.

1.7 Concept classification

The following concepts apply to this research:

Older adult: an individual is regarded as elderly or as an older person if they are of a chronological age of 65 years and over (World Health Organisation, 2010).

Self-reported activity: involves individuals either recording activities as they occur or recalling previous activities, which is captured using self-administered questionnaires, activity diaries and interviews (Dohrn, 2015).

Actual physical activity: involve both the specific assessment of energy expenditure and of actual movement behaviour (Dohrn, 2015).

Health related quality of life: is a complex dynamic that focuses on how health status and physical activity that influences individuals' quality of life. HRQoL encompasses aspects of both physical and psychological health, as well as emotional and social well-being (Dohrn, 2015).

Life Space Mobility: is the frequency of travel and the support required when moving through different life-space areas (Tsai *et al*., 2015).

Successful Aging: represent the physical, psychological, and social success of aging in individuals (Dogra and Stathokostas, 2012).

Body Mass Index (BMI): height and weight are used to calculate BMI (weight/height^2–kg/m^2) according to the protocol of Thompson *et al*. (2015).

Pedometer: are valid instruments for assessing walking behaviour (Dohrn, 2015).

1.8 Outline of the Chapters

The study is presented in the following five chapters:

Chapter 2. Literature Review: this chapter reviews the local and international literature on the physical activity levels of older adults, their body mass index, health-related quality of life, life-space mobility and successful aging.

Chapter 3. Methodology: this chapter outlines the research design, study population and sampling methods, the measuring instruments, the data collection tools, processes and analysis, as well as the ethical considerations.

Chapter 4. Results: this chapter presents the results of the statistical analyses for the quantitative data obtained for the four study Objectives. The results are presented in a tabular format and where appropriate, in a graphical format.

Chapter 5. Discussion and Conclusion: This chapter discusses the results and in relation to the findings from the literature to meet the objectives of the study. It indicates the extent to which the problem identified in this chapter was addressed and the aim achieved by reviewing the findings from each objective. It outlines the study limitations, the significance of the findings, and makes recommendations relating to the use of the results and future studies.

Chapter Two: Literature Review

2.1 Introduction

The objective of this study was to determine the physical activity levels of older adults, as well as the association of their physical activity levels with body mass index, health-related quality of life, life-space mobility and successful aging of life in older adults from Chatsworth. The focus of this chapter is a literature review of various scientific and peer-reviewed journals that provide background information about physical activity in older adults. The comparison of self-reported and actual physical activity levels is discussed, as well as the association between body mass index, health-related quality of life, life-space mobility and successful aging of life of older adults. Empirical research findings applicable to this research dissertation was also discussed.

2.2 Physical activity

Engaging regularly in physical activity is vital and is a behaviour that needs to be developed in order to sustain good health and well-being among individuals and the population (Bull *et al*., 2009). Elevated levels of inactivity contribute significantly to disease, which results in economic costs. An important area of health is responses to current issues concerning levels of sedentary living and obesity in individuals and populations. This could be done through monitoring of physical activity levels of the population by using standardized protocols (Bull *et al*., 2009).

2.2.1 *Physical activity in older adults*

Thompson *et al.* (2015) define physical activity as any bodily movement that result in the burning of calories. The fourth leading risk factor for universal mortality is physical inactivity. The high levels of living a sedentary life have seen to be causing a projected 3.2 million deaths worldwide (World Health Organisation, 2010). Physical activity is translated into four dimensions of intensity (how hard), duration (how long), frequency (how often) and mode (type) (Sylvia *et al*., 2014), the first three accounting for the total volume of the activity. Metabolic equivalent (METs) is often used to express physical activity intensity, with a single MET being defined as the energy cost of sitting quietly and is calculated to a calorie consumption of one kcal/kg/hour. Activity of moderate-to-vigorous intensity (MVPA) is usually defined as ≥3 METs, this calorie consumption being at least three times higher than for a person sitting quietly (World Health Organisation, 2010).

Sylvia *et al*. (2014) explain that older adults who are involved in exercise regularly benefit greatly. Participation in regular exercise reduces the risk of hypertension, type 2 diabetes mellitus, cardiovascular disease, osteoporosis, thromboembolic stroke, colon and breast cancer, obesity, depression and anxiety. There is extensive literature indicating that physical activity avoids or mitigates functional limitation, diminishes risk of falls as well by injuries caused by falls, and is an effective treatment for countless chronic diseases in older adults (Sylvia *et al*., 2014). Involvement in strengthening and aerobic physical activity above the minimum suggested amounts offers supplementary health benefits that results in advanced levels of physical fitness, further decreasing the risk for early development of chronic health diseases death due a sedentary lifestyle. Furthermore, to supplement muscle strength, older adults should participate in higher-impact weight-bearing activities and extra-muscle strengthening activity, as tolerated (Nelson *et al*., 2007).

Thompson *et al.* (2015) explain that the urgency for effective physical activity interventions is greatly needed, as most older individuals are sedentary and are at higher risk for developing chronic disease or mobility limitations. The purpose of exercise interventions is to support individuals in changing their behaviour by replacing sedentary pursuits with active ones. A successful and effective physical activity intervention must be developed along the physical activity habits of the lifestyle for whom it is intended and most importantly it must be enjoyable. It is important to teach individuals that activities they would consider to be enjoyable such as gardening or dancing, can meet the daily goal of accumulating 30 minutes of moderate intensity activity.

2.2.2 *Sedentary behaviour in older adults*

As previously highlighted, sedentary living is one of the primary hazards for persons who are overweight or obese and those living with chronic illnesses such as diabetes, cardiovascular diseases, hypertension, and various forms of cancer, stress, anxiety and depression. It can also impair and contribute to social exclusion and loneliness (World Health Organisation, 2010). Dohrn (2015) expresses that sedentary behaviour as any behaviour categorized by very little bodily movement and an energy expenditure of ≤1.5 METs, often in a resting or sitting position. Sedentary behaviour is sometimes used interchangeable with the term ‘inactivity’ as there is no uniform definition of physical inactivity, but ‘inactive’ is suggested as a term for describing a person who does not meet physical activity recommendations.

Sylvia *et al*. (2014) explain that it has been proposed that poor health in ageing causes mortality, independent of time spent in MVPA. Both total times spent sedentary and prolonged time spent sedentary without breaks have been associated with health risks. Current evidence is insufficient for specific recommendations on maximum sedentary time per day or week, or breaks in sedentary time (Sylvia et al., 2014).

Dohrn (2015) further highlights that high volumes of sedentary time have been observed among older adults, although there is only limited data of the potential impact of this on physical function. A study by Ming *et al*. (2015) observed that older adults spend a greater time viewing television which prospectively is linked to a slower gait speed. A forthcoming study by Tremblay *et al*. (2010) reported that inactivity was strongly related to decreased physical function, most noticeable among older women and those who reported the most time being sedentary. Few studies have used objective assessments of sedentary time in older adults.

2.2.3 *Recommendations of Physical Activity for Older Adults*

According to the World Health Organisation (2010), an individual is regarded as elderly or as an older person if they are at a chronological age of 65 years and over. Thompson *et al.* (2015) noted that the Physical Activity Recommendations from the American College of Sports Medicine for older adults that are aged 65 or older is to promote and maintain good health, in those who have a good-standing of health and have no health ailments that restrict mobility, should include:

1. Maintain a physically active lifestyle to promote and ensure good health.
2. Participate in endurance exercises that is of moderate-intensity or vigorous-intensity for at least 30 minutes for five days per week or for at least 20 minutes for three days per week respectively. Endurance exercise of moderate intensity comprises a moderate level of effort in relation to an individual's cardiovascular capability. On a 10-point gauge, where sitting is regarded as 0 and all-out exertion is 10, moderate intensity exercise is a 5 or 6 and displays visible rises in heart rate and breathing while exercises that is of vigorous intensity that causes large rises in heart rate and breathing is a 7 or 8.
3. Perform combinations of MVPA to meet this recommendation. These can be in the form of combined low intensity exercises regularly performed during daily life such as washing dishes, self-care, or moderate intensity exercise that last less than ten minutes such as taking a walk to the parking lot of a store or at the office or even taking out trash.
4. Perform strength exercises at least twice each week by incorporating the main muscles of the body which preserve or increase muscular endurance and strength. It is suggested that for at least two non-consecutive days per week, 8–10 exercises be should be completed

using the main muscle groups. In order to take full advantage of strength development, 10–15 repetitions for each exercise with a resistance such as a weight should be used. Moderate to high level of effort should be used for resistance training.

5. Improvement of personal fitness. This will reduce the risk for disabilities and chronic diseases as well as prevent unhealthy weight gain and is expected to exceed the minimum suggested volume of physical activity.
6. Maintain the flexibility necessary for regular physical activity and daily life. Flexibility exercises should be done for at least 10 minutes each day, on at least two days per week.
7. Perform workouts that improve or maintain balance to decrease the risk of injury from falls.
8. Execute every exercise in such a way that it will effectively and safely treat any medical condition.
9. Plan to engage in suitable exercises that addresses each suggested type of activity. Exercise is therapeutic for individuals with chronic conditions and should have a prevention and treatment plan in place. For those not physically active at the suggested levels, training regimes should include a gradual approach to increase physical activity over time. Long periods of exercise lower than the suggested levels are suitable for some older adults with low fitness capabilities as they increase their activity levels steadily. Older adults should also be urged to self-monitor their physical activity on a regular basis and to re-evaluate plans as their abilities improve or as their health status changes.

Nelson *et al*. (2007) make clear that exercise must be customised to each individual according to an evaluation of the nature of the activity restrictions and the ability of the individual that will govern the individualised level of physical activity and other essentials of the activity plan. The activity program depends on health care and available resources intended for people with activity restrictions, such as pulmonary and cardiac rehabilitation centres as well as workout classes specifically intended for seniors with arthritis.

2.2.4 Areas of importance in promoting physical activity in older adults

Dohrn (2015) explains that with adequate experience, ability, training and fitness, older adults can attain high levels of physical activity. However, it is a challenge for some older adults to achieve that. It is important that numerous factors must be highlighted in encouraging physical activity among the aged, as described below:

1. Reduce sedentary behaviour. It is evident that individuals who participate in less physical activity than the required still attain some health benefits (Dohrn (2015).
2. Increase participation in exercise of moderate-intensity and give less importance to accomplishing high levels of physical activity. Emphasis should be placed on setting

realistic goals for moderate-intensity activity and should be within the range of 30–60 minutes a day.

3. Practicing a gradual (stepwise) approach. For older adults, the correct way to increase exercise is gradually over time. This is important as it reduces the risk of overuse injuries. This approach makes the increase in exercises more enjoyable and allows optimistic support that eventually lead to accomplishing transitional goals. Seniors tend to spend too much time at one type of an activity such as joining workout classes 2-3 days per week in order to gain knowledge, fitness, as well as self-confidence.

Nelson *et al*. (2007) explain that there is a need for the development of an exercise plan that is uniquely designed for each individual. This plan should distinguish suggested levels of physical activity unique to each individual and should describe the way one anticipates meeting them. It is suggested that seniors with chronic illnesses should create an exercise plan in conjunction with a healthcare professional to ensure that it effectively considers treatment and risk supervision in relation to chronic illnesses. The strategy must be personalized in line with the chronic illnesses and exercise restrictions, the risk for falls, individual abilities and fitness capabilities, policies for diminishing the risks of physical activity and increasing physical activity gradually.

Nelson *et al*. (2007) further explain that healthy older adults who are asymptomatic and without chronic diseases should also develop an exercise strategy, if possible, also in consultation with a healthcare professional or fitness expert, in order to benefit from their knowledge on physical activity and injury prevention. This sanction reiterates the instruction of consulting a healthcare professional before embarking on intensifying training routines. Consultations with health care professionals should always be done irrespective of whether or not an older adult presently plans to increase their exercise regime. It is of utmost importance that policies; health advancement strategies and educational methods are implemented for the aged. Beside these, exercise regimes should be conducted in old-age homes, retirement villages and life care facilities. Older adults also should be involved in physical activity through employer-sponsored and community health promotional activities as well as be advised on healthy eating regimes. (Drewnowsk and Evans, 2001).

Although it has been established that both endurance and strength exercise can elicit important benefits for older adults, the approaches on how to increase levels of physical activity is unclear. It has been established that exercise plans for older adults are both effective and safe, but there is limited evidence on how both high and low amounts of physical activity influences health-related quality of life. However, despite the considerable effects of exercise in preventing disease and increasing lifespan, many individuals still continue to be sedentary, predominantly older adults. An understanding of why people choose to begin an exercise program rather than remain physically inactive is important in attempting to implement a community-based exercise program, particularly one that targets elderly people (Drewnowsk and Evans, 2001).

Nelson *et al*. (2007) explain that most seniors should engage in physical activity, and that older adults with health conditions should execute the physical activity in such a way that it remedies the conditions. Furthermore, older adults with health conditions should participate in physical activity in such a way that it decreases the risk of developing other chronic illnesses. Considering the vast evidence on the value of physical activity, it should be one of the highest priorities in the prevention and treatment of illness and disablement in the elderly.

2.3 Demographic variables and the effect on physical activity in older adults

Evenson *et al*. (2012) explain that patterns of physical activity are closely related with age, sex and ethnicity groups in all individuals. Shiroma and Lee (2010) elucidate that there seems to be a contrary association between physical activity and its association with age, gender and ethnic groups amongst individuals. The effects of age, gender and ethnicity on physical activity in older adults is reviewed in the section that follows.

2.3.1 Age

The process of aging is inevitable, regular involvement in physical activity can lessen the biological influences of living sedentary and improve lifespan by reducing the development of chronic ailments and disabling conditions. Unfortunately, in the aging literature there is no agreement with regards to when old age commences, as well as no specific guidelines about the minimum age of participants in studies that examine the various aspects of the aging process (Chodzko-Zajko *et al*., 2009).

The recently published American College of Sports Medicine physical activity and public health recommendations for older adults explain that, in most cases, 'old age' guidelines apply to persons who are 65 years or older. However, these guidelines can also be pertinent for adults between the age range of 50–64 years old who have chronic ailments or functional limitations that influences their mobility and exercise (Chodzko-Zajko *et al*., 2009). Progressing age is related to decreases in functionality and changes in body composition. These common age-related biological changes influence a wide array of bodily functions which can impact on daily life as well as the preservation of physical liberation. Two examples of biological aging are declines in cardiovascular ability and muscle mass (Evenson *et al*., 2012).

As indicated by self-report responses and body motion sensors like pedometers, it was observed that older people are commonly less active than younger adults. However, some active older adults have measured up to some younger active adults in relation to the amount of time spent on physical activity per day. The types of physical activities most popular among older adults are most of the time of lower intensity such as walking, golf, gardening, low-impact water aerobics activities, while the younger adults enjoy running, and higher impact aerobics activities.

Another study by Shiroma and Lee (2010) observed that research on physical activity and cardiovascular risk was done on adults who were between the ages of 45 to 60 years. This suggested that physical activity is also indirectly related to cardiovascular risk among individuals that are 60 years and older. A study by Evenson *et al*. (2012) observed that MVPA was lower in the age range of 60 to 69-year olds and participants who were 80 years or older.

Davis *et al*. (2011) reiterates that less involvement in physical activity is associated with increasing age and higher volumes of sedentary time. In other words, advancing age is depicted by lower activity volume, less high-intensity physical activity, and a lower frequency of being physically active. From the above-mentioned evidence it is clear that age is associated with lower physical activity levels (Davis *et al*., 2011) and therefore it seems justified for the current study to investigate the influence of physical activity on adults who are 65 years and above

2.3.2 Gender

The inverse relationship between physical activity and the threat of chronic disease developing is present in both genders, if not more distinct in women (Shiroma and Lee, 2010). In agreement to this, a study by Evenson *et al*. (2012) observed that significantly more men were physically active compared to women. However, Shiroma and Lee (2010) conducted a study and observed that cardiovascular risk reduction in active women was 40% whereas in men it was 30%. Davis *et al*. (2011) proposed that the for-gender differences could be due to the traditional gender roles, with men involved in more strenuous activities while women participate in less strenuous domestic chores, such as home making and cooking. Through self-reported responses it was observed that those travelling away from their home were active men. A study by Prince et al. (2008) highlighted the trends observed within pedometer data and compared responses from a physical activity questionnaire to the pedometer data, which enabled them to validate the accuracy of the questionnaire responses, with the physical activity was higher for males than females and for those with a lower BMI. However, it is likely that a response bias occurred due to social desirability, which could have influenced over-reporting of physical activity by individuals. Future research is needed to identify whether a partiality does exist and to what extent.

