The Effects of a Structured Group Exercise Program on Functional Fitness of Older Persons Living in Old Age Homes within the Ethekwini Municipality, South Africa

by

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Mini - Dissertation presented in part fulfilment for the degree of

Master of Health Sciences

At

University of KwaZulu-Natal

School of Health Sciences

College of Health Sciences

2014

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DECLARATION

I, Mr Levin Chetty declare that

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This dissertation is dedicated to my Grandmother,

For always believing in me and inspiring me – no words can express how much you are missed.

ACKNOWLEDGEMENTS

I wish to express my sincere gratitude and appreciation to the following people and institutions:

- My Lord and Saviour **Jesus Christ** - for his strength and his grace. I am nothing without him.

- My **parents** - for their sacrifices, endless support and always being my pillars of strength.

- My **brothers, sister in law, aunts** and **uncles**, and especially my **niece** and **nephew** - for the love, joy and just for being my family.

- My **supervisor** and **co-supervisor** - for their wisdom, understanding, encouragement and guidance throughout this project. Their mentorship, motivation and belief in me is sincerely appreciated.

- My **friends** and **colleagues** in the **Department of Physiotherapy**, especially my dearest **Predeshni** - for the fun, laughter, joys, trials and most of all companionship as we journey through life, work and studies.

- **Residents** of the **five aged care facilities** used in this project - thank you for participating in the study. Your courage and will to persevere, in spite of your age, will never be forgotten.

- **The University of KwaZulu-Natal** - for affording me the opportunity to undertake this study and for providing an environment conducive for me to attain my goals.

ABSTRACT

Aim: The study aimed to determine the effects of a structured group exercise program on functional fitness of older persons living in five old age homes within the eThekwini Municipality of South Africa.

Population: The study population comprised men and women aged 60 years and older, who reside in an old age home within the eThekwini Municipality.

Design: A quasi-experimental design was used to compare the effect of a 12 week group exercise program on two groups of participants using pre-test post-test procedures.

Methodology: Twenty participants each were selected from five old age homes. Participants were randomly allocated into either an experimental group or a comparison group at each site. The experimental group participated in the exercise intervention three times weekly for 12 weeks, while the comparison group received the same intervention twice weekly for 12 weeks. The prescribed intervention was guided by the recommendations outlined by the American College of Sports Medicine (ACSM) and American Heart Association (AHA) respectively. It comprised of warm-up, balance, endurance, resistance and cool-down components. Assessments of upper and lower body strength and flexibility, aerobic endurance, agility and balance were conducted before and after the intervention using the Senior Functional Fitness Test. Data was analysed using Microsoft Excel 2013 and Statistical Package for Social Sciences version 20.1.

Results: Comparisons of baseline and post-intervention measures showed greater improvements in upper and lower body strength and flexibility, as well as aerobic endurance capacity ($p < 0.05$). But, no improvements were observed in participant's agility and balance levels. With regards to training frequency, no significant difference in functional fitness measures was observed between both groups following the 12 week intervention program.

Conclusion: Twelve weeks of multifaceted group exercise training, at least two times per week can be used as an effective strategy to promote functional fitness in the elderly population.

CONTENTS

ABBREVIATIONS

ACSM	American College of Sport Medicine
AHA	American Heart Association
ATP	Adenosine Triphosphate
CBD	Central Business District
CDC	Centres for Disease Control
CVD	Cardiovascular Disease
ECG	Electrocardiogram
ES	Effect Size
RPE	Rate of Perceived Exertion
UN	United Nations
VO2Max	Maximal Oxygen Consumption
WHO	World Health Organization

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CHAPTER 1 – INTRODUCTION

1.1. Background

The process of ageing is associated with a decline in the body's physiological systems, which may lead to limited or decreased physical capacity (Manini and Pahor, 2009). Health for the older adult is generally defined as the maintenance of functional dependence until death (Grove and Spier, 1999). The musculoskeletal and cardiovascular systems are the most greatly affected systems during the ageing process because of their involvement with the most basic functions of everyday life (Grimby and Saltin, 2008). The musculoskeletal system in the elderly shows a marked reduction in muscular strength and endurance, due to the combination of sarcopenia (loss of muscle mass) and neural control as one gets older. Similarly, the cardiovascular system is associated with declines in maximal aerobic performance due to decreased cardiac output (i.e. the delivery of oxygenated blood to the muscles) and oxygen uptake at the muscle as one gets older (Clark and Manini, 2008). Health in the elderly can further be hindered by a lack of exercise, poor nutrition and chronic disabling conditions (Resnick, 2000).

Furthermore, physical inactivity has been identified as a vital risk factor for many chronic health problems such as cardiovascular diseases, hypertension, obesity, osteoporosis, diabetes mellitus and mental health problems in adults over the age of 50 years (van der Bij et al., 2002). Participation in regular exercise, particularly aerobic exercise and resistance training, drastically reduces the risk of disabilities while producing significant physical and psychological health benefits (Daley and Spinks, 2000).

There is an association between ageing and a marked reduction in aerobic power, muscle strength and physical fitness, with large portions of the elderly population falling below, or barely above, the 'threshold' of minimum physical ability (Mor et al., 1989). Furthermore, even a minor illness can render them totally dependent on others for their care (Astrand, 1992). Older people have a low functional status and an increased incidence of chronic disease and can benefit from participation in exercise programs (Galloway and Jokl, 2000).

A structured plan of enhanced physical activity has been shown to improve health and quality of life in the older population and these benefits may have a positive bearing on the preservation of functional capacity and decreased medical costs in the elderly population (Duthie, 2007).

Despite the benefits of exercise, high percentages of the elderly population continue to lead sedentary lifestyles. South African adults have a particularly high prevalence of physical inactivity which in terms of attributable deaths, ranks ninth compared to other risk factors (Joubert et al., 2007). In a report submitted to the United Nations Secretary on the situation of older persons in South Africa (April 2011), the present generation of older persons was clearly identified as the most affected by the country's troubled apartheid past. Through considerable effort on the part of government and civil society organizations, the Older Persons Act was passed and gazetted on 2006 (Joubert and Bradshawb, 2006). The act has attempted to address physical inactivity in the older population as one of its major national health priorities, and dynamically embrace the concept of active ageing. The central themes of the act were the obligations placed on government and relevant stakeholders to promote:

- Active ageing in communities.
- Quality of life, the dignity and well-being of older persons.
- Prevention of abuse of older persons.

Active ageing applies to both individuals and population groups. It encourages individuals to realize their potential for physical, social and mental well-being throughout their life expectancy, whilst also allowing them the freedom to participate in society while providing adequate protection, security and care whenever or wherever needed (Plouffe and Kalache, 2010).