2.3.3 Ethnicity

A study conducted by Matthews *et al*. (2010) identified that self-reported physical activity enablers and barriers differ among ethnically as well as geographically diverse group of older adults. With respect to ethnic groups, there is limited literature on non-white populations (Shiroma and Lee, 2010). Common physical activity barriers that are associated among the different ethnic groups included health issues, the fear of falling and inconvenience of being active while common enablers are constructive outcome expectations, social support and access to physical activity programs. It was observed that barriers that existed among the American Indians was due to the lack of knowledge about physical activity and its associated health benefits while Caucasian Americans stressed the importance of physical activity programs that are developed for older persons. These discoveries recommend numerous ways to promote physical activity among seniors which include the development of physical activity programs designed for their age group, and health discussions that promote physical activity.

A study by Evenson *et al*. (2012) explain that in the United States, self-report measures indicated that white adults were more physically active than other races. By contrast, among 60 years or older adults, overall physical activity was highest among Hispanics and other race groups. Cultural differences may exist between the self-reported and objective measures through difficulties in interpretation or to the types of activities that so far cannot easily be distinguished with the accelerometer used in this study.

In summary, the literature on demographic variables, such as age, gender and ethnicity, have indicated an association with physical activity in the elderly, and subsequently serve as a motivation for considering these variables when selecting the sample of older adults as well as including them when investigating factors that may impact on their physical activity. However, there is a dearth of literature regarding any association between the demographic variables of age, gender and ethnicity and physical activity in South Africa. The respective relationships of body mass index (BMI) with physical activity, as found in the reviewed literature, are discussed next.

2.4. Physical Activity and Body Composition for Older Adults

Sylvia *et al*. (2014) describe body composition as the proportion of fat and fat-free mass in the body. A healthy body composition is composed of a lower ratio of body fat and a higher ratio of fat-free mass. Body composition is a measurement that evaluates an individuals' health and fitness level. Visser and Harris (2012) explain with aging an individual experience an increase in the accumulation of body fat, which thus increases body weight, generally due to the high fat percentage, and a decay in muscle mass. It has been observed that body mass and fatness plateaus at the age of seventy-five to eighty years of age followed by a gradual decline. However, body mass patterns vary among different individuals, and phases of weight loss and weight gain is common in old age which may affect body composition. Body fat is redistributed with aging through decreases in subcutaneous and appendicular fat and increases visceral and ectopic fat. The skeletal muscle mass from the body also declines with aging known as sarcopenia. The decay in muscle mass and elevation in body fat causes obesity in old age which is associated with a higher risk of mobility limitations, disability and mortality (Visser and Harris, 2012).

One way to measure body composition is through body mass index (BMI), which is a measure that determines if an individual is overweight and obese. BMI is calculated by dividing an individual's weight in kilograms by the square of height in meters (Thompson *et al.*, 2015). Pelegrini *et al.* (2014) describe that aerobic exercise-based interventions that are prescribed according to lactate threshold induced changes in body composition and lipid profile. The changes noted were reductions in BMI and body fat percentages, as well as changes in lipid profile were there were increases in high density lipoprotein (HDL) cholesterol and reductions in triglyceride levels, thus reducing the odds of cardiovascular disease.

Patel *et al.* (2009) explain that old age has no significant impact on most physiological variables such as blood cholesterol and glucose, haemoglobin, pulse rate, systolic and diastolic blood pressure, with an overall negative impact of aging on the body composition. These changes in overall adiposity are important factors in many common age-related disorders such as cardiovascular disease. Therefore, it is likely that the age-associated decreases in muscle mass, and strength and endurance, may be a critical determinant for functional loss, dependence and disability. To help prevent unhealthy weight gain, some older adults may need to exceed the minimum recommended amounts of physical activity to a level that is individually effective in achieving energy balance, while considering diet and other factors that affect body weight (Nelson *et al*., 2007). From the reviewed literature, it can be seen that body mass index greatly influences physical activity in older adults, with aging having an adverse impact on it. The classifications of BMI are shown in Table 2.1.

Table 2.1. Classification of BMI

Classification	BMI (kg/m²)	Obesity Class	BMI (kg/m²)
Underweight	<18.5	1	30.0-34.9
Normal	18.5-24.9	2	35.0-39.9
Overweight	25.0-29.9	3	≥40

Source: ACSM (2014)

2.5 Measurement of Physical Activity

The process of measuring physical activity is often used to perceive deviations in physical activity levels, estimate population prevalence and tendencies, and evaluate the efficiency of exercise programmes that intend to alter physical activity levels. The assessment of physical activity can also be used to guide nutritional advice by assisting with the calculation of individual energy requirements (Elliot *et al*., 2014). Physical activity can be measured in various ways, as illustrated in Figure 2.1. Dohrn (2015) describes that physical activity can be assessed as either the energy cost of the body movement (energy expenditure) or as movement behaviour. Depending on how data are collected, physical activity assessments methods can also be categorized as either subjective or objective.

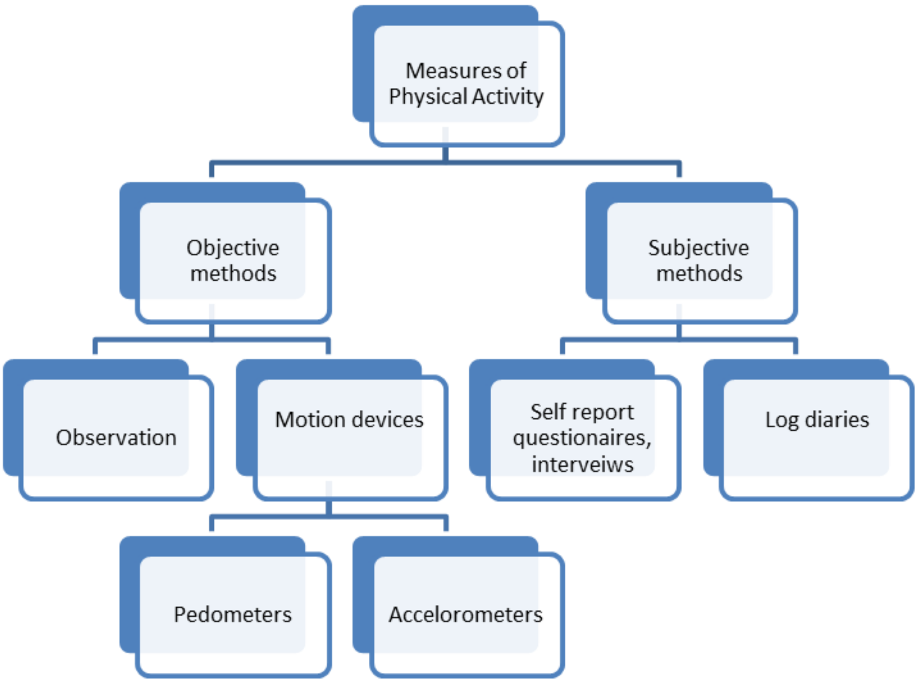

Figure 2.1. Measurement of physical activity (Adapted from Hardy *et al*., 2012)

2.5.1 Subjective Measures

Dohrn (2015) explains that subjective methods for assessing physical activity rely on the individual recording activities as they occur or recalling previous activities, which is captured using self-administered questionnaires, activity diaries and interviews. The most frequently used are questionnaires, especially in epidemiological studies, given that they are relatively easy to administer at a low cost. Questionnaires vary in detail, from short global instruments with a few items to give an overview of activity level, to long, detailed quantitative questionnaires covering the history of activity over the past year or even a lifetime (Dohrn, 2015). Questionnaires often classify individuals as ‘active’ (i.e., meeting physical activity recommendations) or ‘inactive’. Activity diaries can provide detailed hour-by-hour information but entail a high participant burden that may also affect physical activity behaviour. Both questionnaires and activity diaries can be used for more detailed calculations of energy expenditure by using standard energy costs of specific activities (METs), although the validity is low due to large individual differences in energy costs for the same activity. Interviewer-administered questionnaires have a higher validity (Dohrn, 2015) and are also preferred for more detailed assessments of activity behaviour. In-depth interviews are valuable for providing a deeper understanding of physical activity behaviours, such as attitudes and perceptions of exercise as well as experiences of physical activity.

Dohrn (2015) further explains that a disadvantage with subjective assessments is the low accuracy for determining physical activity volume. Self-report methods often overestimate actual activity volume due to recall bias and social desirability bias (i.e., tendency to report physical activity levels corresponding to perceived expectations). However, certain activities may also be underestimated, especially unstructured activity interspersed over the day and light intensity activity, both common behaviours among older adults. In addition, wording and definitions in questionnaires may introduce bias. For example, household activities, which in many cases are activities specific to older women, are sometimes excluded in questionnaires about leisure time physical activity that are used for comparison to the criterion of sufficient physical activity.

2.5.2 Objective Measures

Dohrn (2015) explains that objective methods are generally more accurate than subjective ones and involve both the specific assessment of energy expenditure and of actual movement behaviour. Doubly labelled water method and direct calorimetry are two accurate but expensive methods to measure energy expenditure, mainly used for validation research. Indirect calorimetry using portable devises is a more accessible method to assess energy expenditure by measuring ventilatory volume and oxygen uptake. Direct observation is another method primarily used as a validation criterion, as it can also generate important contextual information about physical activity behaviour, such as mode of physical activity, as well as when, where and with whom it occurs. The substantial investigator burden and the need to prevent the invasion of participant privacy limit the applicability of direct observation in free-living conditions and has mainly been used when studying children.

Dohrn (2015) further explains that the most frequently used objective methods for assessing physical activity behaviour are pedometers and accelerometers, both small wearable movement sensors. Pedometers measure ambulatory activity, such as walking and stepping, as well as track the number of steps. The internal mechanisms for detecting steps in pedometers are either a spring-suspended lever arm, a horizontal beam, or a piezoelectric crystal (such as the mechanism in accelerometers). Pedometers commonly used in research, such as Yamax and Omron, are valid instruments for assessing walking behaviour, which is a common exercise among older adults (Dohrn, 2015). Although the accuracy can be attenuated at very slow walking speeds and in individuals with an altered walking pattern. As stated by Dohrn (2015) "*While not ideally suited for assessing physical activity pattern or intensity of activity, pedometers have several advantages, such as low cost, low participant burden, ease of use, and having an output (i.e., steps) that is easy to understand"*.

Chodzko-Zajko *et al*. (2009) explain that participation in physical activity and aging is a very complex process that involves many factors that interrelate with one another, including primary aging processes, and 'secondary aging' effects that results from chronic disease and lifestyle behaviour and genetic factors. The influence of physical activity on aging in individuals is a challenge to research as cellular aging processes and disease mechanisms are highly intertwined . It has been observed that there are currently no lifestyle interventions, including exercise, which have been shown to reliably extend maximal lifespan in humans. Rather, regular exercise enhances average lifespan through its impact on chronic disease development. Physical activity can also confine the impact of aging through restoring the functional capacity in seniors that were previously sedentary.

2.5.3 Correlation between Subjective and Objective Methods of Physical Activity Measurement

A review by Evenson *et al.* (2012) looked at the correlation of physical activity-based questionnaires (subjective measuring method) compared to objective measuring methods (accelerometers, pedometers). It was observed that self-reported physical activity assessments showed higher validity and reliability among women, with questionnaires compared to objective measures (accelerometers, pedometers) ranging from slight to fair correlation. A study by Colbert *et al*. (2011) examined the correlation of self-reported physical activity with objective measures in adults. The participants wore three activity monitors (pedometer, accelerometer, and a Sense Wear armband) for 10 days and completed three questionnaires. The results showed that the objective devices more appropriately ranked physical activity than self-reported instruments in older adults.

2.5.4 Step Defined Recommendations

Dohrn (2015) highlights that to accurately recall time spent in different activities or estimate activity intensity might be difficult, specifically for older adults, who have a more sporadic physical activity pattern than younger people. An alternative strategy to recommendations based on time and activity intensity is to encourage people to achieve a daily step count. Step count is a simple and straightforward method of assessing physical activity behaviour proven to be valid and sufficient for capturing habitual physical activity volume. Several studies have shown that step count interventions are successful in increasing habitual physical activity. A goal of 10,000 steps per day is often cited as a recommended target for health, but even fewer steps may meet the current health recommendations. According to Tudor-Locke *et al*. (2011), translating 150 minutes of MVPA into steps per day, healthy older adults are recommended to accomplish at least 7,100 steps per day when averaged over a week. This has been adopted in the Physical Activity Recommendations from the American College of Sports Medicine for exercise prescription, although the appropriateness of this recommendation remains to be proven. It is projected that a minimum level of 4,600 step per day, if averaged over a week, is needed to include 150 minutes of MVPA for older adults with chronic conditions or disabilities. An activity level of less than 5,000 steps per day in the elder population is generally considered to be very low, and it is suggested as an indicator of a ‘sedentary lifestyle’ (Figure 2.1). This threshold has been used in a limited number of studies, showing that individuals taking less than 5,000 steps per day are more expected to have a poor health-related quality of life and an elevated incidence of cardiovascular risk factors, obesity, and depression, but further evaluations are needed.

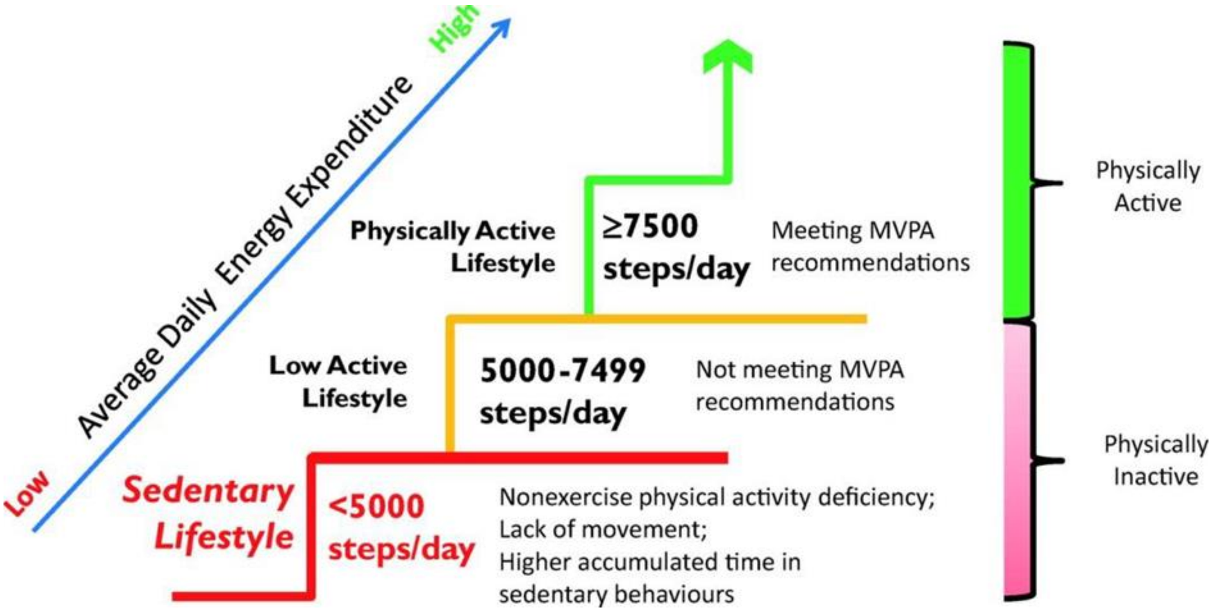

Figure 2.2. Average Daily Energy Expenditure and Step Count (Adapted from Dohrn, 2015)

2.5.5 Physical Activity and Health-related Quality of Life

Dohrn (2015) highlights that health-related quality of life (HRQoL) is a complex phenomenon that focuses on how physical activity and health influences one's quality of life. HRQoL incorporates aspects of both physical and psychological health, as well as emotional and social well-being. Wilson and Cleary in 1995 developed a conceptual model of health-related quality of life to clarify the various components and relationships that exists between these components. An essential aspect is that it is a patient-reported outcome measure, and thereby an important addition to clinical endpoints for assessing the effects of different interventions, both in research as well as in clinical practice.

Dohrn (2015) further explains that moderate to strong associations exist between physical activity and HRQoL in older individuals, being moderately positive, but sometimes mixed, with the influence of physical activity varying in the different domains as mentioned above. However, there is insufficient evidence on pathways between elevated levels of physical activity and HRQoL in older people, or vice versa. Other factors, such as self-efficacy, may mediate the association between them. Furthermore, most studies rely on the subjective assessment of physical activity, with self-reported physical activity and HRQoL possibly having conceptual overlaps, specifically in the physical functioning domains, expanding the relationship between these two constructs.

Olivares *et al*. (2011) describe that the aim of physical activity is to maintain or improve HRQol. From this study, there were positive correlations observed between PA and both physical and mental health-related factors. In agreement to this, several studies have reported links between physical activity and HRQoL, however associations between physical fitness and HRQoL is limited and insufficient. The limited available literature on this relationship explains that the better physical fitness scores will report higher scores for numerous HRQoL domains that are measured by the Short Form 36 Questionnaire. This is mainly true for the physical functioning, physical role and vitality domains. Positive correlations have also been noted between PA and both physical and mental health-related factors.

A study by Queiroz *et al*. (2016) observed the mean quality of life scores of older individuals and indicated that the social function and mental health domains had the highest means, with significant documentation of a better general health in the group that performed physical activity consecutively for over ten years. A study by Bogen *et al*. (2017) used the multiple regression model, and established data on steps per day ($B=.005$, $p\leq.001$) and walks per day ($B=-.174$, $p=.010$) associated with the SF36-PF which established that the daily life walking steps per day in seniors was positively related to health-related physical functioning. Health professionals are therefore likely warranted in advising older people to walk for health-purposes. In terms of the capability approach, functional ability is essential, focusing on what people accomplish with the resources at their disposal. Therefore, it is crucial to understand how physical health influences quality of life and function in older adults in order to make suitable healthcare and treatment decisions (Gerber *et al.,* 2016).

Increasing physical activity is a practical approach for enhancing health and quality of life among older adults. Drewnowsk and Evans (2001) proposed two outcome categories, functioning and well-being, to evaluate the effect of physical activity on the overall quality of life. The concept of functioning includes physical ability and dexterity, cognition and activities of daily living while well-being includes emotional well-being, self-concept and universal insights related to health and overall life satisfaction.

Drewnowsk and Evans (2001), further explain that regardless of age, activity levels or health of participants, physical activity improves HRQoL measures. However, the associations between physical activity and quality of life is greatly reliant on which of the domains was of greatest concern to that older person. The influence of physical fitness on HRQoL was less intense when the person was already functioning above the normal range. Furthermore, disability and dysfunction were more noticeable and unfavourable to quality-of-life measures than were decreases in level of fitness.

Since independent physical functioning is seen as such an important domain to HRQoL, physical activity regimes should involve the input of participants in the design of a program. The input that participants may have in the design of a program probably being more important to quality-of-life outcomes than meeting specific criteria for frequency intensity and duration (Drewnowsk and Evans, 2001).

2.5.6 *Physical Activity and Life-Space Mobility*

Tsai *et al*. (2015) explain that life-space refers to the spatial zone a person persistently moves through in daily life such as the bedroom, home, yard, neighbourhood, town and beyond, while life-space mobility is the rate of travel and the support required when moving through different life-space zones. In order to assess mobility which is where people move or travel, and is also considered the rate of movement and degree of independence, is a vital task done by physical therapists, with most physical activity intervention programmes being purposed to directly or indirectly improve movement. Some existing mobility measures include evaluations of transfer skills, gait or wheelchair mobility, while mobility instruments such as basic activities of daily living (ADL), and instrumental activities of daily living (IADL) are used. Unfortunately, these measures only describe what individuals can do at a given point in time, rather than what activities individuals are involved in daily. Therefore, there is a great need for an instrument that incorporates the complexity of mobility experienced by older adults as well as providing an evaluation of the frequency of travel to various places as well as the need for support. An instrument of that nature would allow physical therapists to investigate barriers of mobility within an individual’s home, neighbourhood and beyond.

Portegijs *et al*. (2014) observed that just by having the ability of going outdoors is a vital aspect in preserving physical and psychological health, as well as total well-being in older people. Older adults who experience limitations with life-space mobility give up treasured activities, such as getting involved in out-of-home activities that includes visiting of friends and accessing community services. With advancing age, seniors tend to spend most of their time in and around their own home, making it important to obtain insight into the limitations in life-space mobility. Portegijs *et al*. (2014) confirms that physical, psychological as well as social aspects are crucial to preserve life-space mobility in relatively healthy older people.

Rantakokko *et al*. (2015) explain that as adults age it is necessary to find ways for them to continue to be active and independent for as long as possible in their daily lives . Older adults who displayed behaviours of not going outdoors that much was related to difficulties in mobility, and poor performance of daily activities, specifically while walking outdoors, even as little as two blocks per day. Booth *et al.* (2000) and Humpel *et al*. (2002) explain that aspects associated with sedentary behaviours in older people are poorly understood and there is a need to investigate psychological and perceived environmental influences related to physical activity participation. This will aid in identifying predictors of physical activity in older adults, such as social support, access to facilities, and neighbourhood safety, which can be used for the development of policy and intervention approaches to endorse health in the aged. Humpel *et al*. (2002) highlighted that in order to understand these associations, further development of environmental models, together with behaviour-specific and context-specific measurement strategies are needed. Improved longevity is associated with an increase in numerous chronic conditions that sometimes translate into functional disability and need for assistance. These added years will expel declining health which will result in reduced mobility and increased depression, isolation and loneliness.

From the reviewed literature it can been seen that life space and environmental conditions have a great impact on physical activity, and the environment can determine whether the association can have a positive or negative connotation on physical activity. However, there is a great need for research to be done in this area, specifically in South Africa.

2.5.7 Physical Activity and Successful Aging

Dogra and Stathokostas (2012) explain that sedentary behaviour may impact the entire aging process. The term successful aging (SA) is used to represent the physical, psychological, and social success with which adults age. The relationship between physical activity and successful aging is already well established. Unfortunately, there is inadequate data available on the relationship between sedentary behaviour and successful aging. Chronic disease and functional impairments are the physical components of successful aging. In a study conducted by Dogra and Stathokostas (2012), participants were categorised as having no mobility problems, having a problem but not requiring any aids, requiring mechanical support, or requiring help from others or cannot walk as per their responses. Those in the first two groups were categorized as aging successfully and those in the last two groups were categorized as aging poorly.

Dogra and Stathokostas (2012) highlight that older adults are urged to develop skills and behaviours that help them to age gracefully. This requires the accomplishment of three conditions: 1) preservation of health which includes mental, physical and social well-being; 2) active participation in society; and 3) a feeling of security. Choi *et al.* (2017) explain that aging is infused with the loss of health, enduring age-related diseases, a decrease in physical condition and activity, decrease of physical attractiveness, loneliness, disability, reliance and difficulties in access to adequate healthcare and nursing services. However, the frequency of aging differs greatly among individuals because of genetics, environmental, behavioural factors and lifestyle choices.

In conclusion, while it can be deduced from the above findings that several studies have researched the association between physical activity and body composition, HRQoL, life-space mobility and successful aging in older adults, it is limited, with gaps remaining regarding these associations, specifically in the South African context. In addition, data collected through objective methods, such as pedometers, in an elderly population in KwaZulu-Natal Province, more particularly the Chatsworth residential area in the city of Durban, has yet to be published.

Chapter 3 describes the methods and procedures that were used to address the objectives of this study.

Chapter Three: Methodology

3.1 Introduction

This chapter encompasses an account of the components of the research process that were applied in order to achieve the aim of the study. A full description of the research design, the participants, the sampling method and the data collection and analysis of the results is presented. The chapter concludes with the ethical issues that were considered and the relevant approval that was sought to conduct the study.

3.2 Research design

A research design can be considered as the blueprint of the study, where the procedures are laid out for an effective and efficient study to be conducted (Fouche *et al.*, 2011). There are two types of research designs, namely quantitative and qualitative and a quantitative design was chosen for this study ((Fouche *et al.*, 2011).

Quantitative research designs are administered to explore the research problem via data capturing and analysis by means of statistical methods ((Fouche *et al.*, 2011). The specific classification of the study design used for this study was a non-experimental, descriptive, quantitative, correlational research study design.

Incorporating a non-experimental, correlational research study design indicates that there is no control or experimental group present. Non-experimental research designs correspond to the use of descriptive statistics, whereby questionnaires and surveys are commonly used (Fouche *et al.*, 2011). Correlational research study designs involve no intervention plan and no pre- or post-testing. The purpose of using the descriptive, quantitative, correlation research design is to quantify the physical activity levels and to determine the possible correlation that exists between physical activity and body mass index, health-related quality of life, life-space mobility and successful aging data of older adults in Chatsworth, KwaZulu Natal with the use of descriptive and correlation statistical techniques.

3.3 Sampling method

Sampling method refers to the selection of participants from the relevant population that will be analysed within the study (Unrau *et al*., 2007). The sampling method incorporated in this study was randomised sampling (Unrau *et al*., 2007). This involved a randomized sample of individuals who resides in the Aryan Benevolent Homes or Aryan Benevolent West Sun Home for the Aged based in Chatsworth, KwaZulu Natal, South Africa who volunteered to participate in the study. The convenience sampling technique allows an easily obtainable sample group, all of whom meet the criteria of the study but there will be a greater potential for bias (Unrau *et al*., 2007). Every effort was made to maintain consistency and accuracy throughout the study for each individual.

The participants were recruited through diverse means. Firstly, the Aryan Benevolent Homes and Aryan Benevolent West Sun Home for the Aged were contacted telephonically and via email regarding the study and requested to assist by informing and encouraging their residents to participate. The residents who were interested in the study were then approached in group sessions. The process of recruitment was in interest of advertisements that was placed at the two old aged homes in Chatsworth, KwaZulu Natal, providing information about this research project as well as through 'word of mouth' advertising of the study assisted in recruiting participants.

3.4 Participants

The study population employed older adults aged between 65 – 85 years old both males and females who reside in the Aryan Benevolent Homes and Aryan Benevolent West Sun Home for the Aged based in Chatsworth, KwaZulu Natal, South Africa. By only including participants over the age of 65 years it was possible to eliminate certain psychological stresses such as job-related concerns (Bull *et al.*, 2009). Hundred-and-sixty and 50 participants were recruited respectively from the two old age homes. To provide a statistical power of 80% and significance level of 95%, for a population of 375, a sample of 210 participants was required to be recruited to report on the findings of the study by using alpha =.05 and margin of error =.05.

This study used a purposive sampling technique and participants were only included if they were an older adult aged between 65-85 years of age and was able to walk without a walking device that is no orthopedic limitation. Participants were excluded if they were unable to walk due to ill health or disability or had mental health problems and limited writing ability was excluded from the study.

3.5 Data collection tools

The instruments used within a research study enables the collection of data from a selected target group which is then analysed and presented as useful and understandable information (Wilkinson & Birmingham, 2003). The measuring instruments involved in this study included four questionnaires, an electronic scale to measure body mass, a stadiometer to measure height and a pedometer to measure the step count. These measuring instruments will be explained in more detail, as well as the protocols and procedures that were consistently adhered to in order to obtain the required information.

Table 3.1 Data collection tools

	Objective	**Data Collection Tool**
1	To determine the self-reported and actual physical activity levels of older adults	a. GPAQ Pedometer
2	To determine the correlation between self-reported versus actual physical activity levels of the older adults	b. GPAQ Pedometer
3	To establish the association between the body mass index of older adults to their actual physical activity levels.	c. Pedometer SECA scale SECA stadiometer
4	To establish the association between health-related quality of life, life-space mobility and successful aging of life of older adults to their actual physical activity levels.	d. SF-36 LSQ SAS Pedometer

3.5.1 Questionnaires

Four questionnaires were administered prior to the use of the pedometer in order to obtain demographic and biographic information. Each questionnaire included a combination of dichotomous questions, multiple choice questions and contingency questions.

All questionnaires were submitted and completed on the same day. Clarity on unanswered questions was obtained from the participant at the testing venue.

The following questionnaires were used in this study:

a. **Global Physical Activity Questionnaire (GPAQ)**

The Global Physical Activity Questionnaire is a valid and reliable instrument which is used to evaluate levels of MVPA and monitor change in MVPA in a population sample in order to evaluate the effectiveness of physical activity interventions on a community or population level (Bull *et al.*, 2009; Cleland *et al.*, 2014). (Appendix D) The GPAQ is adjustable to incorporate cultural differences and it has been used in more than 100 countries globally (Cleland *et al*., 2014). The GPAQ comprises of 19 questions grouped to capture physical activity undertaken in different behavioural domains.

The Global Physical Activity Questionnaire is structured as follows:

Part 1- Job related physical activity questions

Part 2- Transport physical activity related questions

Part 3- Recreation activities

Part 4- Sedentary Behaviour related questions

Within the work and recreation activities domains, questions evaluate the occurrence and duration of two different categories of activity defined by the energy requirement or intensity. In the transport domain, the frequency and duration of all walking and cycling for transport is captured. The GPAQ part 1 was adapted in this study to suit the older adults who were tested. Instead of the word "job" in the job-related physical activity questions, the researcher used the word home. The reliability coefficients were of moderate to substantial strength (Kappa 0.67 to 0.73; Spearman's rho 0.67 to 0.81). GPAQ also showed a moderate to strong positive relationship (range 0.45 to 0.65) on criterion validity.

The scoring for the GPAQ for a population's physical activity (or inactivity) can be described in different ways. The two most common ways are (1) to estimate a population's mean or median physical activity using a continuous indicator such as MET-minutes per week or time spent in physical activity, and (2) to classify a certain percentage of a population as 'inactive' or 'insufficiently active' by setting up a cut-point for a specific amount of physical activity.

b. RAND Medical Outcomes Study 36-Item Health Survey (SF-36)

It is a short, 36-item, self-administered tool that takes less than 10 minutes to complete. The SF-36 measures health-related quality of life in multi-item scales that address eight diverse health concepts. (Dohrn, 2015) (Appendix E)

The SF-36-Item Health Survey is structured as follows:

Part 1-Vitality related questions

Part 2-Physical functioning

Part 3-Bodily pain

Part 4-General health perceptions

Part 5-Physical role functioning

Part 6-Emotional role functioning

Part 7-Social role functioning

Part 8-Mental health

This is a valid and reliable instrument to determine health-related quality of life among older individuals (Hebling and Pereira, 2007, Dohrn, 2015). The SF-36 has eight scaled scores. The scores are weighted sums of the questions in each section. The scores range from 0 – 100. The lesser scores equate to more disability while greater scores equal less disability and better health-related quality of life (Hebling and Pereira, 2007). The high Cronbach′s coefficients obtained (0.86–0.87 for all scales) showed the internal consistency of the items with their corresponding scale and between the scales. Several authors have demonstrated the reliability and validity of SF-36 questionnaire and their two factors structure in older people (Syddall et al. 2009; Bohannon and DePasquale 2010; Walters et al. 2001; Bartsch et al. 2011; Hu et al. 2010).

c. Life-Space Mobility Questionnaire (LSQ)

The Life Space Questionnaire can be used to establish the spatial extent of an older person's mobility. This concept is useful as an outcome measure in studies evaluating interventions designed to enhance mobility and independence in older populations. From this questionnaire one is interested in finding out how much the person moves about and the spatial extent of the person's life space. This helps determine what is the usual range of places in which the person participates in activities within a designated time frame (Tsai *et al.*, 2015) (Appendix F). This questionnaire is valid and reliable as it can customize the administrations, to enable the researcher to know prior to administering the measure where the person lives such as in a rural, suburban, or urban area or whether they live in a house or apartment (Portegijs *et al.*, 2014, Tsai *et al.*, 2015). The life-space measure was the total score (range 0–9). Reliability of the instrument was 0.8 with reportedly good construct and criterion validity (Stalvey et al., 1999).For the questions, it was also important to know how the respondent got to these destinations as one might have driven, or been driven by another person, wheeled in a wheelchair, taken a taxi cab, or used public transportation (Portegijs *et al.*, 2014).

A total score (LSC) iscalculated by adding the score of each level calculated as the product of the level of the living space (1–5), the level of independence (2 = no assistance, 1.5 =

only use of equipment or equipment usage, 1 = help of a person) and the frequency (4 = daily, 3 = 4 to 6 times per week, 2 = 1 to 3 times per week or 1 = less than once per week). This score range from 0 (complete restriction to bed) to 120 points (complete independent travel frequently out of town).

d. The Successful Aging Scale (SAS)

The Successful Aging Scale (SAS) is a valid and reliable scale as it is developed based on 4 well-known models of successful aging (Choi *et al*., 2017, Dogra and Stathokostas, 2012). It included 14 questions based on lifestyle choices, decision making, physical activity and mental health (Dogra and Stathokostas, 2012) (Appendix G). The questionnaires were distributed to each participant where questions were read out to them by the researcher to help understanding of each questionnaire and to ensure it was completed correctly.