The word "active" suggests continued social, economic, cultural, spiritual and civic involvement, not just the ability to remain physically active or to participate in the labour force. Older adults can actively contribute to their families, communities and countries even though they may retire, face illness or live with disabilities. Therefore, the objective of

active ageing is to extend healthy life expectancy and quality of life for everyone as they get older. Ageing clearly occurs within the context of family, friends, neighbours and work colleagues; hence interdependence as well as intergenerational cohesion becomes important principles of the active ageing process (Sagner, 2000).

Lord (2007) propose that general exercise prescriptions do not always involve the intensity of stimulus deemed necessary to provide gains in strength, balance or endurance, especially as one gets older (Lord, 2007). Evidently, such prescriptions for the elderly have yet to be meticulously tested for effectiveness and cost-effectiveness.

1.2. Study Aim

The study aimed to determine the effects of a structured group exercise program on functional fitness levels of older persons residing in five old age homes within the eThekwini Municipality, South Africa.

1.3. Study Objectives

1.3.1. To describe the demographic profile of the exercise participants on the group exercise program.
1.3.2. To determine the effects of a 12 week group exercise program on functional fitness.
1.3.3. To assess the effect of the frequency of exercise prescription on functional fitness.

1.4. Conclusion

In South Africa, to date, there are no known scientifically evaluated structured exercise programs for older populations residing in aged care facilities. This study attempts to assess a structured exercise program developed specifically for residents at aged care facilities, as well as the frequency of exercise required to improve muscular strength, endurance, flexibility, agility and balance in the aged. It is anticipated that the results of the study will contribute significantly towards the promotion of the concept of active ageing enshrined in both the World Health Organization's Policy on Ageing (Kalache and Gatti, 2003) and the

South African Policy for Older Persons (Schatz and Ogunmefun, 2007). In the long term, it is proposed that the intervention will have a positive impact on the burden of chronic diseases whilst improving the health related quality of life of the older citizen living in old age homes in South Africa.

CHAPTER 2 – LITERATURE REVIEW

2.1. Introduction

Over the past two decades, the world has witnessed a significant demographic ageing process, which has resulted in profound social and political transformations, and has greatly challenged society and humanity's options as we have progressed into the 21st century (Waite, 2004). The global population aged 60 or over is escalating rapidly. Evidence suggests that it will increase by more than 50 percent over the next four decades, increasing from 264 million in 2009 to 416 million by 2050 (Marques et al., 2011). According to the United Nations (UN), the population aged 60 or over is the fastest growing population in the world. It is expected that the number of persons aged 60 or over will triple by the year 2100, increasing from 841 million in 2013 to 2 billion in 2050 and close to 3 billion in 2100 (UN, 2013). The UN confirms that 66 percent of the world's older persons already live in less developed regions whilst by 2050, 79 percent will do so and this figure will reach 85 percent by 2100. It is further postulated that by the year 2050, there will be more people over 60 years of age worldwide than children (Lunenfeld, 2008).

In South Africa, whilst the growth rate may not be as rapid as the developed world, the aged population is also on the increase. A community survey in 2007 indicated that 5.4 percent (2.61 million) of the population was 65 years or over as compared to 4.9 percent (2.21 million) in 2001. Furthermore, approximately 23.1 percent of this population is disabled, with physical disabilities accounting for 20.4 percent of overall disability prevalence (Ramklass et al., 2010).

In April 2002, the World Health Organization (WHO) developed a Policy Framework on active ageing which served to inform discussion and eventual formation of action plans that promote healthy and active ageing (Stenner et al., 2011). "Active Ageing" is a model that has been employed since the late 1990's by the WHO, and it defines active ageing as the "the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age."

This review of literature will describe the evidence on the pathophysiology of ageing particularly in the geriatric population of 60 years and older. It will outline the development and impact of group exercise programs for older persons with particular reference to those living in aged care facilities and discuss the effect of exercise programs on functional fitness in older persons.

2.2. The Ageing Process

Ageing is a complex process that begins at conception and continues throughout the course of life. It can be defined as a 'progressive, generalized impairment of function, resulting in an increased vulnerability to environmental challenge and a growing risk of disease and death' (Kirkwood, 2005). All through this lifespan, the body reflects its genetic capacity to adapt and repair, but with advancing age there is an inclination for all the bodily systems to demonstrate reduced efficiency. While ageing may be unique for each individual, there are generalizations that can be observed for each of the bodily systems (Weinert and Timiras, 2003).

From maturity to senescence there is a significant decline in neuromuscular function and performance which is characterized by an inevitable reduction in skeletal muscle mass and associated loss of strength (Doherty, 2003). Sarcopenia is the term used to define this apparent loss of muscle mass and strength and the consequent functional impairment that occurs with the ageing process (Mobasheri and Mendes, 2013). Decreased physical activity as one reaches old age appears to be the key factor involved in the development of sarcopenia (Janssen, 2010). Mitchell et al (2012) reviewed the underlying changes in muscle characteristics and the etiology of sarcopenia, and concluded that the loss of muscle strength is a more consistent risk factor for the development of disability and death as compared to declining muscle mass (Mitchell et al., 2012).

Cardiovascular disease (CVD) is also a major risk factor with increasing age (Lopez et al., 2006). It is approximated that by the year 2030, twenty percent of the world's population will be aged 65 years or over and CVD will have accounted for forty percent of all deaths,

ranking as the leading cause of death in this population (North and Sinclair, 2012). Age specific mortality rates due to heart disease and stroke together with the incidence of peripheral vascular disease and vascular cognitive impairment increase exponentially with age in individuals over the age of 65 years (Dai et al., 2012). Mitochondrial dysfunction is synonymous with the ageing process as it has been found to be responsible for age related pathological alterations of the cardiovascular system and vascular pathophysiology (Trifunovic and Larsson, 2008). This is largely due to the important role that the mitochondria plays in several cellular processes such as the production of Adenosine Triphosphate (ATP), biosynthetic pathways, cellular homeostasis, ion homeostasis, oxygen sensing, signalling and the regulation of programed cell death. Population based studies clearly indicate that regular physical activity has the capacity to drastically reduce the risk of CVD. It is presumed that the beneficial effects of exercise are the result of its positive effect on mitochondrial function (Menshikova et al., 2006).

2.3. Exercise Prescription

In 1995, the American College of Sports Medicine (ACSM) together with the Centres for Disease Control (CDC) recommended that all adults in the United States should accumulate 30 minutes or more of moderate intensity physical activity on most or preferably all days of the week (Pate et al., 1995). This recommendation is in line with those outlined by the WHO. However, these recommendations have been amended by the American Heart Association (AHA) and ACSM by endorsing separate recommendations for all adults who are 65 years and older and those adults between the ages of 50 and 64 years who have clinically significant disease impairments and limitations (Haskell et al., 2007). Both the WHO and AHA further concur that vigorous intensity aerobic physical activity for a minimum of 20 minutes three times per week and at least two non-consecutive days of moderate to high intensity resistance training each week are also acceptable. Overall, evidence suggests that moderate intensity activities have the greatest effect to offset age related declines in cardiorespiratory function, muscular strength and power as well as maintaining independent function (Sims et al., 2010). However, it is very apparent that there is insufficient evidence to establish optimal or the 'best' intensity or duration of physical activity for this population.