3.5.2 Anthropometric measurements

Prior to the answering of the questionnaires, each participant was required to undergo an anthropometric assessment, where their height and body mass was measured and recorded. The anthropometric variables measured were body mass and height. Stature and body mass were measured according to the protocols described by the International Society for the Advancement of Kinanthropometry (Norton & Olds, 1996).

e. Height/Stature

A SECA stadiometer measuring to the nearest 0.1cm was used. The participants stood with feet together with the heels, buttocks and upper part of the back touching the scale. The measurer placed hands along the jaw of the subject with the fingers reaching to the mastoid processes. The participant’s head was placed in the Frankfort plane by putting the orbitale and the tragion in the same horizontal plane. The participant was instructed to take and hold a deep breath, and while keeping the head in the Frankfort plane, the measurer applied a firm upward lift through the mastoid processes. The recorder held the head board firmly down on the vertex, crushing hair as much as possible. The recorder further assisted by watching that the feet did not come off the floor and that the position of the head was maintained in Frankfort plane. The reading was taken to nearest 0.1 cm (Norton & Olds, 1996).

f. Body mass

A SECA electronic scale measuring to the nearest 0,1kg was used to measure mass. The participants were barefooted and wearing minimal clothing. The scale was checked to make sure it is reading zero. The participant stood on the center of the scales without support and with the weight distributed evenly on both feet. The reading was then taken to the nearest 0,1kg. (Norton & Olds, 1996). The same stadiometer and electronic scale were used throughout to ensure reliability and consistency. Height and weight were used to calculate BMI (as weight/height^2– kg/m^2) according to the protocol of Thompson *et al*. (2014). Height and weight measurements were used to calculate BMI by applying the following formula of weight (kg) ÷ height^2 (m^2).

g. Pedometer

Participants were required to wear an Omoron Pedometer Walking Style Pro 2.0 for seven consecutive days. Pedometers were deemed valid indicators of physical activity at moderate and fast speeds and accumulated evidence suggests that they are highly reliable at more practical speeds (Ueno, 2013, De Craemer *et al*., 2015). These were worn at the waist throughout each day and removed only when sleeping and bathing (or any other water-based activity). Measurement started the day after the anthropometric measurement session. Participants were given a recording sheet they had to complete daily. The record sheet recorded their daily step count. Participants recorded the following information for each day of wear that is the time the pedometer was put on and taken off, the duration of time the pedometer was off during the day (if any), as well as the total step count when the pedometer was removed at night.

3.6 Data collection

The proposal for the study was submitted for approval to the Biomedical Research Committee (BREC) of the University for authorization prior to the commencement of the research study. Data collection commenced in September 2018 and concluded in October 2018. Participants were recruited from the Aryan Benevolent Homes and Aryan Benevolent West Sun Home for the Aged. All participants were informed of the study by the researcher.

On arrival, participants handed in consent forms. Numbers were assigned to each participant and recorded on all data pages. This strengthened participant confidentiality throughout the study.

For the data collection process, the participants were divided into four groups to make the process easier and more efficient for the researcher to work with. Each group was seated and requested to complete each questionnaire. This process took approximately 30 minutes. Seating arrangements were pre-planned so that each participant sat apart from one another to ensure confidentiality in their answers. The researcher (or members of the research team) remained in this room always administering the questionnaires, ensuring that all questions are understood and completed. Thereafter, each group entered another room where anthropometric measurements were taken by ISAK qualified team members. This was performed out of view of other participants and privately as to maintain the confidentiality of the participant's results and to aid in the surety of the participant's privacy. This process took approximately 1 minute per participant. Participants then swapped rooms and complete the tasks required of them. Once all data was collected, it was filed in chronological order to maintain confidentiality. The researcher kept the collected data information in a locked office.

The participants were then given pedometers (Omoron Pedometer Walking Style Pro 2.0) to wear for 7 consecutive days (Ueno, 2013). The researcher handed out the pedometers to the group and explained how the pedometers work. The researcher had to set up the pedometer according to each participants body mass, height and stride length. The older adults were shown how to wear and remove the pedometers when the participant went to bed at night. The researcher then returned to the retirement villages on the eighth day to collect the pedometers. The entire data collection process was approximately 8 days per retirement villages. The study took place over a month due to rotation of the use of pedometers among the participants.

3.7 Data analysis

Descriptive statistics is defined as the analysis of data that describes, summarizes and simplifies data effectively but does not allow conclusions to be drawn (Gravetter & Wallnau, 2008). There are two ways in which to utilize descriptive statistics, namely measures of central tendency and measures of spread (Gravetter & Wallnau, 2008). Measures of central tendency (mean and median) and spread (range, quartiles, minimum and maximum and standard deviation) were used to describe the step count , amount of spent on physical activity and BMI data obtained. Frequency distributions were used to describe the participants in terms of age and gender as well as to describe step count , amount of spent on physical activity and BMI respectively in terms of the relevant categories of various variables measured. Descriptive statistics were represented by means of tables and graphs.

The first objective of this study used descriptive statistical analysis and a binomial test was used to test whether a proportion of answered yes or no questions from the GPAQ were significant. For the second objective, for all the 'yes/no' questions, an independent samples t-test was used to test if the average number of steps is significantly different for those who respond yes or no.

For the questions from the GPAQ that were measured in either number of days or minutes, Pearson's correlation coefficient was applied to test if there is a linear relationship between the average number of steps in seven days. For third objective, a Pearson's correlation coefficient was also applied to test the relationship between BMI and step count.

The fourth objective used descriptive statistical analysis and a binomial test to test whether a proportion of answered yes or no questions from the LSQ were significant. The data for SAS was recoded with such that a higher score implies better aging strategies/coping with age. Items 1 and 11 were reverse coded so that they were consistent. These 14 items were analysed with factor analysis to identify the underlying factors present in this data. Factor analysis with promax rotation was used. Bartlett's test of sphericity, which tests the overall significance of all the correlations within the correlation matrix, was significant ($\chi 2 = 2776.16$, $p<0.0005$), indicating that it was appropriate to use the factor analytic model on this set of data. Three factors were extracted which account for 79.20% of the variance in the data. These factors were tested for reliability using Cronbach's alpha. Alpha >.7 was considered to indicate a reliable measure. Throughout a p-value of 0.0005 was used to indicate significance. The analysis was carried out using SPSS (Statistical Package for Social Sciences).

3.8 Ethical considerations

Ethics is defined as the philosophy involving the ideas about behaviour in terms of what is morally right or wrong (Merriam-Webster, 2017). Ethics revolves around human conduct involving the values of men and women, such as obeying the law, abiding by human rights and maintaining a safe and healthy environment for research participants (The Business Dictionary, 2015). Ethics as summarised by Strydom (2011) in the following definition:

> "…*a set of moral principles which is suggested by an individual or group, is subsequently widely accepted, and which offers rules and behavioural expectations about the most correct conduct towards experimental subjects and respondents, employers, sponsors, other researchers, assistants and students*."

Ethical clearance was obtained from the University to conduct the research. This also includes approval from the University's Biomedical Research Ethics Committee (BREC). Informed consent form was signed by all participants, thereby granting permission to include them in research. Equipment was borrowed from the Sport Science gymnasium and/or Biokinetics Clinic. Therefore, it was important to ensure that all the equipment was calibrated before the start of the tests. When the tests were over the equipment was returned in the condition that they were borrowed.

Questionnaires and information sheets were administered by the researcher. The researcher was present while questionnaires were being completed. Mass and height were measured using the International Society for the Advancement of Kinanthropometry (ISAK) procedures. Physical activity was objectively measured using Omron Walking Style Pro 2.0 pedometers (Ueno, 2013). All collected data was kept in a locked office with only the researchers having access to it. All data analyzed via a computer was kept in a password protected electronic file

Research involving human subjects must be guided by good clinical practice and human rights principles to ensure participation of participants. The researcher seeked approval from relevant authorities in the retirement villages targeted for this study and obtained informed consent from the potential participants. The homes/retirement villages involved in this study and the participants were furnished with a brief background to the study. Furthermore, the participants were provided with the following details:

- The nature and purpose of the study.
- The procedures of the research.
- The benefit of the research.
- The right of the subjects to stop/withdraw their participation at any time.
- The voluntary nature of research participation.
- The procedures used to ensure confidentiality and anonymity.

This information was captured in a written consent form which was delivered to participants with follow-up telephone calls being made to give clarifications where necessary. Once permission and informed consent was obtained, the participants were formally invited to take part in the study. This helped to reduce suspicion and promote sincere responses. Ethical standards were adopted in this research through coding all participants' names and coding the name of the organizations they represent. This was meant to guarantee confidentiality and anonymity.

In summary, this chapter focused on the research methodology that was used for the study. The research design, the inclusion criteria for the participants involved, the sampling method that was incorporated, and how the data collection and analysis of the results was performed, were provided. The chapter concluded with ethical considerations and the relevant approval that was sought to conduct the study.

Chapter 4 presents the results of the study that were obtained from the data analysis. The results reflect the outcome of both the descriptive and inferential statistical analyses.

Chapter Four: Results

4.1 Introduction

This chapter focuses on the results obtained from the questionnaires as well as from the pedometers. The order in which the results are presented is in line with the four objectives of the study. Descriptive information pertaining to the sample as well as their total step count and BMI are provided before indicating the relationships with total step count and BMI respectively. Lastly, the relationship of step count respectively with health-related quality of life, life-space mobility and successful aging of life are reflected.

4.2 Demographic profile

A total of 210 elderly adults participated in the study and ranged between the ages of 65 to 92 (Table 4.1), with the majority of the participants being females (61.9%, n=130). Their age distribution indicates that that three quarters (67.9%) were between the ages of 65-79. The minimum and maximum age of the participants were 65 and 92 years (M=72.2, SD=6.09). **Table 4.1: Frequency distribution for gender and age (N=210)**

		number		%
Gender	Male	80		38.1
	Female	130		61.9
Age	65-69	84		39.9
	70-74	59		28.0
	75-79	40		18.9
	80-84	17		8.0
	85-89	6		2.9
	90-94	4		1.9
	Min	**Max**	**Mean**	**SD**
	65	92	72.22	6.09

Of the 210 participants, the females (n=130) had is significant (p<0.005) higher total step count for seven days (M=13829.06, SD=9172.52) than the males (n=80) (Table 4.2).

Table 4.2: Total number of steps in males and females in 7 days

Gender	n	t	M (SD)	p-value	95% Confidence Interval Lower	Upper
Male	80	-0.53	13765.95 (7765.59)	0.96	-2398.03	2271.81
Female	130		13829.06 (9172.52)			

There is a significant, moderate and negative relationship (r=-0.346, p<.005) between the age of the participants and the total steps for seven days (Table 4.3), which indicates that the higher the age of the participant, the lower the step count.

Table 4.3: Correlation for age and total steps for seven days

	Total no. of steps in 7 days	r	p-value
Age	13805.02	-.346**	0.005

** Correlation is significant at the 0.01 level (2-tailed).

4.3 Objective 1: To determine the self-reported and actual physical activity levels of older adults

The participant's self-reported physical activity levels were recorded with the GPAQ and actual physical activity levels were tracked with the Omron Walking Style Pro 2.0 pedometer. Descriptive statistical analysis was used for this purpose and a binomial test was used to test whether the proportion of questions answered yes or no from the GPAQ was significant.

4.3.1 Self-reported activity levels from GPAQ

The frequency distribution of responses for question 1, 4, 7, 10 and 13 from the GPAQ are indicated in Table 4.4 (respondents could respond to these with a 'yes' or ''no'). A significant number (73%, n=153) indicated that they do not do vigorous-intense activities that cause large increases in breathing or heart rate, such as carrying, running hard, lifting heavy loads or digging for at least 10 minutes continuously ($p<.0005$). A significant 78% (n=164) indicated that they do participate in daily activities that involve moderate-intensity activity that causes small increases in breathing or heart rate ,such as brisk walking or carrying light loads ($p<.0005$). A significant 89% (n=187) indicated that they walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places ($p<.0005$). A significant 88% (n=185) indicated that they do not participate in vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate, such as running or football ($p<.0005$). A significant 63% (n=133) indicated that they do participate in moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing ($p<.0005$).

Table 4.4: Response for question 1, 4, 7, 10 and 13 from GPAQ

Questions	Response	n	%	p-value
1. Do your activities at home involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying running hard or lifting heavy loads or digging] for at least 10 minutes continuously?	Yes	57	27.1	.000[a]
	No	153	72.9	
4. Do your daily activities involve moderate-intensity activity that causes small increases in breathing or heart	Yes	164	78.1	.000[a]
	No	46	21.9	

rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously?				
7. Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?	Yes	187	89.0	.000[a]
	No	23	11.0	
10. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like running or football, for at least 10 minutes continuously?	Yes	25	11.9	.000[a]
	No	185	88.1	
13. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing or heart rate such as brisk walking, cycling, swimming, and volleyball) for at least 10 minutes continuously?	Yes	133	63.3	.000[a]
	No	77	36.7	

[a] Based-on Z approximation

Table 4.5 displays the frequency distribution of responses for question 2, 3, 5, 6, 8, 9, 11, 12, and 13 from the GPAQ (responded indicated with ‘days’ or ‘minutes’). During a typical week at home, the participants spent a minimum and maximum of 0 and 3 days (M=1.36, SD=4.11) respectively on vigorous-intensity activities as part of their weekly activities. The participants spend a minimum and maximum of 0 to 270 minutes (M=5.81, SD=21.19) respectively on doing vigorous-intensity activities at home on a typical day. During a typical week at home, participants spend a minimum and maximum of 0 and 7 days (M=3.58, SD=2.19) respectively on moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking or carrying light loads. They spent a minimum and maximum of 0 to 270 minutes (M=33.69, SD=37.50) respectively on doing moderate-intensity activities at home on a typical day.

In a typical week the participants spent a minimum and maximum of 0 and 7 days (M=2.96, SD=1.70) respectively on walking or using a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places. They spent a minimum and maximum of 0 to 240 minutes per day (M=28.93, SD=30.42 minutes) respectively on walking or using a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places. Likewise, they spent a minimum and maximum of 0 and 3 days (M=0.64, SD=3.05) respectively on vigorous-intensity sports, fitness or recreational (leisure) activities. The participants spent a minimum and maximum of 0 to 30 minutes per day (M=1.68, SD=4.82) respectively on vigorous-intensity sports, fitness or recreational (leisure) activities.

Time spent on moderate-intensity sports, fitness or recreational (leisure) activities ranged from a minimum of 0 to a maximum of 7 days (M=2.50, SD=3.05), and a minimum and maximum of 0 to 150 minutes per day (M=15.50, SD=4.82) respectively on moderate-intensity sports, fitness or recreational (leisure) activities**.** It was also observed that the participants spent a minimum and maximum of 30 to 1440 minutes per day (M=540.57, SD=2.23) respectively sitting or reclining on a typical day.

Table 4.5: Responses for questions 2, 3, 5, 6, 8, 9, 11, 12, 14 and 16 from GPAQ

Questions	Min	Max	Mean	SD
2. In a typical week at home, on how many days do you do vigorous-intensity activities as part of your activities? (days)	0	3	1.36	4.11
3. How much time do you spend doing vigorous-intensity activities at home on a typical day (minutes)	0	270	5.81	21.19
5. In a typical week at home, on how many days do you do moderate-intensity activities as part of your activities? (days)	0	7	3.58	2.19
6. How much time do you spend doing moderate-intensity activities at home on a typical day? (minutes)	0	270	33.69	37.50
8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places? (days)	0	7	2.96	1.70
9. How much time do you spend walking or bicycling for travel on a typical day? (minutes)	0	240	28.93	30.42
11. In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities? (days)	0	3	0.64	3.05
12. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day? (minutes)	0	30	1.68	4.82
14. In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities? (days)	0	7	2.50	3.05
15. How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day? (minutes)	0	150	15.50	4.82
16. How much time do you usually spend sitting or reclining on a typical day?(minutes)	30	1440	540.57	2.23

Figure 4.1 illustrates that the majority of the participants spend their time in the week sitting or reclining (541 minutes per day). A large number of the participants spend an average of 5.81 and 1.68 minutes per day respectively doing vigorous-intense activities at home or participating in vigorous-intensity sports, fitness or recreational (leisure) activities. However, on average, 33.69 and 15.50 minutes per day is spend respectively on moderate-intensity activities at home or participating in moderate-intensity sports, fitness or recreational (leisure) activities. The participants spend on average 28.93 minutes per day walking or use a bicycle (pedal cycle) for travelling. The self-reported physical activity levels of the older adults in this study was low to moderate.