Due to the diverse aetiology of diseases in the older adult population, global recommendations are difficult to formulate and adopt. Most of the difficulty revolves around the potential safety concerns in this population (O'Connor et al., 2009). However, evidence indicates that the types and intensity of physical activity recommended for this population are relatively safe and that serious adverse events during clinical trials are very rare (Gordon et al., 1995). Both the AHA and ACSM further reiterate a multifactorial approach to physical activity by recommending aerobic, strength and flexibility exercises for the elderly (Paterson et al., 2007). In addition to incorporating each category of activity for this population, the activity plan must also consider how, when and where physical activity will be performed. Ideally, individuals who are sedentary should begin with shorter bouts of activity and gradually move towards increased intensity and volumes of exercise (Gudlaugsson et al., 2012).

Although high levels of physical activity may have the capacity to thwart the ageing process, age related changes continue to be evident despite lifelong high intensity physical activity. This trend is evident in studies conducted by (Lepers and Cattagni, 2012) and (Ploutz-Snyder, 2003). Both studies reported that master marathon runners and power lifters who continue to train for 2 to 3 hours per day remain susceptible to the physiological declines seen with the ageing process. However, both studies agree that it is possible for those who begin and maintain a physical activity program throughout their lives to have a greater reserve capacity to maintain higher levels of function into later life.

Research studies that aim to ascertain better physical activity methodologies to improve physical function in the aged remain ongoing (Weening-Dijksterhuis et al., 2011, Reid and Fielding, 2012, Liu and Fielding, 2011, Liu and Latham, 2009, De Vries et al., 2012). Interestingly, these studies focus not only on improving the musculoskeletal and cardiovascular systems through traditionally based exercise programs but also through the incorporation of task specific activities. Task specific exercises involve the practicing of movements that mimic everyday activities in a progressively challenging manner, that have been found to improve function by incorporating task specificity and highlighting neural control of movement (Manini et al., 2007).

2.4. Functional Fitness

Functional fitness in the elderly is defined as having the ability to perform normal everyday activities safely and independently without undue fatigue. It includes components such as upper and lower body strength, upper and lower body flexibility, aerobic endurance and motor agility/dynamic balance (Toraman and Ayceman, 2005). Insufficient levels of physical activity, especially in the elderly can cause physical declines that will eventually lead to functional limitations in basic tasks such as lifting, stooping, walking or climbing stairs – all of which are daily requirements of independent functioning (Rikli, 2005). Rikli and Jones (1999) further postulate that the percentage decline in functional fitness measures is consistent with age related declines in physical performance.

The early detection of weakness and assessment of functional fitness levels in the elderly can drastically help to prevent the age related declines that transpire (Jackson et al., 1995). However, the inability to adequately measure functional fitness performance in the aged is closely associated with understanding and reducing loss of function in later years (Spirduso, 2010). Of even more vital concern is the periodic assessment of functional fitness because it has been proven to have substantial implications for health care costs in the elderly (Santos et al., 2012).

The senior functional fitness test was developed and validated in order to evaluate functional fitness (Rikli and Jones, 2001). The test was developed to assess the major underlying physical parameters associated with independent functional mobility in the aged. As such, upper and lower body strength, upper and lower flexibility, agility/dynamic balance and aerobic endurance were evaluated utilizing the 30 second chair stand, arm curl, chair sit and reach, back scratch, 8 foot up and go, and 6 minute walk tests respectively. “Criterion performance scores” were further generated after conducting a national study in which individuals were placed into four categories of functional mobility based on their scores achieved in the six functional tests (Rikli and Jones, 1999b).

With the use of the senior functional fitness test, Krol-Zielinska et al (2011) was able to demonstrate significant differences in physical activity and functional fitness with respect to

living settings and sex in the elderly (Król-Zielińska et al., 2011). Additionally, Wilkin and Haddock (2011) further suggested that while females displayed greater upper and lower flexibility, their male counterparts displayed higher levels of physical activity and greater upper and lower body strength. Male participants were also able to perform the 8 foot up and go test more quickly than the females, suggesting greater agility/dynamic balance in this sex (Wilkin and Haddock, 2011).

While the need and development of age-appropriate tools to evaluate the physiological attributes (strength, endurance, flexibility, agility and balance) required in performing activities of daily living has been widely explored, the effects of frequency of exercise requires further investigation. Significant strength improvements in individuals over 60 years of age were reported by Nicholls et al (1995), following strength training twice a week for 12 weeks (Nichols et al., 1995). Differences in flexibility in the elderly following a training program twice a week for 12 weeks were further observed (Brown and Holloszy, 1993), while Wolfson et al (1996) found that participation in an exercise program three times per week over 12 weeks improved dynamic balance considerably (Wolfson et al., 1996). Paw et al (2001) noticed improved functional ability after 17 weeks, following an all-round functional skills training program twice a week (Paw et al., 2001). Functional skills training twice a week, or a combination of resistance training coupled with functional skills training have been proven to effectively improve fitness and performance measures in the elderly (Paw et al., 2006). These studies all demonstrate that exercise conducted twice or more per week can provide adequate improvements. However, very little literature exists to establish how frequently the aged should exercise to gain improvements in functional fitness levels (Nakamura et al., 2007).

Despite early responses to strength training, probably as a result of neural adaptations and hypertrophy of the trained muscle (Laidlaw et al., 1999, Bemben and Murphy, 2001), much of the evidence on the effects of functional fitness training have assessed responses to programs of at least 12 weeks in duration (Porcari and Foster, 2008). A non-experimental investigation on the effects of a 12 week functional exercise circuit on older adults established the circuit to be suitable and safe for this population and observed functional improvements (Whitehurst et al., 2005).

Aged care facilities usually target older people with intermediate and high levels of psychological and social frailty (Ciairano et al., 2010). Most of the individuals placed in these facilities have either lost their partners, or lack the children or relatives who are able to provide them with the support needed to meet the demands of daily life and activities. They rely on these facilities because they offer specialized care for the aged such as specialized nursing and other personnel, as well as general housekeeping services (Cheng et al., 2011). Despite the clear advantages offered by these facilities, certain risks can also manifest. There is a tendency for the elderly living in such facilities to be removed from the daily life of their communities, thereby increasing the likelihood of disengagement and depression. As a result, they risk becoming less capable of taking care of their own selves than their current state allows. The potential consequences of residing in aged care facilities, if not adequately addressed, can have serious repercussions on the physical and psychological functioning of the elderly (Becker and Rapp, 2010).

CHAPTER 3 – METHODOLOGY

3.1. Study Design

A quasi-experimental research design approach was adopted for this study, to compare the effects of a 12 week group exercise program on two groups of participants. Dependent variables were assessed prior to the intervention to establish a baseline and after the intervention to determine the effect of the intervention.

A quasi-experiment is an empirical study that is often implemented to estimate the causal impact of an intervention on its target population (Mitchell and Jolley, 2012). Although this type of research design does not impose the strict limitations as true experimental designs, it allows the control of extraneous variables by controlling when the observations (measurements) are made, who receives the treatment and when the treatment is administered (Eliopoulos et al., 2004). In this way, causation is enhanced.

3.2. Research Setting

Five aged-care facilities within a 20 to 30 kilometre radius of the eThekwini CBD area were randomly selected for the study. The five sites randomly selected were:

- Tafta on the Ridge
- Ray Hulett Old Age Home
- Aryan Benevolent Old Age Home
- Clayton Gardens Old Age Home
- Mary Asher Old Age Home

3.3. Study Population

The study population comprised individuals who were 60 years of age and older and residing in an aged care facility within a 20 to 30 kilometre radius of the eThekwini CBD.

Following a medical screening process (Appendix C), 20 participants per site became eligible for participation in the study.

3.4. Inclusion Criteria

- Participants who were ≥ 60 years of age.
- Participants who were autonomous in their activities of daily living.
- Participants who were not involved in any structured physical activity program during the last three months prior to the start of the program.
- Male or female participants.

3.5. Exclusion Criteria

- Individuals who were < 60 years of age.
- Individuals participating in other clinical trials/research.
- Individuals who were undergoing hormonal supplementation.
- Individuals who were deemed unable to participate following a medical assessment.

3.6. Sampling Strategy

The study utilized a sample of convenience. Participants were enrolled onto the program in accordance with the study's inclusion and exclusion criteria. A maximum of 20 participants were invited to participate in a group exercise program at each of the five old age homes. Participants were then randomly allocated to an experimental (group 1) and comparison group (group 2) of 10 each at the respective sites. Group 1 (experimental) received the intervention 3 times per week for 12 weeks, while group 2 (comparison) received the same intervention 2 times per week, also for 12 weeks.

3.7. Functional Fitness Testing (Appendix D)

A history and physical evaluation prior to the commencement of the study was conducted on all participants. This was conducted by a sports medicine physician and was used to detect any cardiac risk factors, exertional signs/symptoms and physical limitations that may have existed. Potential contraindications (Table 1) to aerobic and resistance training in this population do exist (Medicine, 2013). However, following appropriate evaluation and treatment, patients are able to perform exercise at low levels/intensities (Nied and Franklin, 2002).

Table 1 – Potential Contraindications to Aerobic Exercise and Resistance Training

Absolute	Relative
Recent ECG change or myocardial infarction	Cardiomyopathy
Unstable angina	Valvular heart disease
Third-degree heart block	Complex ventricular ectopy
Acute congestive heart failure	
Uncontrolled hypertension	
Uncontrolled metabolic disease	

Evaluation of the functional fitness of the elderly was conducted using the Functional Fitness Test (Rikli and Jones, 1999a). The test evaluates upper and lower body strength and flexibility, aerobic endurance, agility and dynamic balance in accordance with the following techniques:

Lower body strength was assessed using the chair stand test, which records the number of stands completed in 30 seconds.

Upper body strength was assessed using the arm curl test. This test measures the total number of repetitions performed in 30 seconds.

Lower body flexibility was assessed using the chair sit and reach test. This test measures the maximum forward reach towards or past the toes (cm) while sitting on the edge of a chair with one leg bent and the other extended.

Upper body flexibility was assessed using the back scratch test. This test measures the distance (cm) of overlap or between the tips of the middle fingers when the arms reach up as far as possible in the middle of the back.

Agility and dynamic balance was assessed using the 8-foot up-and-go test. This test records how fast a participant can get up from a chair, walk around a cone placed 8 feet away (244cm) and then to sit down again.

Aerobic endurance was assessed using the 6-minute walk test. In this test two cones are placed 45.7 meters apart and each participant is required to walk as briskly as possible (no running) from end to end. The maximum distance covered in 6 minutes is recorded.

3.8. Exercise Prescription (Appendix E)

The ACSM recommends cardiac stress testing for sedentary and minimally active older adults wanting to participate in vigorous intensity exercise (Thompson et al., 2013). Table 2 outlines the guidelines for cardiac stress testing, however moderate endurance and resistance training can be conducted provided the exercise program begins at a low intensity and increases in intensity are gradual (Franklin, 2000). This study followed those guidelines when prescribing exercise for this population. The exercise program began at a low intensity and increases in intensity and duration were gradual over the period of 12 weeks. Participants were further encouraged to discontinue exercise and seek medical intervention should they experience major warning signs/symptoms such as chest pain, palpitations or light-headedness. Intensity for the first 4 weeks was equivalent to 1-2 on the RPE scale (very light to fairly light), while during weeks 5 to 8 the intensity was increased to 3-4 (moderate to somewhat hard). An intensity of 4-5 was maintained through weeks 9 to 12. The duration of endurance exercise also increased over the 12 week period from 10 minutes (weeks 1 to 4), to 14 minutes (weeks 5 to 8) and finally 20 minutes (weeks 9 to 12).

Table 2 – Guidelines for Cardiac Stress Testing

Men ≥ 45 years old and women ≥ 55 years old who plan to exercise at 60% VO2 max.
Known coronary artery disease or cardiac symptoms.
Two or more coronary artery disease risk factors: Hypertension, smoking, hypercholesterolemia, obesity, sedentary lifestyle and family history of early coronary artery disease.
Diabetes
Known or major signs/symptoms of pulmonary or metabolic disease.

The exercise prescription used in this study is in accordance with current consensus recommendations of ACSM and AHA. The duration of the exercise program was 12 weeks. The frequency of sessions was three times per week (Monday, Wednesday and Friday) for group 1 and two times per week (Monday and Friday) for group 2. The total duration of exercise progressed from 50 to 80 minutes per session. Sessions were conducted each morning between 08h00 and 10h00, at least 60 minutes after breakfast. Each class consisted of a 10 minute warm up, followed by 45 minutes of strength, endurance and mobility/balance exercises, and concluded with a 5 minute cool down and stretching routine.

3.8.1. Warm-up (10 minutes)

The warm-up included progressive exercises involving dynamic stretching. Intensity was increased gradually. Continuous rhythmic endurance activities such as easy walking and toe and heel presses were utilized. The warm-up further included rehearsal (step by step with slower tempo) exercise sequences, as well as joint specific mobility exercises (e.g. arms overhead). Intensity was monitored using Borg's Rating of Perceived Exertion (RPE) scale (Borg, 1998).