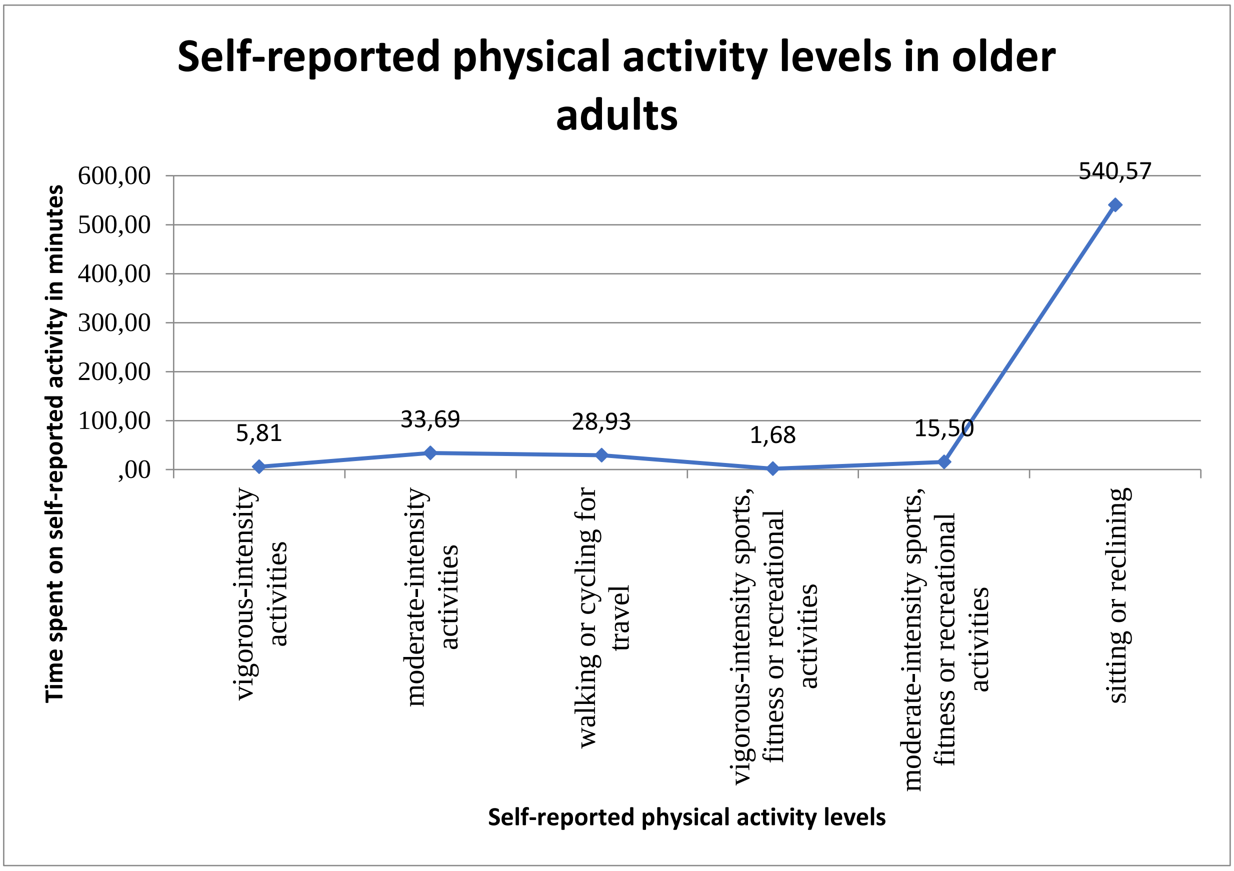

Figure 4.1: Self-reported physical activity levels in older adults from GPAQ

4.3. Actual physical activity levels from Pedometer

Table 4.6 represents the total number of steps of the participants in seven days as well as the average number of steps per day during that time. The minimum and maximum for the total number of steps taken by participants were 1386 and 47196 (M=13805.02, SD=8644.40) respectively. The average number of steps taken per day for the seven days were 198 and 9549 (M=2024.70, SD=1351.63) respectively.

Table 4.6: Total and average number of steps for 7 days

Tracking of Steps	Min	Max	Mean	SD
Total number of steps in 7 days	1386	47196	13805.02	8644.40
Average number of steps per day in 7 days	198	9549	2024.70	1351.63

4.4 Objective 2: To determine the correlation between actual physical activity levels versus self-reported of the older adults

For all the ‘yes/no’ questions, an independent samples t-test was used to establish if the average number of steps was significantly different for those who respond yes or no. Table 4.7 indicates that 57 of the 210 participants responded ‘yes’ to performing vigorous intensity activities at home, their average number of steps per day were higher (M=2553.84, SD= 076.97) than those who responded ‘no’ (M=1827.57, SD=1393.04). A higher step count was significantly correlated to performing vigorous intensity activities at home (M=2553.84, SD=1076.97, 95% CI=323.85-1128.69, p<.0005). Table 4.7 indicates that 187 participants responded ‘yes’ to walking or using a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places each day. Their average number of steps per day (M=2103.87, SD=1342.64) were higher than those who responded ‘no’ (M=1381.00, SD=1276.08). A higher step count was significantly correlated with walking or using a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places (M=2103.87, SD=1342.64, 95% CI=140.99-1304.75, p<.05).

Of the 210 participants, 185 did not participate in vigorous-intensity sports, fitness or recreational (leisure) activities that caused large increases in breathing or heart rate, such as running or football (Table 4.7). Their average number of steps per day were lower than those who responded ‘yes’. A lower step count was significantly correlated to not participating in vigorous-intensity sports, fitness or recreational (leisure) activities (M=1940.14, SD=1368.65, 95% CI=149.53-1271.16, p<.05).

Table 4.7: The response for question 1, 7 and 10 from the GPAQ and average number of steps in 7 days

Average number of steps in 7 days for responses to:		n	t	df	M (SD)	p-value	95% Confidence Interval Lower	Upper
1. Do your activities at home involve vigorous-intensity activity ...?	Yes	57	3.558	208	2553.84 (1076.97)	0.0005	323.85	1128.69
	No	153			1827.57 (1393.04)			
7. Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places…?	Yes	187	2.449	208	2103.87 (1342.64)	0.015	140.99	1304.75
	No	23			1381.00 (1276.08)			
10. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities ...?	Yes	25	2.497	208	2650.48 (1041.65)	0.013	149.53	1271.16
	No	185			1940.14 (1368.65)			

For the questions from the GPAQ that were measured in either number of days or minutes, Pearson's correlation coefficient was applied to test if there is a linear relationship between the average number of steps in seven days and the other measures. There is a significant, but small positive correlation between the number of steps and number of days doing vigorous intensity activities at home (r=0.170, p=.013), and the time spent doing moderate-intensity activities at home (r=0.183, p=.008) (Table 4.8). There is also a significant and moderate negative correlation between number of steps and time spend sitting or reclining (r=-0.300, p<.0005). This significant, negative correlation means that the more steps taken by the participant, the less time they spend sitting or reclining.

Table 4.8: Association between the response for question 2, 3, 5, 6, 8, 9, 11, 12, 14 and 16 from GPAQ and average number of steps in 7 days

	Average no. of steps in 7 days	r	p-value
2. In a typical week at home, on how many days do you do vigorous-intensity activities as part of your activities?	2024.70	.170*	0.013
3. How much time do you spend doing vigorous-intensity activities at home on a typical day?	2024.70	.011	0.875
5. In a typical week at home, on how many days do you do moderate-intensity activities as part of your activities?	2024.70	.074	0.283
6. How much time do you spend doing moderate-intensity activities at home on a typical day?	2024.70	.183**	0.008
8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	2024.70	.006	0.926
9. How much time do you spend walking or bicycling for travel on a typical day?	2024.70	.111	0.108
11. In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?	2024.70	.042	0.546
12. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	2024.70	.123	0.076
14. In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities?	2024.70	-.057	0.413
15. How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day?	2024.70	-.097	.163
16. How much time do you usually spend sitting or reclining on a typical day?	2024.70	-.300**	0.0005

* Correlation is significant at the 0.05 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed)

4.5 Objective 3: To establish the association between the body mass index of older adults to their actual physical activity levels

The body mass index (BMI) data obtained was categorised and interpreted according to the ACSM (2014) normative data referred to in Chapter 2 and reflected in Table 4.9 and 4.10, with a Pearson's correlation coefficient being applied to test this relationship. Table 4.11 illustrates the minimum and maximum BMI of 16.6kg/m^2 and 38.5kg/m^2 (M=26.49, SD=3.62) respectively.

Table 4.9 represents the frequency distribution of the participant's BMI categories, with the majority being overweight (51%, n=107).

Table 4.9: Participant's body mass index (BMI)

	Min	Max	Mean	SD
Weight (kg)	41.3	106.5	67.81	10.39
Height (m)	1.3	1.8	1.60	0.08
BMI (kg/m^2)	16.6	38.5	26.49	3.63
BMI Category	**Number**	**%**		
Underweight	6	2.9		
Normal	67	31.9		
Overweight	107	51		
Obese class I	28	13.3		
Obese class II	2	1.0		

Table 4.10 indicates that there is no significant relationship between the BMI (r=0.63, p=0.366) and actual steps taken.

Table 4.10: Association between the body mass index of older adults to their actual physical activity levels

	Average number of steps in 7 days	r	p-value
BMI	2024.70	0.366	0.63

4.6 Objective 4 :To establish the association between health-related quality of life, life space mobility and successful aging of life of the older adults to their actual physical activity levels

To achieve this objective, the participants were required to complete three self-reported tests. The RAND health survey (SF-36) was used to determine the participants health related quality of life. The life-space mobility questionnaire (LSQ) was used to determine the life-space mobility of the participants by inquiring about their travels and journeys during a three-day period. The Successful Aging Scale (SAS) was used to determine how well the participants were aging. The questions asked were centred around three aspects of aging which were physical health, social well-being and mental health. It has been observed that physical activity positively influences better quality of life, successful aging and life-space mobility in older adults therefore it was of interest to determine if similar conclusions for this study would be established.

4.6. 1 The RAND health survey (SF-36)

Table 4.11 displays the frequency distribution of responses for categories of questions from the RAND health survey (SF-36). From Table 4.14 it can be deduced that the higher the mean score is for a variable, the better the participant's health status in that area. The Energy/fatigue category reflects best health status (M=59.90, SD=18.78), while the Role limitation due to emotional health category reflects the poorest health status (M=40.95, SD=43.93). However, although the energy/fatigue, pain and general health status categories have the highest values, they still below the accepted minimum alpha of 0.7.

Table 4.11: Frequency distribution of questions from the RAND health survey (SF-36)

Scale	M (SD)	Alpha
Physical functioning	41.14 (23.75)	0.92
Role limitations due to physical health	55.71 (46.37)	0.95
Role limitations due to emotional health	40.95 (43.93)	0.88
Energy/fatigue	59.90 (18.78)	0.56
Emotional well-being	43.48 (19.66)	0.75
Pain	53.10 (18.97)	0.59
General health	56.27 (19.56)	0.55

Figure 4.2 illustrates that the average state of health in Energy/fatigue and Role limitations due to physical health, which has the best health status, while Emotional well-being and Role limitations due to emotional problems has the worst .

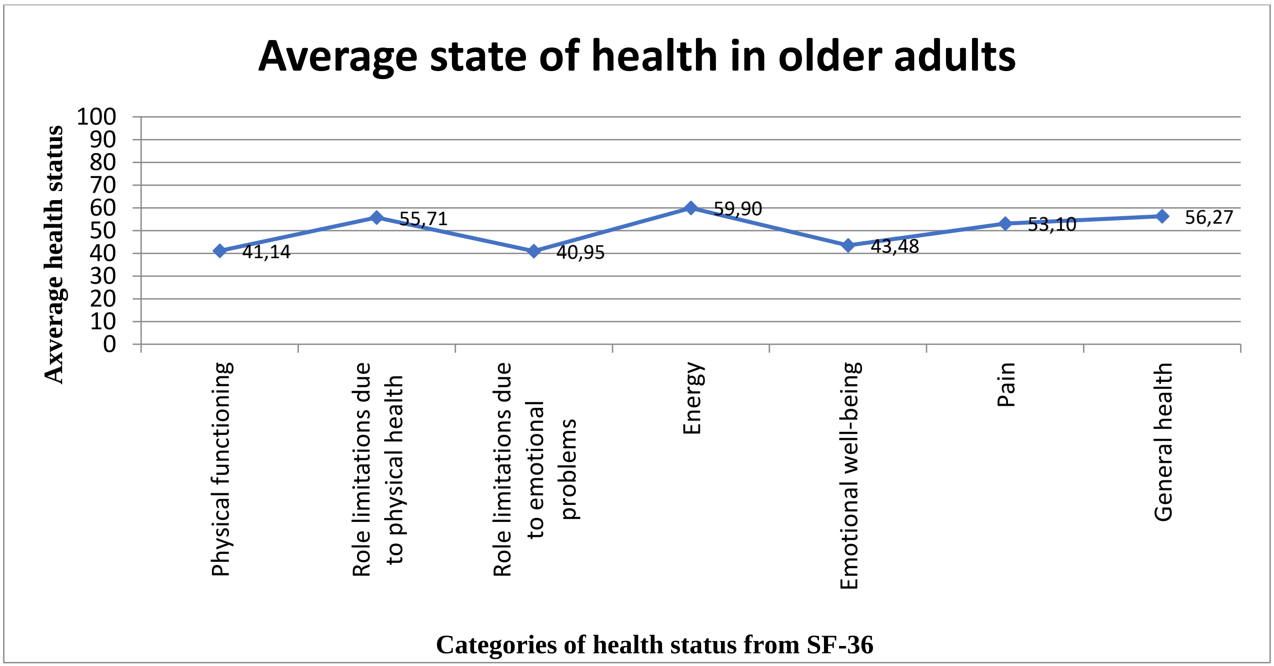

Figure 4.2: Average state of health in older adults

4.6.2 Life-Space mobility questionnaire (LSQ)

From Table 4.12 it can be seen that a significant 93% (n=196) of the participants indicated that in that the past three days they had been to other rooms of their home besides the room where they sleep ($p<.0005$). A significant 90% (n=190) indicated that they had been to an area immediately outside their home, such as the porch, deck or patio, hallway of an apartment building or garage ($p<.0005$). A significant 65% (n=137) indicated that during the past three days they have been to an area outside their home, such as a yard, courtyard, driveway or parking lot ($p<.0005$). A significant 93% (n=196) and 66% (n=139) respectively indicated that they have not been to places outside their immediate neighbourhood that are within their town or community or to outside their immediate town or community ($p<.0005$).

Table 4.12: Frequency distribution of responses from Life–Space mobility questionnaire (LSQ)

Questions	Response	n	%	p-value
1. During the past 3 days, have you been to other rooms of your home besides the room where you sleep?	Yes	196	92.9	.000[a]
	No	15	7.1	
2. During the past 3 days, have you been to an area immediately outside your home such as your porch, deck or patio, hallway of an apartment building, garage?	Yes	190	90	.000[a]
	No	21	10	
3. During the past 3 days, have you been to an area outside your home such as a yard, courtyard, driveway, or parking lot?	Yes	137	64.9	.000[a]
	No	74	35.1	
5. During the past 3 days, have you been to places outside your immediate neighbourhood but within your town or community?	Yes	15	7.1	.000[a]
	No	196	92.9	
6. During the past 3 days, have you been to places outside your immediate town or community?	Yes	72	34.1	.000[a]
	No	139	65.9	

[a] Based-on Z approximation

Figure 4.3 illustrates that the majority of the participants go to other rooms in their homes (93%) as well as walk to an area immediately outside their home, such as a porch, deck or patio, hallway of an apartment building or garage (90%). However, a large percentage of the participants indicated that they have not been to places outside their immediate neighbourhood that are within their town or community (93%).