3.8.2. Endurance Exercise (15-30 minutes)

The desired intensity of endurance exercise was determined using the Borg RPE Scale. An exercise program that begins with an intensity of light to somewhat hard without exceeding an intensity of hard, is most appropriate for previously sedentary older adults (Mazzeo, 1998). Accordingly, the intensity throughout the program was maintained between 1 and 5 on Borg's RPE scale (Appendix F).

Endurance training involved walking as this encourages continuous rhythmic movement with utilization of the larger muscle groups.

3.8.3. Resistance Exercise (15-30 minutes)

The study included resistance exercises that were aimed at developing total body muscular endurance, strength and power. Given the age and functional ability of participants the following ten resistance exercises were deemed appropriate and included in the exercise program:

- Ball Squat
- Calf raises
- Wall push up
- Hip extension
- Seated bicep curl
- Seated tricep extension
- Seated lateral shoulder raise
- Seated arm/leg march
- Seated rowing
- Seated abdominal crunch

Ten repetitions per set of each exercise were performed over the 12 week program. The number of sets performed progressed from 1 set of each resistance exercise during weeks 1

to 4, to 2 sets of each resistance exercise during weeks 5 to 12. Abdominal strengthening exercises were also used to develop core strength.

3.8.4. Cool-Down (5 minutes)

Static flexibility and relaxation activities at a low intensity were performed to allow the body to adjust from exertion to rest. A stretch was applied twice to each muscle group of the body, while relaxation strategies (slow deep breathing) were encouraged between stretches and at the end of activity. Each stretch was held to a point of gentle tension but not pain, for a period of 15-30 seconds.

3.9. Data Collection/Management

Baseline assessments of functional fitness measures were conducted and recorded prior to the start of the study (Appendix G). The exercise prescription, as previously discussed, was implemented and follow-up assessments were conducted immediately after the 12 week program had ended, at each of the five aged care facilities.

All results were entered into a database created and supported by Microsoft Excel version 2013. Independent double entering of data was conducted to minimize error. All data was checked and cleaned prior to analysis.

3.10. Statistical Analysis

Data was analysed using the Statistical Package for Social Science version 20.1 for Windows software. A p-value of < 0.05 was considered as being statistically important. The Kolmogorov-Smirnov test was used to test for normality of baseline and follow-up data. A paired t-test and Wilcoxon matched-pair signed rank test was used to analyse normally distributed and non-parametric data respectively. Chi-square tests were used to analyse nominal and order (categorical) data. To emphasize clinical significance Cohen's *d* effect sizes (ES) were also calculated, with the magnitude of the standardized effects interpreted using thresholds of 0.0 to 0.2 (trivial), 0.2 to 0.6 (small), 0.6 to 1.2 (moderate), and greater than 1.2 (large) respectively (Hopkins et al., 2009).

3.11. Ethical Considerations

This study forms part of a larger study titled “Group exercise and its relation to perceived health status, functional status, immune and hormonal status of older persons living in aged care facilities within the eThekwini Municipality.”

Ethical clearance for this study was obtained from the University of KwaZulu-Natal (UKZN) School of Health Sciences Research Committee and from the UKZN Biomedical Research Ethics Committee – BE251/11 (Appendix A).

Permission to conduct the study was obtained from the Department of Social Development and each of the five participating aged care facilities.

Participation in the study was voluntary. Each participant was requested to sign an informed consent form prior to the commencement of the study (Appendix B). Participants were additionally informed that they could withdraw from the study at any stage without fear of victimization.

Data will be kept confidential for use by researcher and supervisors only. Coding and non-use of identifiers was employed to protect the identity of participants.

Information will be stored under lock and key for a period of 5 years, after which all information gathered will be destroyed.

CHAPTER 4 – RESULTS

4.1. Introduction

This chapter presents the results of the findings obtained from the measurements taken in this study. This data represents the measurements taken from 86 elderly participants at five old age homes within the eThekwini Municipality.

4.2. The Sample

In total, 118 participants were tested as a baseline demo. This number was reduced to 86 participants with valid results for the follow-up.

4.3. The Research Instrument

The research instrument consisted of 18 items, with a level of measurement at a nominal level for the biographical details. The remaining data was numerical in nature.

4.4. Biographical Data

This section summarises the biographical characteristics of the respondents.

4.4.1. Racial Distribution

The racial composition of the sample is represented in Figure 1. Nearly three-quarters of the sample population were Indian (74%) with similar numbers of White and Coloured participants (3% difference). Black Africans comprised the smallest grouping of 1%. An increased Indian participation in the study can be attributed to the larger Indian population living within the eThekwini Municipality.

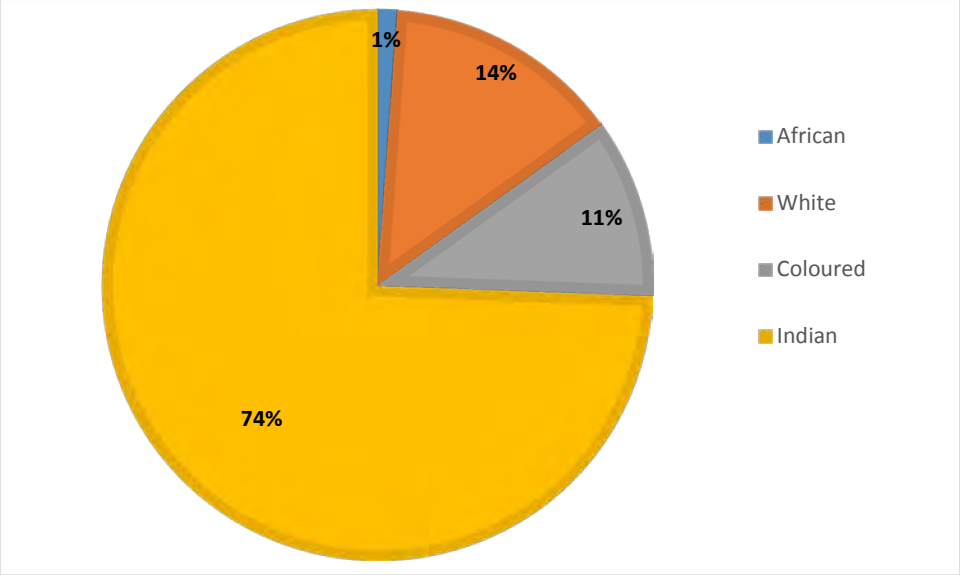

Figure 1: Racial distribution of the sample population

4.4.2. Gender Distribution

There were far more elderly female participants than their male counterparts in the study (Table 3). The ratio of males to females was 1:4 (22.1%:77.9%).

Within the age category of 60 to 70 years, 18.8% were male while 81.3% were female. Within the category of females (only), 38.8% were between the ages of 60 to 70 years. The category of females between the ages of 60 to 70 years formed 30.2% of the total sample.