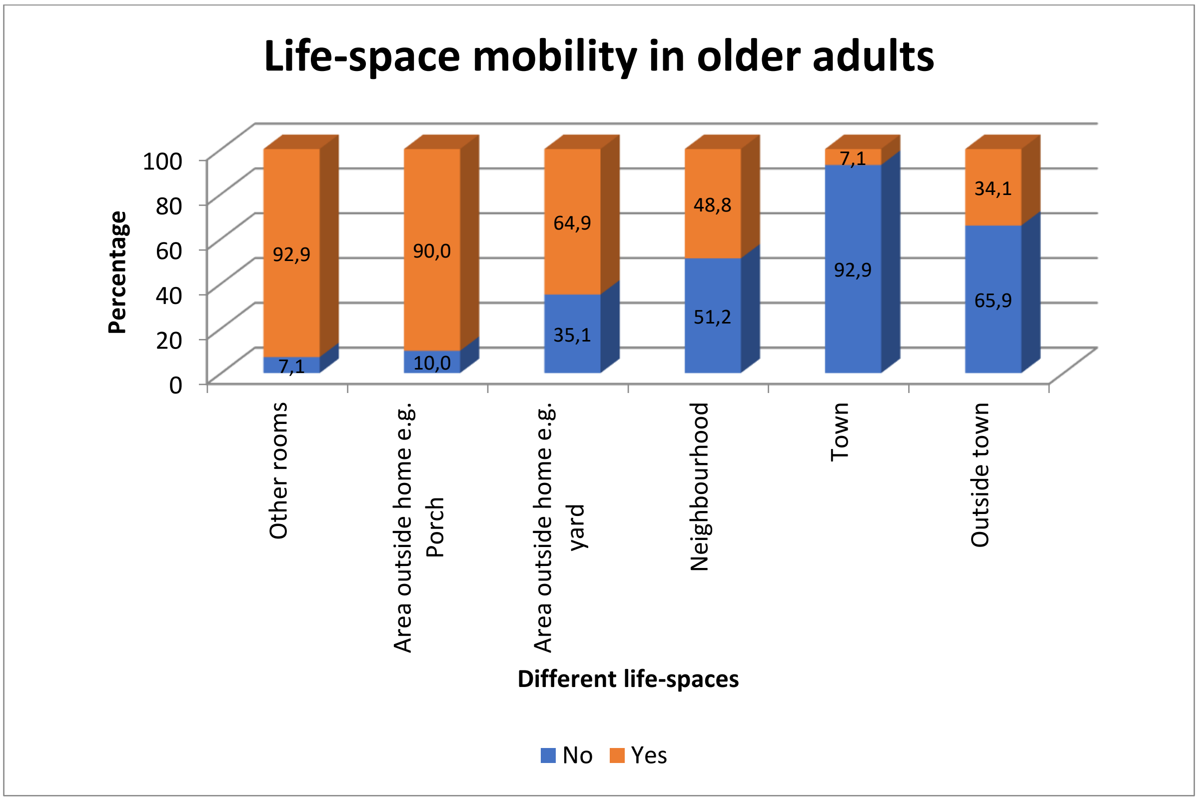

Figure 4.3: Life-space mobility in older adults

4.6.3 Successful Aging Scale (SAS)

The data for SAS was recoded, with a higher score implying better aging strategies and/or coping with age. Items 1 and 11 were reverse coded so that they were consistent. These 14 items are analysed using factor analysis with promax rotation to identify the underlying factors present in this data. The Kaiser-Meyer-Olkin measure of sampling adequacy indicated that the strength of the relationships among the variables was high (KMO=.87), thus it was acceptable to proceed with the analysis. Bartlett's test of sphericity, which tests the overall significance of all the correlations within the correlation matrix, was significant (χ^2 = 2776.16, p<0.0005), indicating that it was appropriate to use the factor analytic model on this set of data (Table 4.13). Three factors were extracted which accounted for 79.20% of the variance in the data.

Table 4.13: Inferential Statistics: KMO and Bartlett's Test for SAS

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.879
Bartlett's Test of Sphericity	Approx. Chi-Square	2776.16
	Df	78
	p-value	.000*

***** Correlation is significant at the 0.01 level (2-tailed)

Table 4.14 reflects the pattern matrix to sort the factors related to successful aging.

Table 4.14: Pattern Matrix[a] for SAS

Question	Factor		
	1	2	3
SAS6. I strive to remain independent for as long as possible.	.761		
SAS14. I am comfortable in accepting both my good and bad qualities.	.740		
SAS7. I make attempts to remain relatively free of disease and disability.	.696		
SAS1. I am able to make choices about things that affect how I age, like my diet, exercise and smoking.	.489		
SAS9. I am actively engaged with life through regular social contacts.		.931	
SAS12. I can deal with whatever comes my way.		.685	.
SAS13. I make attempts to engage in healthy lifestyle habits.		.600	
SAS8. I try to maintain good physical and mental functioning as I age.		.560	
SAS10. I make every effort to achieve goals that are important to me.		.530	
SAS3. In difficult times, I develop mental toughness in dealing with the situation.			.901
SAS2. When things don't go as well as they used to, I keep trying other ways until I achieve the same result.			.700
SAS11. I feel that I am in control of my immediate environment.			.657
SAS5. I am actively engaged with life through productive activities.			.543

These factors presented in Table 4.15 were tested for reliability using Cronbach's alpha, with an Alpha value >.7 being regarded as indicating a reliable measure. Each factor displayed an alpha value >7, with table 4.15 displaying a significant disagreement to all three measures for successful aging, which indicates that the participants seem to cope well with aging. The mean scores are all <4, with Preservation of social well-being being the worst with a mean of 1.62, and Preservation of mental health being the best with a mean of 1.83.

Table 4.15: Categories associated with SAS

Categories	M (SD)	Alpha
1. Preservation of physical health (PH)	1.62 (0.75)	alpha = .768
2. Preservation of social well-being (SWB)	1.36 (0.75)	alpha = .937
3. Preservation of mental health (MH)	1.83 (1.14)	alpha = .851

4.6.4 The association between total LSQ and average number of steps in 7 days

Table 4.16 indicates that there is a positive, weak correlation between total LSQ and the average number of steps in seven days of the participants (r =.224, p=0.001).

Table 4.16: Association between LSQ and average number of steps

	Average number of steps in 7 days	r	p-value
Total LSQ	2024.70	0.224**	0.001

** Correlation is significant at the 0.01 level (2-tailed)

4.6.5 The association between SF-36 and SAS and average number of steps in 7 days

There are no significant correlations with SF-36 and the average number of steps in 7 days of the participants, and a negative, weak but significant correlation between the following SAS measures (Table 4.17). The factors for SAS were preservation of physical health (r=-.152, p=0.027), preservation of social well-being (r=-.148, p=0.032) and preservation of mental health (r =-.176, p=0.010) and the average number of steps in 7 days.

Table 4.17: Association between SF-36 and SAS and average number of steps

SF-36 and SAS	Average number of steps in 7 days	r	p-value
SF-36			
Physical functioning	2024.70	-0.059	0.395
Role limitations due to physical health	2024.70	-0.112	0.107
Role limitations due to emotional health	2024.70	-0.065	0.325
Energy/fatigue	2024.70	-0.038	0.587
Emotional well-being	2024.70	0.066	0.344
Pain	2024.70	-0.053	0.444
General health	2024.70	-0.015	0.825
SAS			
Preservation of physical health (PH)	2024.70	-.152*	0.027
Preservation of social well-being (SWB	2024.70	-.148*	0.032
Preservation of mental health (MH)	2024.70	-.176*	0.010

* Correlation is significant at the 0.05 level (2-tailed)

4.7 Summary of Findings

There were a range of responses from the 210 participants, many of whom participate is some form of physical activity during the day. From the results it was observed that there are significant findings with subjective and objective physical activity levels, as well as substantial relationships between physical activity and life-space mobility as well as successful aging of life. However, there were no significant association between body composition and health-related quality with physical activity levels of older adults.

Chapter Five: Discussion and Conclusions

5.1 Introduction

This final chapter presents a discussion of the results listed in Chapter 4 in relation to related research reviewed, focusing specifically on the objectives. This chapter concludes with a summary of the key findings, the significance and limitations, and recommendations for future research. Since, a large proportion of the research related to this topic has been conducted internationally, with limited to no studies in South Africa more specifically the elderly population in KwaZulu- Natal (KZN) Province, particularly the Chatsworth residential area outside the city of Durban. There was a considerable need for more research data using subjective and objective methods, such as pedometers or accelerometers. Furthermore, there is lack of data on the association between physical activity and body composition, health-related quality of life, life-space mobility and successful aging of life in older adults. For this reason, the study aimed to determine the physical activity and body composition levels of older adults and the association of physical activity on body composition with health-related quality of life, life-space mobility and successful aging of life of older adults in Chatsworth, KwaZulu-Natal Province.

5.2 Demographic profile of the population

There were more females participants (n=130) than males (n=80), and there was a non-significant ($p<0.05$) higher step count total for seven days in females (M=13829.06, SD=9172.52) than the males (M=13765.95, SD=7765.59) These findings are in contrast with research findings by Prince *et al.* (2008) and Evenson *et al*. (2012), who found that the physical activity levels were higher for males than females when comparing their pedometer data and responses from a physical activity questionnaire.

However, Shiroma and Lee (2010) observed that the likelihood of active women and men in developing cardiovascular disease was 40% and 30% respectively. Shiroma and Lee (2010) explain that this could be due to that although the extent of the association appears stronger in women than in men, comparisons across gender are limited. This could be due to the that fact that various studies used a diverse range of questionnaires in assessing physical activity. The findings and reviewed literature indicate there is need for research to identify whether a bias does exist among gender, and to what extent.

The minimum and maximum age of the participants were 65 and 92 years (Mean=72.2, SD= 6.09 years), with many participants being between the ages of 65-69 years old (39.9%, n=84), with a significant, moderate and negative relationship (r=-.346, p<.005) between the age of the participants and the total steps for seven days (Table 4.3). This indicated that the higher the age of the participant, the lower the step count. This observation agrees to a study conducted by Dohrn (2015), where it was observed that physical activity levels are lower with higher age, and that a considerable number of older adults do not participate in adequate physical activity. Chodzko-Zajko *et al.* (2009) explain that physical activity and public health recommendations for older adults suggest that, in most cases, 'old age' physical activity guidelines apply to individuals aged 65 years or older.

Progressing age is related to decreases in functionality and changes in body composition. These common age-related physiological changes influence a wide array of bodily functions which can impact on daily life as well as the preservation of physical independence in older adults. Two examples of biological aging are reductions in cardiovascular ability and muscle mass (Evenson *et al*., 2012).

Chodzko-Zajko *et al*. (2009) agree with the findings from this study, and explain that older populations are generally less physically active than young adults, as indicated by self-reports and interviews, body motion sensors and more direct approaches for determining daily physical activity levels and caloric expenditure. Although the total time spent per day in exercise and lifestyle physical activities by some active older adults may approach the levels of younger normally active adults, the types of physical activities most popular among older adults is of a lower intensity (walking, gardening, golf, low-impact aerobics activities) than the younger adults (running, higher impact aerobics activities).

Davis *et al*. (2011) also highlight that increasing age is associated with higher volumes of sedentary time and lower levels of physical activity. The sharp age-related decline in physical activity seems to be exemplified by lower activity volume, less high-intensity physical activity, and lower frequency of moving around. The study indicates that age is associated with lower physical activity levels, and the current study findings also reported that the age of the participants had an impact on their physical activity levels.

5.3 Objective 1: To determine the actual physical activity levels and self-reported activity levels in older adults

The participant's actual physical activity levels were tracked with the Omron Walking Style Pro 2.0 pedometer and self-reported physical activity levels were recorded with the GPAQ. The minimum and maximum for the total number of steps taken for 7 days by the participants were 1386 and 47196 (M=13805.02, SD=8644.40) respectively. The average number of steps taken per day for 7 days by the participants were 198 and 9549 (M=2024.70, SD=1351.63) respectively.

In agreement to this study, Dohrn (2015) found that only 20-60% of older adults meet the physical activity recommendations, which depends on assessment method and definition of the recommendation. Most studies that have been conducted on healthy older adults reflect a wide normative step range of 2,000-9,000 per day. Tudor-Locke *et al*. (2011) proposed that translating 150 minutes of MVPA into steps per day, healthy older adults are recommended to achieve at least 7,100 steps per day when averaged over a week. This has been adopted in the Physical Activity Recommendations from the American College of Sports Medicine for exercise prescription, although the appropriateness of this recommendation remains to be proven. It is estimated that a minimum level of 4,600 step per day, if averaged over a week, is needed to include 150 minutes of MVPA for older adults with chronic ailments or disabilities (Thompson *et al.*, 2015). An activity level of less than 5,000 steps per day in the elder population is generally considered to be very low, and it is suggested as an indicator of a 'sedentary lifestyle' (Thompson *et al.*, 2015). This threshold has been applied in a limited number of studies, showing that individuals taking less than 5,000 steps per day are more likely to have a poor health-related quality of life and an elevated incidence of cardiovascular risk factors, obesity, and depression, but further evaluations are needed. (Thompson *et al.*, 2015). However, in contrast to the suggestions by Tudor-Locke *et al*. (2011) it is noted that the participants from this study did not meet the recommended number of steps per day, which implies that the older adults from this studies' step count is considered very low, and that most lead a sedentary lifestyle.

In responses to question one, four, seven, ten and thirteen from the GPAQ where the participants could respond to with a 'yes' or 'no', a significant 73% (n=153) indicated that they do not do vigorous-intense activities that cause large increases in breathing or heart rate, such as carrying, running hard, lifting heavy loads or digging for at least 10 minutes continuously ($p<.0005$). The results were also all significant ($p<.0005$) for the following responses: they participate in daily activities that involve moderate-intensity activity that cause a small increases in breathing or heart rate, such as brisk walking or carrying light loads (78%, n=164); walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places (89%, n=187); do not participate in vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate, such as running or football (88%, n=185), and participate in moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing, (63%, n=133).

Nelson *et al.* (2007) suggest that to encourage and maintain health, older adults need to participate in aerobic physical activity either of moderate or vigorous intensity each week. In addition, a combination of MVPA can be performed to meet this recommendation. Aerobic exercise of moderate-intensity comprises a moderate level of effort in relation to an individual's cardiovascular fitness. On a 10-point scale, where sitting is regarded as 0 and all-out exertion is 10, exercise that is of moderate intensity is a 5 or 6 and produces visible increases in heart rate and breathing, while vigorous-intensity activity is a 7 or 8, and produces large increases in heart rate and breathing. For example, given the heterogeneity of fitness levels in older adults, for some older adults, a moderate-intensity walk is a slow walk, while for others it is a brisk walk. This recommended amount of aerobic activity can be in the form of combined low intensity exercises regularly performed during daily life such as washing dishes, self-care, or moderate intensity exercise that last less than ten minutes such as taking a walk to the parking lot of a store, or at the office, or even taking out trash (Nelson *et al*., 2007).

According to Nelson *et al.* (2007) and Thompson *et al.* (2015), the need for effective physical activity interventions is vital, as most older individuals are sedentary and at a high risk for chronic disease or functional limitations. The purpose of physical activity interventions is to help individuals change their behaviour from sedentary pursuits to active ones. For a physical activity intervention to be effective, it must be developed along the physical activity habits of the lifestyle for whom it is intended, and must also be enjoyable. It is essential to teach people that one can accumulate 30 minutes of moderate intensity activity through fun activities such dancing or gardening.

In agreement to Nelson *et al.* (2007) and Thompson *et al.* (2015), the majority of the participants from this study responded to participating in moderate intensity exercise rather than vigorous intensity exercise throughout the week. In responses to question two, three, five, six, eight, nine, eleven, twelve, and thirteen from the GPAQ where the participants responded by indicating either 'days' or 'minutes', it was found that in a typical week at home, they spend a minimum and maximum of 0 and 3 days (M=1.36, SD=4.11) respectively on vigorous-intensity activities as part of their weekly activities. They spend a minimum and maximum of 0 to 270 minutes (M=5.81, SD=21.19) respectively on doing vigorous-intensity activities at home on a typical day. In a typical week, they spend a minimum and maximum of 0 and 3 days (M=0.64, SD=3.05) respectively on vigorous-intensity sports, fitness or recreational (leisure) activities, and they a minimum and maximum of 0 to 30 minutes per day (M=1.68, SD=4.82) respectively on vigorous-intensity sports, fitness or recreational (leisure) activities. From the above findings, it is clear that the participants did not meet physical activity recommendations of vigorous-intensity aerobic activity for a minimum of 20 minutes on three days each week (Thompson *et al.*, 2015).

In a typical week at home, participants spend a minimum and maximum of 0 and 7 days (M=3.58, SD=2.19) respectively on moderate-intensity activity that causes a small increases in breathing or heart rate, such as brisk walking or carrying light loads, and a minimum and maximum of 0 to 270 minutes (M=33.69, SD=37.50 minutes) respectively on doing moderate-intensity activities at home on a typical day. In a typical week, the participants spend a minimum and maximum of 0 and 7 days (M=2.96, SD=1.70) respectively on walking or using a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places. They spend a minimum and maximum of 0 to 270 minutes per day (M=28.93, SD=30.42 minutes) respectively on walking or using a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places. The findings show that in a typical week, they spend a minimum and maximum of 0 and 7 days (M=2.50, SD=3.05) respectively on moderate-intensity sports, fitness or recreational (leisure) activities. They also spend a minimum and maximum of 0 to 30 minutes per day (M=15.50, SD=4.82) respectively on moderate-intensity sports, fitness or recreational (leisure) activities. It was also observed that they spend a minimum and maximum of 30 to 1440 minutes per day (M=540.57, SD=2.23) respectively sitting or reclining on a typical day.

From the above findings it is clear that the participants met the physical activity recommendations of moderate-intensity aerobic (endurance) physical activity of a minimum of 30 minutes on five days per week (Thompson *et al.*, 2015). In this regard, Thompson *et al.* (2015) further noted that the Physical Activity Recommendations from the American College of Sports Medicine for older adults that are aged 65 or older is to promote and maintain good health, in those who have a good-standing of health and have no health ailments that restrict mobility, should include:

1. Maintain a physically active lifestyle to promote and ensure good health.

2. Participate in aerobic (endurance) physical activity that is of moderate-intensity or vigorous-intensity for at least 30 minutes for five days per week or for at least 20 minutes on three days per week respectively.

Thompson et al. (2015) also suggest that older adults can perform combinations of MVPA to meet this recommendation. These can be in the form of combined low intensity physical activities regularly performed during daily life such as washing dishes, self-care, or moderate intensity physical activities that last less than ten minutes such as taking a walk to a parking lot of a store, or at the office, or even taking out trash. Considering the Physical Activity Recommendations from the American College of Sports Medicine, it is thus clear that the participants from this study did meet the physical activity recommendations per a week (Thompson et al., 2015). It is concerning however that on average, the participants spend 540 minutes per day sitting or reclining on a typical day.

5.4 Objective 2: To determine the correlation between actual physical activity levels versus self-reported physical activity levels of the older adults

It was observed that 57 participants of the total population of 210 responded 'yes' to performing vigorous intensity activities at home, with their average number of steps per day being higher (M=2553.84, SD=1076.97) than those who responded 'no' (M=1827.57, SD=1393.04). A higher step count was significantly correlated to performing vigorous intensity activities at home (M=2553.84, SD=1076.97, 95% CI=323.85-1128.69, p<.0005). One hundred and eighty-seven (89 %) of the 210 participants responded 'yes' to walking or using a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places. Their average number of steps per day (M=213.87, SD=1342.64) were higher than those who responded 'no' (M=1381.00, SD=1276.08). A higher step count was not significantly correlated with walking or using a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places (M=2103.87, SD=1342.64, 95% CI=140.99-1304.75, p<.0005).

In this regard, Dohrn (2015) found that objective assessment methods are generally more accurate than subjective methods, and involve the specific assessment of energy expenditure and actual movement behaviour. Pedometers commonly used in research, such as Yamax and Omron, are valid instruments for assessing walking behaviour, which is the most frequent type of physical activity in older adults (Dohrn , 2015). However, the accuracy can be attenuated at very slow walking speeds and in individuals with an altered walking pattern. As stated by Dohrn (2015) "*While not ideally suited for assessing physical activity pattern or intensity of activity,* *pedometers have several advantages, such as low cost, low participant burden, ease of use, and having an output (i.e., steps) that is easy to understand*."

The results show that the average number of steps per day is significantly higher among the participants who responded 'yes' to doing moderate-intensity activity at home than for those who responded 'no' (M=1381, SD=1276.08) p<.0005). One hundred and eighty-five (88%) of the 210 participants did not participate in vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate, such as running or football. Their average number of steps per day were lower than those who responded 'yes'. This is evident that a lower step count was significantly correlated to not participating in vigorous-intensity sports, fitness or recreational (leisure) activities (M=1940.14, SD=1368.65, 95% CI=149.53-1271.16, p<.0005).

However, Nelson *et al.* (2007) states that the negative elements of perceived physical activity is that simply telling older adults that their effort during activity should be 5–6 (or 7–8) on a 10-point scale may not achieve the desired level of effort. Subjective perception of effort is related to objectively measured level of effort, but not linearly. When there is concern that an adult will not engage in activity at the desired intensity, a period of supervised exercise can help them learn the desired level of effort. Everson *et al*. (2012) suggests that the difference between the self-report and objective measures may be due to cultural differences in interpretation or to the types of activities, something that cannot be easily distinguished with the accelerometer. In agreement to Everson *et al*. (2012) and Nelson *et al.* (2007), Harada *et al*. (2001) suggests that for older adults, physical activity measurement is complicated, because they often engage in lighter activities more frequently than moderate or vigorous activities, and may perform them on an irregular basis, making it difficult to recall. Older adults may perform physical activity at a substantially lower level of energy expenditure than younger adults. Furthermore, they may have difficulty with memory and cognition, which interferes with their ability to recall past physical activity, especially over long periods of time. To avoid these problems, physical activity surveys have been developed specifically to administer to older adults (Harada *et al*., (2001).

Dohrn (2015) explains further that a disadvantage with subjective assessments is the low accuracy for determining physical activity volume. Self-report methods often overestimate actual activity volume due to recall bias and social desirability bias (i.e. tendency to report physical activity levels corresponding to perceived expectations). However, certain activities may also be underestimated, especially unstructured activity interspersed over the day and light intensity activity, both common behaviours among older adults. From the results observed, Dohrn (2015) highlights that to accurately recall time spent in different activities or to estimate activity intensity might be difficult, especially for older adults, who often have a more sporadic physical activity pattern than younger people. An alternative strategy to recommendations based on time and activity intensity is to encourage people to achieve a daily step count. Several studies have shown that step count interventions are successful in increasing habitual physical activity. A goal of 10,000 steps per day is often cited as a recommended target for health, but even fewer steps may meet the current health recommendations.

A significant but small positive correlation was observed between number of steps and the number of days doing vigorous intensity activities at home (r=.170, p=.013), and the time spent doing moderate-intensity activities at home (r=.183, p=.008). There is also a significant and moderate negative correlation between number of steps and time spend sitting or reclining (r=-.300, p<.0005). This significant, negative correlation means that the more steps taken by the participant the less time is spend sitting or reclining (Table 4.10). Similarly, Wanderley *et al.* (2011) objectively assessed physical activity and physical fitness levels of older adults, which were positively associated with physical health and HRQoL.

However, in agreement to Dohrn (2015), recalling time spent in different activities or estimating activity intensity is difficult in older adults. As suggested by Dohrn (2015), an alternative strategy to recommendations based on time and activity intensity is to encourage people to achieve a daily step count. However, from the study only three of the sixteen items on the GPAQ significantly correlated with the step count results.

5.5 Objective 3: To establish the association between body mass index (BMI) and actual physical activity levels

The participant's minimum and maximum BMI were 16.6kg/m^2 and 38 kg/m^2 (M=26.49, SD=3.62) respectively with the majority being overweight (51%, n=107). However, there was no significant relationship between BMI (r=0.63, p=0.366) and actual steps taken. Visser and Harris (2012) agree with these findings, that with aging, an individual experience an increase in the accumulation of body fat, which thus increases body weight generally due to the high fat percentage, and a decay in muscle mass. It has been observed that body mass and fatness plateaus at the of age seventy-five to eighty years of age followed by a gradual decline. However, body mass patterns differ among different individuals, and periods of weight loss and weight gain is common in old age. Body fat redistributes with aging by decreasing subcutaneous and appendicular fat and increasing visceral and ectopic fat. The skeletal muscle mass from the body also declines with aging known as sarcopenia. The decline in muscle mass and elevation in body fat causes obesity in old age which is linked to a high risk of mobility restrictions, disability and death.

Seniors need to surpass the minimum suggested amounts of physical activity in order to be effective in achieving energy deficit or balance that will help to avert unhealthy weight gain, while considering healthy nutritional choices and other factors that influence body composition (Nelson *et al*., 2007). From the reviewed literature, it can be seen that body mass index greatly influences physical activity in older adults, with aging negatively influencing their physical activity levels, resulting in a large number of the participants being overweight in this study.

5.6 Objective 4: To establish the association between health-related quality of life, life-space mobility and successful aging of life of the older adults to their actual physical activity levels

The participants health-related quality of life (HRQoL) was established by completing the SF-36 questionnaire, while life-space mobility and successful aging of the older adults were determined by the life-space mobility questionnaire and the successful aging scale, respectively.

5.6.1 The RAND Health Survey (SF-36)

After observing the responses for the categories of the RAND health survey (SF-36), it can be deduced that the higher the mean score is for the various variables measured, the better the participant's health status in that area. The energy/fatigue category reflected a poor health status (M=9.90, SD=18.78), while the role limitation due to emotional health category had the besthealth status (M=40.95, SD=43.93). However, although the energy/fatigue, pain and general health status categories had the highest values, it is still below the accepted minimum alpha of 0.7 (Table 4.14 and Figure 4.2).

Although there were no significant correlations between the SF-36 and the average number of steps in seven days among the participants, Dohrn (2015) found that a moderate to strong associations exist between physical activity and HRQoL in the older adult population, being moderately positive, but sometimes mixed, with the influence of physical activity varying in the different domains. However, there is insufficient evidence on pathways between elevated levels of physical activity and HRQoL in older adults, or vice versa. Other factors, such as self-efficacy, may mediate the association between them. Furthermore, most studies rely on the subjective assessment of physical activity, with self-reported physical activity and HRQoL possibly having conceptual overlaps, especially in the physical functioning domains, inflating the relationship between these two constructs (Dohrn, 2015).

In agreement to the current study's finding, Olivares *et al*. (2011) highlight that the aim of physical activity is to improve or maintain HRQoL. From this study, there were positive correlations observed between PA and both physical and mental health-related factors. In agreement to this, several studies have reported links between physical activity and HRQoL, however associations between physical fitness and HRQoL is limited and insufficient. The limited available literature on this relationship explains that better physical fitness scores usually report higher scores for numerous HRQoL domains that are measured by the Short Form 36 Questionnaire (SF-36). The SF-36 incorporates domains related to successful and independent living such as physical functioning, physical role and vitality domains. A study conducted by Queiroz *et al*. (2016) is also in agreement with the findings of this study, as the mean quality of life scores of elderly people indicate that the social function and mental health domains were the highest.

It was also deduced that there were no significant correlations between the participants SF-36 scores and the average number of steps in seven days. In disagreement to the findings of this study, Bogen *et al*. (2017) concluded that the daily life walking steps per day in seniors was positively associated with health-related physical functioning. Health professionals are therefore likely justified in advising older people to walk for health-purposes. In terms of the capability approach, functional ability is crucial, focusing on what people achieve with the resources at their disposal. Different diseases affect an individual's ability to function to varying degrees, and can induce a state referred to as 'potential disability'. To make suitable healthcare and treatment choices, it is therefore important to understand how health profiles affect quality of life and function in the elderly (Gerber *et al.*, 2016). From the reviewed literature, it can be seen that health-related quality of life is greatly influenced by the physical activity levels of the older adults, although the results from those studies did not correlate with the finding of this study.

5.6.2 Life-space Mobility Questionnaire (LSQ)

The findings from the Life-Space mobility questionnaire indicated that a significant 93% (n=196) of participants had been into rooms of their home besides the room where they sleep ($p<.0005$) in the last three days. Results for the following responses regarding the last three days were all significant ($p<.0005$): they had been to an area immediately outside their home, such as the porch, deck or patio, hallway of an apartment building or garage (90%, n=190), and 65% (n=137) had been to an area outside their home, such as a yard, courtyard, driveway, or parking lot. A significant 93% (n=196) and 66% (n=139) of the participants respectively indicated that in the past three days they had not been to places outside their immediate neighbourhood within their town or community, or to places outside their immediate town or community ($p<.0005$). A positive, weak, but significant correlation was found between total LSQ and the average number of steps in seven days ($r=.224$, $p=0.001$).

In agreement with this study, Portegijs *et al*. (2014) observed that that just by having the ability of going outdoors is a vital aspect in maintaining physical and psychological health, as well as total well-being in older people. Older adults who experience limitations with life-space mobility give up treasured activities, such as getting involved in out-of-home activities which includes visiting of friends and accessing community services. With advancing age, seniors tend to spend most of their time in and around their own home, making it important to obtain insight into the limitations in life-space mobility. The Portegijs *et al*. (2014) study shows that physical, psychological as well as social aspects are crucial to maintain life-space mobility in relatively healthy older people.

Rantakokko *et al*. (2015) and Booth *et al.* (2000) agree with the findings of this study, and explain that as adults age it is necessary to find ways for them to continue to be active and independent for as long as possible in their daily lives . Older adults who displayed behaviours of not going outdoors that much was related to difficulties in mobility, and poor performance of daily activities, specifically while walking outdoors, even as little as two blocks per day. Booth et al. (2000) and Humpel et al. (2002) explain that aspects associated with sedentary behaviours in older people are poorly understood and there is a need to investigate psychological and perceived environmental influences related to physical activity participation. This will aid in identifying predictors of physical activity in older adults, such as social support, access to facilities, and neighbourhood safety, which can be used for the development of policy and intervention approaches to endorse health in the aged. Humpel et al. (2002) highlighted that in order to understand these associations, further development of environmental models, together with behaviour-specific and context-specific measurement strategies are needed. Improved longevity is associated with an increase in numerous chronic conditions that sometimes translate into functional disability and need for assistance. These added years will expel declining health which will result in reduced mobility and increased depression, isolation and loneliness. From the reviewed literature it can been seen that life space and environmental conditions have a great influence on physical activity, and that the environment can determine whether the association can have a positive or negative connotation on physical activity. However, there is a great need for research to be done in this area, specifically in South Africa.

5.6.3 Successful Aging Scale (SAS)

The results from the three measures of the Successful Aging Scale were all non-significant. A Cronbach's alpha value of >.7 is considered to indicate a reliable measure with all the mean scores for the SAS <7, which suggests that the participants seem to be coping well with aging. Preservation of social well-being was the worst category with a mean of 1.62, and mental health was the best, with a mean of 1.83. There was a negative, weak, but significant correlation between the following SAS measures, as indicated by preservation of physical health (r=.152, p=0.027), preservation of social well-being (r=-.148, p=0.032) and preservation of mental health (r=-.176, p=0.010) and the average number of steps in seven days.

Dogra and Stathokostas (2012) agree to the current study's finding, in that sedentary behaviour may impact the entire aging process. The term successful aging (SA) is used to represent the physical, psychological, and social success that occurs as one ages. The relationship between physical activity and successful aging is already well established. Unfortunately, there is inadequate data available on the relationship between sedentary behaviour and successful aging. In a study conducted by Dogra and Stathokostas (2012), it was observed that older adults are encouraged to develop skills and behaviours that help them to age gracefully. This requires the accomplishment of three conditions: 1) preservation of health, which includes mental, physical and social well-being; 2) active participation in society; and 3) a feeling of security (Dogra and Stathokostas, 2012). As such, the current analysis limited the definition of physical successful aging to those with functional impairment only. Choi *et al.* (2017) explain that aging is infused with the loss of health, enduring age-related diseases, a decrease in physical condition and activity, decrease of physical attractiveness, loneliness, disability, reliance on others, and challenges in access to healthcare and nursing services also tends to follow. However, the frequency of aging differs greatly among individuals because of genetics, environmental, behavioural factors and lifestyle choices. From the reviewed literature, it can be seen that successful aging is greatly influenced by physical activity. Unfortunately, there is limited data on the relationship between sedentary behaviour and successful aging.

5.7 Significance of study

The significance of the study is as follow:

1. The study provided baseline data on body mass index and physical activity levels of older adults for the Aryan Benevolent Homes and Aryan Benevolent West Sun Home for the Aged in Chatsworth, KwaZulu-Natal.
2. The study was helpful in identifying older adults who are at risk of excessive weight and obesity, poor health-related quality of life, poor mobility or poor aging, and thus inform on policies that manage and prevent this.
3. The findings can be used as baseline values on which further and bigger research studies can build that will direct efforts to reform the prevention and management of good health-related quality of life as well as successful aging in older adults.
4. The results from this study can guide exercise-based interventions and health promotion interventions and talks that can be implemented to educate and promote healthy aging in adults.

5.8 Study limitations

Certain limitations were associated with this study and the list below needs to be considered.

1. *Participant dishonesty:* Participants could have been dishonest when filling out the questionnaires, making it seem that they are more physically active than they really are.
2. *Participants have difficulty using the pedometer:* As the sample was the elderly population, some had trouble understanding the usage of the pedometer. However, the researcher made sure that each participant clearly understands how it works.
3. *Pedometer:* As this a technical device, technical errors may occur.
4. The generalizability of the findings due to the non-probability sampling technique utilized and the recruitment from institutional homes rather than community settings.
5. The selection bias and the possible mismatch between objective physical activity from pedometer and self-reported responses from SF-36, LSQ, SAS and GPAQ

5.9 Recommendations

The following are recommendations for future research:

- The present study should be repeated, but with a larger sample of older adults from the entire Chatsworth area, and ensure that there is representation of diverse individuals.
- The present study should be repeated with other ethnic groups represented.
- Physical activity intervention strategies should be implemented to promote and encourage successful aging of older adults in Chatsworth.

5.10 Conclusions

The findings of this study showed considerable agreement with subjective and objective physical activity levels, as well as the relationship between physical activity with life-space mobility and successful aging of life. From the reviewed literature, it is clear that body composition and health-related quality of life is greatly influenced by the physical activity levels of older adults, although this did not correlate with finding of this study. Further research is needed to shed more light on the above findings. The data from this study is important as it can be used to persuade relevant government, schools and health professionals about the significance of the problem of physical inactivity in the elderly and the need to implement strategies to improve their quality of life. This could be done by implementing exercise-based interventions and health promotion talks that can aid in the prevention and reduction of physical inactivity thus encouraging healthy aging among South Africans.

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Appendix A: Ethical Clearance

UNIVERSITY OF KWAZULU•NATAL ™

INYUVESI YAKWAZUW-NATALI

08 August 2018

Ms J Naiker (213518435) School of Health Sciences College of Health Sciences
213518435@ukzn.ac.za

Protocol: The association between physical activity and Body Mass Index, quality of life, life-space mobility and successful aging in older adults.