Within the age category of 70 to 80 years, 25.7% were male while 74.3% were female. Within the category of females (only), 38.8% were between the ages of 70 to 80 years. The category of females between the ages of 70 to 80 years formed 30.2% of the total sample.

Within the age category of 80 to 90 years, 21.1% were male while 78.9% were female. Within the category of females (only), 22.4% were between the ages of 80 to 90 years. The category of females between the ages of 80 to 90 years formed 17.4% of the total sample.

Table 3: Gender distribution by age

			Gender		Total
			Male	Female	
Age - Grouped	60 - < 70	Count	6	26	32
		% within Age - Grouped	18.8%	81.3%	100.0%
		% within Gender	31.6%	38.8%	37.2%
		% of Total	7.0%	30.2%	37.2%
	70 - < 80	Count	9	26	35
		% within Age - Grouped	25.7%	74.3%	100.0%
		% within Gender	47.4%	38.8%	40.7%
		% of Total	10.5%	30.2%	40.7%
	80 - < 90	Count	4	15	19
		% within Age - Grouped	21.1%	78.9%	100.0%
		% within Gender	21.1%	22.4%	22.1%
		% of Total	4.7%	17.4%	22.1%
Total		Count	19	67	86
		% within Age - Grouped	22.1%	77.9%	100.0%
		% within Gender	100.0%	100.0%	100.0%
		% of Total	22.1%	77.9%	100.0%

4.4.3. Marital Status

The marital status of the respondents is represented in Figure 2. A little more than half of the cohort (54.7%) had been widowed. The remaining participants had similar numbers of respondents for the three remaining categories. Approximately 16.3% and 14% reported that they had been married or divorced respectively, while 15.1% advised that they were never married. The study noted that the marital status of a patient did not influence the results in any manner.

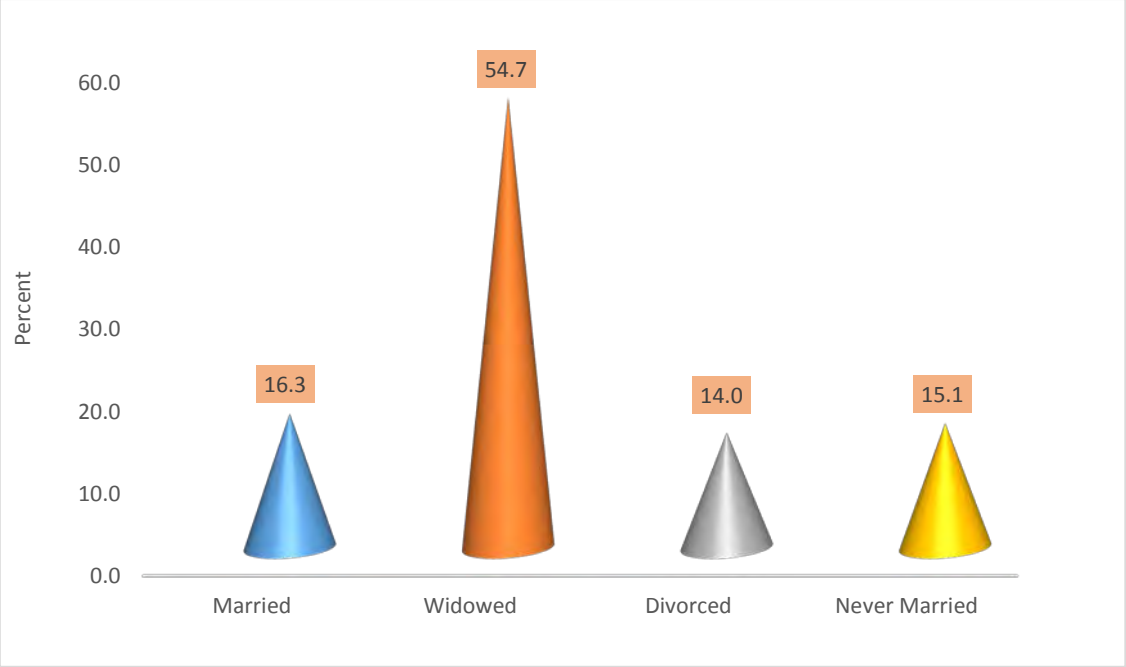

Figure 2: Marital Status of Participants

The traditional approach to reporting a result requires a statement of statistical significance. A p-value is generated from a test statistic. A significant result is indicated with "$p < 0.05$". The Chi square test was performed to determine whether there was a statistically significant difference across the options for each of the biographical data. Table 4 indicates whether the spread was uniform, that is, the frequency counts were similar in each category per variable.

By age, there was no significant difference across the categories (60 - < 70, 70 - < 80, 80 - < 90) as represented by the p-value of 0.08. However, by gender, race and marital status, the p-values indicate that the percentages are not evenly spread.

Table 4: Biographical Test Statistics

	Age - Grouped	Gender	Race	Marital Status
Chi-Square	5.047[a]	26.791[b]	115.023[c]	40.419[c]
df	2	1	3	3
Asymp. Sig.	.080	.000	.000	.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 28.7.

b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 43.0.

c. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 21.5.

4.5. Functional Fitness Measures

The section that follows analyses the scoring patterns of the patients per variable. Prior to the commencement of the testing procedures, the ratio data was tested for normality using the One-Sample Kolmogorov-Smirnov Test. These results are shown in Table 5. All the variables satisfied the condition for normality except the Chair Sit and Reach, and the 8-Foot Up and Go tests respectively. As a result, analysis of the comparisons was done using non-parametric tests. For age, the mean and standard deviation was 72.87 ± 7.54 years.

Table 5: Ratio Data Normality [N=86]

	Mean	Std. Deviation	Kol. Smirnov Z	Sig. (*p*)
Age	72.686	7.539	0.837	0.486
Chair Stand (Number of reps)				
Before	12.895	4.268	1.317	0.062
After	15.279	4.573	0.818	0.516
Right Hand Arm Curl (Number of reps)				
Before	13.290	4.403	1.024	0.245
After	19.279	5.260	1.328	0.059

Left Hand Arm Curl (Number of reps)	14.081	4.454	0.913	0.375
Before	20.000	5.138	0.794	0.554
After				
Chair Sit & Reach (cm)				
Before	-12.454	11.990	0.878	0.423
After	-3.692	9.852	2.002	0.001
Back Scratch (cm)				
Before	-11.738	11.755	0.597	0.868
After	-9.942	10.047	0.878	0.425
8-Foot Up & Go (sec)				
Before	8.471	3.178	1.732	0.005
After	7.436	4.086	2.216	0.000
6-Minute Walk Test (m)				
Before	347.845	132.206	0.983	0.288
After	403.274	110.023	0.737	0.649

4.5.1. Baseline and Follow-up Measures

The means and standard deviations as well as the type of test used to compare the variables between the baselines values (Before) and follow-up values (After) are presented in Table 6. Four of the five pairings indicate that the differences between the Before and After mean values were significant. These were the chair stand, arm curls (for both right and left arms), as well as the six minute walk test ($p < 0.05$). The magnitude of the standardized effect was small for the chair stand ($d = 0.5$), back scratch ($d = 0.2$) and six minute walk ($d = 0.4$) tests respectively. In contrast, a moderate effect was observed in both the right and left arm curls ($d = 1.2$). The mean values for the After scenarios increased when compared to the Before scenarios (with similar standard errors). Increases in the chair stand, arm curl, back scratch and six minute walk tests respectively, demonstrates improvements in upper and lower body strength, upper and lower body flexibility, and aerobic endurance in this population following the intervention of 12 weeks of group exercise.

Table 6: Baseline and Follow-up Measures - Chair Stand, Arm Curl, Back Scratch and Six Minute Walk Tests [N=86]

		Mean	Std. Deviation	Sig. (*p*)	Cohen's ES (*d*)	95% CI
Pair 1	Chair Stand			0.000		0.23,
	Before	12.895	4.268		0.5	0.84
	After	15.279	4.571		small	
Pair 2	Right Arm Curl			0.000		0.91,
	Before	13.291	4.403		1.2	1.56
	After	19.279	5.260		moderate	
Pair 3	Left Arm Curl			0.000		0.91,
	Before	14.081	4.454		1.2	1.56
	After	20.000	5.138		moderate	
Pair 4	Back Scratch			0.173		-0.13,
	Before	-11.738	11.755		0.2	0.46
	After	-9.942	10.046		small	
Pair 5	6-Minute Walk			0.000		0.14,
	Before	348.402	133.721		0.4	0.74
	After	402.378	111.176		small	

4.5.2. Non-Parametric Data

The Wilcoxon Paired Test was utilized to observe non-parametric data. These included both the Chair sit and reach, and 8-foot up and go tests respectively. The results are reflected in Table 7. The p-values are significant ($p < 0.05$). Hence it implies that there is a difference in values between the pairs. The means and standard deviations are shown in Table 8. The greater value of -3.692 for the Chair sit and reach test is for the After group (Follow-up), whilst the higher value of 8.471 for the 8-foot up and go test is larger for the Before group (Baseline). This implies an improvement in lower body flexibility but not agility and dynamic balance following the intervention of 12 weeks of group exercise.

Table 7: Wilcoxon Paired Test - Chair Sit and Reach and 8-Foot Up and Go [N=86]

	Z	Asymp. Sig. (2-tailed)
Chair Sit and Reach	-5.897	0.000
8-Foot Up and Go	-5.486	0.000

Table 8: Mean and Standard Deviation - Chair Sit and Reach and 8-Foot Up and Go [N=86]

	Mean	Std. Deviation
Chair Sit and Reach		
Before	-12.454	11.990
After	-3.692	9.852
8-Foot Up and Go		
Before	8.471	3.178
After	7.436	4.086

4.6. Training Frequency

The effect of frequency of exercise (between both groups of participants) on each variable was tested using multivariate analysis (Table 9). This was done to ascertain whether exercise undertaken two or three times per week will produce profound effects on functional fitness levels. The results indicate that one of the variables i.e. the back scratch showed a significant difference with reference to frequency of exercise in group 1 ($p < 0.05$). However, the magnitude of the standardized effect shows very little significant differences between the both groups for most variables. The arm curl (right and left), as well as the chair sit and reach tests appear to be the only variables that produced a moderate to large effect, with the other variables producing a small and sometimes trivial effect. This suggests that training three times per week could have no greater potential benefits in improving functional fitness levels, than training two times per week in this population.

Table 9: Functional Fitness of both study groups before and after intervention

	Group 1 (*n*=45) **Exercise 3 X week**	**Group 2 (*n*=41)** **Exercise 2 X week**	**Sig. (*p*)**	**Cohen's *d* ES (95% CI)**	
				Group 1	**Group 2**
Chair Stand					
Baseline	13.6 ± 4.6	12.1 ± 3.8	0.123	Small 0.43 (0.02, 0.85)	Moderate 0.74 (0.29, 1.18)
12 Weeks	15.6 ± 4.8	14.9 ± 4.3	0.362		
Arm Curl - Right					
Baseline	13.6 ± 4.5	13.0 ± 4.3	0.828	Large 1.25 (0.80, 1.70)	Large 1.20 (0.73, 1.67)
12 Weeks	19.6 ± 5.1	18.9 ± 5.5	0.499		
Arm Curl - Left					
Baseline	14.2 ± 4.7	13.9 ± 4.2	0.917	Large 1.20 (0.75, 1.65)	Large 1.27 (0.79, 1.74)
12 Weeks	20.1 ± 5.1	19.9 ± 5.2	0.893		
Chair Sit and Reach					
Baseline	-10.2 ± 12.4	-15.0 ± 11.1	0.049	Moderate 0.67 (0.24, 1.10)	Large 1.93 (1.41, 2.46)
12 Weeks	-2.6 ± 10.2	-4.9 ± 9.4	0.145		
Back Scratch					
Baseline	-8.6 ± 13.5	-15.2 ± 8.4	0.008	Trivial 0.02(-0.44, 0.39)	Small 0.49 (0.05, 0.92)
12 Weeks	-8.9 ± 11.3	-11.1 ± 8.5	0.297		
8-Foot Up and Go					
Baseline	8.2 ± 3.1	8.8 ± 3.3	0.369	Small 0.42(-0.84, -0.01)	Trivial 0.17 (-0.60, 0.27)
12 Weeks	6.9 ± 3.0	8.1 ± 5.0	0.087		
6 Minute Walk					
Baseline	374.39 ± 136.9	318.7 ± 121.8	0.078	Small 0.43(0.01, 0.85)	Small 0.49 (0.05, 0.93)
12 Weeks	427.2 ± 106.7	375.6 ± 108.6	0.053		

*Values are presented as mean ± S.D.

4.7. Conclusion

The results of this study show that the elderly population residing at the aged care facilities were dominated by Indian females, while the marital status of respondents further revealed that many of the participants were widowed. The functional fitness measures indicated improvements in upper and lower body strength, upper and lower body flexibility, as well as aerobic capacity. These were confirmed by higher scores in the arm curl, chair stand, back scratch, chair sit and reach, and six minute walk tests respectively, following the intervention program. However, no improvement was observed in the participant's agility and dynamic balance levels because the baseline values for the 8-foot up and go test were higher than that of the follow-up values. With regards to training frequency, no significant difference between the groups was observed following the intervention program. These results are discussed thoroughly in the next chapter.