Degree: MSc BREC Ref No: BE406/18

EXPEDITED APPLICATION: APPROVAL LETTER

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 1 1 July 2018.

The study was provisionally approved pending appropriate responses to queries raised. Your response received on 01 August 2018 to BREC letter dated 30 July 2018 have been noted by a sub-committee of the Biomedical Research Ethics Committee. The conditions have now been met and the study is given full ethics approval and may begin as from 08 August 2018. Please ensure that site permissions are obtained and forwarded to BREC for approval before commencing research at a site.

This approval is valid for one year from 08 August 2018. To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (201 5), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/ResearchEthics/Biomedical-Research-Ethics.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be noted by a full Committee at its next meeting taking place on 1 1 September 2018.

We wish you well with this study. We would appreciate receiving copies of all publications arising out of this study.

Yours sincerely

Prof D Wassenaar
Deputy Chair: Biomedical Research Ethics Committee

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Appendix B: Gatekeepers Letter

Aryan Benevolent Home Chatsworth

80 Arena Park Drive Chatsworth,

Durban

KwaZulu Natal South

Africa

4092

RE: **Permission to conduct Sport Science Master's Degree research at the Aryan Benevolent Home Chatsworth and Aryan Benevolent West Sun Home for the Aged**

Dear Director

With one of my research interests being working with the elderly population and a Chatsworth resident myself, I am interested in using the Aryan Benevolent Home Chatsworth and Aryan Benevolent West Sun Home for the Aged to conduct research for my master's degree study in Sport Science at the University of KwaZulu Natal on "The Association Between Physical Activity and Body Mass Index, Quality of Life, Life-Space Mobility and Successful Aging in Older Adults".

The study entails the following:

- Participants will be randomly chosen from the Aryan Benevolent Home Chatsworth and Aryan Benevolent West Sun Home for the Aged through individuals who volunteer themselves.
- This research requires a representative sample of 210 participants from both homes preferably 160 from the Aryan Benevolent Home Chatsworth and 50 from the Aryan Benevolent West Sun Home for the Aged.
- Participants will be requested to complete four questionnaires that is in relation to physical activity and its association with quality of life, life-space mobility and successful aging in older adults.
- The researcher also aims to determine each participants body mass index that only requires participants height and weight.
- The participant will be required a to wear a pedometer for 7 days to track physical activity levels. The participants will be explained thoroughly how to use this simple step counting device.
- The study will take place over a month due to rotation of the use of pedometers among the participants. The participants and the both homes will be notified well in advance the exact schedules of when the study will be executed to avoid any inconvenience
- Once all data is collected, it will be filed in chronological order to maintain confidentiality. The researcher will keep the collected data information in a locked office.
- Once research is completed feedback will be given to the Aryan Benevolent Home Chatsworth and Aryan Benevolent West Sun Home for the Aged.

Considering the above conditions, I grant permission for the research to be conducted at Aryan Benevolent Home Chatsworth and Aryan Benevolent West Sun Home for the Aged.

Approved by Director of the

Signature

14-06-18

ARYAN BENEVOLENT HOME COUNCIL
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by Director of the Aryan Benevolent Home Chatsworth

Date

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Appendix C: Participant Information and Informed Consent

<u>**Information Sheet and Consent to Participate in Research**</u>

Date: 30 June 2018

Dear Sir/Madam

My name is Jacqueline Naiker, a Sport Science Master Student from the Biokinetics, Exercise and Leisure Sciences Department at the University of KwaZulu Natal with email address 213518435@ukzn.ac.za and contact number 0736086548.

You are being invited to consider participating in a study that involves research on The Association Between Physical Activity and Body Mass Index, Quality of Life, Life-Space Mobility and Successful Aging in Older Adults. The aim of this study is to determine the physical activity levels of the elderly as well as the association of their physical activity levels with body mass index, health-related quality of life, life-space mobility and successful aging of life in older adults from Chatsworth. The study is expected to enroll 210 participants in total from Chatsworth, KwaZulu Natal. You will be expected to answer four questionnaires based on physical activity, health-related quality of life, life space mobility and successful aging. Each participants Body Mass Index(BMI) will be taken. Thereafter, you will be required to wear a pedometer for 7 days to track physical activity levels.

The study does not include the exploration of any sensitive or emotional responses from the participants. I hope that the study will assist you in understanding the association of physical activity levels with body mass index, health-related quality of life, life-space mobility and successful aging of life as well as the lifestyle adjustments you need to make to promote healthy aging. The results will be published in scientific, peer-reviewed journal to inform the scientific community about the best program to follow to promote healthy aging in older adults.

This study will be ethically reviewed and approved by the UKZN Biomedical Research Ethics Committee. In the event of any problems or concerns/questions you may contact the researcher. Jacqueline Naiker at 0736086548 or the UKZN Biomedical Research Ethics Committee, contact details as follows:

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001
Durban
4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604769 - Fax: 27 31 2604609

Email: BREC@ukzn.ac.za

Participation in this research is voluntary and as a participant you may withdraw participation at any point and that in the event of refusal/withdrawal of participation you will not incur penalty or loss of treatment or other benefit to which you have been entitled to. Inform the principal investigator in writing should you decide to withdraw at any point from the study.

You will not incur any costs because of participation in the study and you will not receive any incentive or be reimbursed for participation in the study.

The data collection, management and utilisation process will be conducted with appropriate sensitivity to privacy, confidentiality and anonymity and voluntary participation. All hard copy versions of the raw data and any personal information of the participants will be stored for five years in the researcher's office in a locked cabinet. Data will also be stored electronically on a password protected computer to which only the PI has access. Thereafter all personal information and raw data will be destroyed except if required otherwise by the UKZN research policy. The identity of the participants will remain anonymous and be kept confidential, with information only being shared amongst the research team always.

CONSENT

I, (Name & Surname - ……………………………………………………………) have been informed about the study entitled "The Association Between Physical Activity and Body Mass Index, Quality of Life, Life-Space Mobility and Successful Aging in Older Adults" by Jacqueline Naiker.

I understand the purpose and procedures of the study is to establish the traditional risk factors on older adults' purpose to provide evidence on the best program *to promote healthy aging in older adults.* You will be expected to answer four questionnaires based

on physical activity, health-related quality of life, life space mobility and successful aging. Each participants Body Mass Index(BMI) will be taken. Thereafter, you will be required to wear a pedometer for 7 days to track physical activity levels.

I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any treatment or care that I would usually be entitled to.

I have been informed about any available compensation or medical treatment if injury occurs to me because of study-related procedures.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher, Jacqueline Naiker at UKZN on 0736086548.

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001
Durban
4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604769 - Fax: 27 31 2604609

Email: BREC@ukzn.ac.za

______________________ ______________________

Signature of Participant Date

______________________ ______________________

Signature of Witness Date

(Where applicable)

Appendix D: Global Physical Activity Questionnaire (GPAQ)

Name of Participant____

Participant Number____

Global Physical Activity Questionnaire (GPAQ)
Activity at Home 1. Do your activities at home involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying running hard or lifting heavy loads or digging] for at least 10 minutes continuously? Yes 1 No 2 2. In a typical week at home, on how many days do you do vigorous-intensity activities as part of your activities? Number of days……… 3. How much time do you spend doing vigorous-intensity activities at home on a typical day? ……………. Hrs.……………. mins 4. Do your daily activities involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously? Yes 1 No 2 5. In a typical week at home, on how many days do you do moderate-intensity activities as part of your activities? ……Number of days 6. How much time do you spend doing moderate-intensity activities at home. On a typical day? ……………. Hrs.……………. mins **Travel to and From Places** The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example, to senior citizen, for shopping, to market, to place of worship. [Insert other examples if needed] 7. Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places? Yes 1 No 2 8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places? ……. Number of days 9. How much time do you spend walking or bicycling for travel on a typical day? ……………. Hrs.……………. mins

Recreational Activities

The next questions exclude the school and transport activities that you have already mentioned.

Now I would like to ask you about sports, fitness and recreational activities (leisure), [insert relevant terms].

10 Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football,] for at least 10 minutes continuously?

Yes 1 No 2

11. In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?

……. Number of days

12. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?

……………. Hrs.……………. mins

13. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing or heart rate such as brisk walking, (cycling, swimming, and volleyball) for at least 10 minutes continuously?

Yes 1 No 2 14. In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities?

……. Number of days

15. How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day?

……………. Hrs.……………. mins

Sedentary Behavior

The following question is about sitting or reclining at home, getting to and from places, or with friends including time spent [sitting at a desk, sitting with friends, traveling in car, bus, train, reading, playing cards or watching television], but do not include time spent sleeping.

16. How much time do you usually spend sitting or reclining on a typical day?

……………. Hrs.……………. mins

Appendix E: RAND Medical Outcomes Study 36-Item Health Survey (SF-36)

Name of Participant____

Participant Number____

RAND Medical Outcomes Study 36-Item Health Survey (SF-36)	
General Health ***1. In general, would you say your health is:*** Excellent Very Good Good Fair Poor	***2. Compared to one year ago, how would you rate your health in general now?*** Much better now than one year ago Somewhat better now than one year ago About the same Somewhat worse now than one year ago Much worse than one year ago
Limitations of Activities The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much? ***3. Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports.*** Yes, Limited a lot Yes, Limited a little No, Not Limited at all ***4. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf.*** Yes, Limited a lot Yes, Limited a little No, Not Limited at all ***5. Lifting or carrying groceries*** Yes, Limited a lot Yes, Limited a little No, Not Limited at all ***6. Climbing several flights of stairs*** Yes, Limited a lot Yes, Limited a little No, Not Limited at all	***7. Climbing one flight of stairs*** Yes, Limited a lot Yes, Limited a little No, Not Limited at all ***8. Bending, kneeling, or stooping*** Yes, Limited a lot Yes, Limited a little No, Not Limited at all ***9. Walking more than a mile*** Yes, Limited a lot Yes, Limited a little No, Not Limited at all ***10. Walking several blocks*** Yes, Limited a lot Yes, Limited a little No, Not Limited at all ***11. Walking one block*** Yes, Limited a lot Yes, Limited a little No, Not Limited at all ***12. Bathing or dressing yourself*** Yes, Limited a lot Yes, Limited a little No, Not Limited at all

Physical Health Problems ***During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities because of your physical health?*** Yes No ***13. Cut down the amount of time you spent on work or other activities*** Yes No ***14. Accomplished less than you would like*** Yes No ***15. Were limited in the kind of work or other activities*** Yes No	***16. Had difficulty performing the work or other activities (for example, it took extra effort)*** Yes No **Emotional Health Problems** ***During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities because of any emotional problems (such as feeling depressed or anxious)?*** ***17. Cut down the amount of time you spent on work or other activities*** Yes No ***18. Accomplished less than you would like*** Yes No ***19. Didn't do work or other activities as carefully as usual*** Yes No
Social Activities ***20. Emotional problems interfered with your normal social activities with family, friends, neighbours, or groups?*** Not at all Slightly Moderately Severe Very Severe	**Pain** ***21. How much bodily pain have you had during the past 4 weeks?*** Not at all Slightly Moderately Severe Very Severe ***22. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?*** Not at all Slightly Moderately Severe Very Severe

Energy and Emotions ***These questions are about how you feel and how things have been with you during the last 4 weeks. For each question, please give the answer that comes closest to the way you have been feeling.*** ***23. Did you feel full of pep?*** All of the time Most of the time A good bit of the time Some of the time A little bit of the time None of the time ***24. Have you been a very nervous person?*** All of the time Most of the time A good bit of the time Some of the time A little bit of the time None of the time	***25. Have you felt so down in the dumps that nothing could cheer you up?*** All of the time Most of the time A good bit of the time Some of the time A little bit of the time None of the time ***26. Have you felt calm and peaceful?*** All of the time Most of the time A good bit of the time Some of the time A little bit of the time None of the time
27. Did you have a lot of energy? All of the time Most of the time A good bit of the time Some of the time A little bit of the time None of the time ***28. Have you felt downhearted and blue?*** All of the time Most of the time A good bit of the time Some of the time A little bit of the time None of the time	***29. Did you feel worn out?*** All of the time Most of the time A good bit of the time Some of the time A little bit of the time None of the time ***30. Have you been a happy person?*** All of the time Most of the time A good bit of the time Some of the time A little bit of the time None of the time

31. Did you feel tired?
All of the time
Most of the time
A good bit of the time
Some of the time
A little bit of the time
None of the time

Social Activities
32.During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?
All of the time
Most of the time
A good bit of the time
Some of the time
A little bit of the time
None of the time

General Health
How true or false is each of the following statements for you?

33. I seem to get sick a little easier than other people
Definitely True
Mostly True
Don't Know
Mostly False
Definitely False

34. I am as healthy as anybody I know
Definitely True
Mostly True
Don't Know
Mostly False
Definitely False

35.I expect my health to get worse
Definitely True
Mostly True
Don't Know
Mostly False
Definitely False

36. My health is excellent
Definitely True
Mostly True
Don't Know
Mostly False
Definitely False

Appendix F: Life-Space Mobility Questionnaire (LSQ)

Name of Participant____

Participant Number____

Life-Space Mobility Questionnaire (LSQ)		
Questions	**1= Yes**	**2=No**
1. During the past 3 days, have you been to other rooms of your home besides the room where you sleep?		
2. During the past 3 days, have you been to an area immediately outside your home such as your porch, deck or patio, hallway of an apartment building, garage?		
3. During the past 3 days, have you been to an area outside your home such as a yard, courtyard, driveway, or parking lot?		
4. During the past 3 days, have you been to places in your immediate neighbourhood, but beyond your own property or apartment building		
5 During the past 3 days, have you been to places outside your immediate neighbourhood but within your town or community?		
6. During the past 3 days, have you been to places outside your immediate town or community?		
7. During the past 3 days, have you been to places outside of your county?		
8. During the past 3 days, have you been to places outside the state of Durban?		
9. During the past 3 days, have you been to places outside the southeast region?		

Appendix G: The Successful Aging Scale (SAS)

Name of Participant____

Participant Number____

Successful Aging Scale (SAS)							
	Strongly Agree	**Agree**	**Moderately Agree**	**Undecided**	**Moderately Disagree**	**Disagree**	**Strongly Disagree**
1. I am unable to make choices about things that affect how I age, like my diet, exercise and smoking.							
2. When things don't go as well as they used to, I keep trying other ways until I achieve the same result.							
3. In difficult times, I develop mental toughness in dealing with the situation.							
5. I am actively engaged with life through productive activities.							
6. I strive to remain independent for as long as possible.							
7. I make attempts to remain relatively free of disease and disability.							

8. I try to maintain good physical and mental functioning as I age.							
9. I am actively engaged with life through regular social contacts.							
10. I make every effort to achieve goals that are important to me.							
11. I feel that I am not in control of my immediate environment.							
12. I can deal with whatever comes my way.							
13. I make attempts to engage in healthy lifestyle habits.							
14. I am comfortable in accepting both my good and bad qualities.							

Appendix H: Step Count Record Sheet

Step Count Record Sheet

Participant Number:

Day	Date	Time the pedometer was put…		Duration of time pedometer was out during the day (if any)	Total Daily Step Count
		ON	OFF		
				Average Steps Taken for seven days =	

Appendix I: Plagiarism Report

Turnitin Originality Report

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Plagiarism Check by Jacqueline Naiker

Similarity Index	Similarity by Source
12%	Internet Sources: 8% Publications: 6% Student Papers: 7%

1% match (publications) "Physical Activity and Cancer", Springer Nature America, Inc, 2011
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1% match (Internet from 21-Jul-2017) http://documents.mx/documents/isak-book.html
< 1% match (publications) "Sedentary Behaviour Epidemiology", Springer Nature, 2018
< 1% match (student papers from 27-Nov-2017) Submitted to Durban University of Technology on 2017-11-27
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< 1% match (student papers from 05-Jun-2018) Submitted to Huntingdon College on 2018-06-05
< 1% match (student papers from 03-Dec-2016) Submitted to Navitas Professional Institute Pty Ltd on 2016-12-03
< 1% match (Internet from 29-Nov-2011) http://etd.lsu.edu/docs/available/etd-05042008-181650/unrestricted/TammyDiss7.pdf
< 1% match (student papers from 22-Nov-2018) Submitted to University of Stellenbosch, South Africa on 2018-11-22
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< 1% match (student papers from 27-Jan-2016) Submitted to William Paterson University on 2016-01-27
< 1% match (student papers from 26-Jun-2017) Submitted to University of Southern California on 2017-06-26
< 1% match (Internet from 02-May-2012) http://bmb.oxfordjournals.org/content/95/1/121.full
< 1% match (Internet from 05-Apr-2018) http://pubs.sciepub.com/ajphr/6/2/10/index.html
< 1% match (student papers from 02-Dec-2014) Submitted to Murdoch University on 2014-12-02