CHAPTER 5 – DISCUSSION

5.1. Introduction

This chapter discusses the results of the findings that were obtained from the study. Of particular interest, are the pre and post results for the different variables tested in this study. These variables are considered concurrently to provide a better understanding of the various issues uncovered by the study. Where possible, the results and findings are related to the available literature specific to exercise, functional fitness and well-being in the geriatric population. This aids to better illustrate the relevance and position of this study in a wider research context. Additionally, the biographical characteristics of the sample population are further elaborated on.

5.2. Sample Characteristics

A total of 118 participants were tested at baseline but this number was reduced to 86 patients with valid results for the follow up. This yielded a response rate of 86%. The main reason for the decrease in number was due to ill-health through various stages of the intervention, with ailments ranging from common influenza to both acute and chronic respiratory conditions. This prevented some participants from sustaining exercise for the full period of 12 weeks. Other factors included the untimely withdrawal of participants at various stages throughout the duration of the study. As a consequence, valid pre and post test results could only be obtained for 86 participants in the study.

All participants were above the age of 65 years, which satisfied the study's inclusion criteria of being elderly or geriatric. The mean age and standard deviation of the group was 72.87 ± 7.54 years respectively. Of the 86 participants tested, 79.9% were female while 22.1% were male, representing a greater ratio of females to males (4:1). The South African National Consensus of 2011 reiterates this disparity by reporting a 5.02% difference in ratio in favour of females versus males in the population aged 65 years and older (www.statssa.gov.za). The greater female to male ratio can further be attributed to the larger number of

respondents (54%) who had reported to have been widowed (see Figure 2). This trend of a greater female to male ratio at old age facilities was also found in other studies (Underwood et al., 2013, Rolland et al., 2007, Morioka et al., 2011, Liubicich et al., 2012).

The racial composition of the sample indicates that nearly three-quarters of the patients were Indian (74%). Whites and Coloureds represented 14% and 11% respectively, while Blacks compromised the smallest grouping in the sample at 1%. While this composition may not be reflective of the current demographic trends in the province of KwaZulu-Natal or South Africa, all of the old age homes used in the study were located in predominately Indian areas within the KwaZulu-Natal municipality. This could account for the large populace of Indian residents at each old age home.

5.3. Upper and Lower Body Strength

Upper and lower body strength was evaluated using the arm curl (for both left and right hand) and 30 second chair stand tests respectively. The results of the study demonstrated significant differences between the before and after scores of participants. It found that both upper and lower body strength had improved following the intervention program. Sustaining optimal strength levels, both in upper and lower body is imperative, especially in older adults, for preserving physical function, preventing chronic diseases and performing activities of daily living. Many common tasks such as hand gripping, lifting and transferring rely heavily on upper body strength (Forrest et al., 2006). Age related declines in lower body strength can be closely associated with the deterioration of such performance variables as gait, stair climbing, rising from a chair and balancing (Vincent et al., 2010). The evaluation and maintenance of upper and lower body strength is critical in preventing and delaying the onset of disability, frailty and dependency during ageing. Studies have clearly indicated that improvements in upper and lower body strength are an essential factor in maintaining functional ability in later years (Paterson and Warburton, 2010, Jones and Rikli, 2000, Garatachea et al., 2009). This study showed similar improvements to DiBrezzo et al (2005) who reported an increase in upper and lower body strength in the elderly following a 10 week exercise program (DiBrezzo et al., 2005). In contrast, Pedero-Chamizo et al (2012) reported a decrease in strength values across age in both genders in the aged population in

Spain (Pedrero-Chamizo et al., 2012). This is probably due to the study differentiating the results by age groups and gender. Most of the studies conducted in the elderly consider the sample as a whole, as did this study. A frequent debate when performing research on the aged is about the need of redefining age groups for the elderly and if gender differentiation should be included.

5.4. Upper and Lower Body Flexibility

Measures of upper and lower body flexibility were evaluated using the back scratch and chair sit and reach tests respectively. The results indicate that the participants performed much better following the intervention program, suggesting greater improvements in their upper and lower body flexibility. Flexibility becomes a fundamental capacity within the ageing process (Gremeaux et al., 2012). The development of musculoskeletal impairments together with the progression of disabilities in the elderly is associated with decreases in flexibility (Holland et al., 2002). Fatouros et al (2001) explains that declines in flexibility are related to the deterioration of functional ability and health status in the elderly, which in turn leads to dysfunction and the inability to perform everyday activities such as getting up from a chair or bed, walking and climbing stairs (Fatouros et al., 2002). Wilkin and Haddock (2011) further suggest that elderly individuals who maintain higher levels of muscular strength and flexibility seldom participate in long term health care programs (Wilkin and Haddock, 2011). Guimaraes and Farinatti (2005) further accentuate the association between decreases in flexibility and the frequency of falls in the elderly (Guimarães and Farinatti, 2005).

5.5. Agility and Dynamic Balance

Agility and dynamic balance in the elderly population was assessed using the 8-foot up and go test. The baseline values were higher to that of the follow-up values. This indicates that there was no improvement in agility and dynamic balance following the intervention program, which is in contrast to other reviewed studies of this nature (Brito et al., 2014). Agility and balance are critical in performing a vast array of common mobility tasks. These include walking, climbing stairs and effecting quick movements to avoid hazardous

obstacles, going to the bathroom, to get on and off private and public transport vehicles, to cross the street or to answer the telephone or the door. Though there are few studies related to the parameters of agility and dynamic balance related to age, the results of some have shown that this component decreases while age increases (Toraman and Yıldırım, 2010). Findings suggest agility and dynamic balance is best improved and the risk of falling reduced, if specific balance and coordination activities are included in exercise programs for the elderly, together with strength, flexibility and aerobic activities (Correa Bautista et al., 2011). Past evidence indicates that performances in the 8-foot up and go test can discriminate among various functional categories in the elderly, and is reactive to changes that can result from increased levels of physical activity (Alexander et al., 1991, Alexander et al., 2001). In this regard, Miotto et al (1999) found that physically active older people performed faster (4.9 seconds) than their sedentary counterparts (5.7 seconds) in the 8-foot up and go scores (Miotto et al., 1999). Similarly, Jones and Rikli (2002) reported the average 8-foot up and go scores to be considerably faster in highly active older people than those of a low active group (Jones and Rikli, 2002). In a study conducted by Liu-Ambrose (2004), resistance training and agility training significantly reduced fall risk scores in the elderly by 57% and 48% respectively, following a 25 week intervention program (Liu-Ambrose et al., 2004). These findings could encourage arguments on three separate levels. Firstly, 12 weeks of intervention is not sufficient to provide improvements in balance and agility levels in the elderly. Secondly, the sample population used in this study was not at an adequately high enough physical activity level. Thirdly, the proprioceptive activities used in the intervention were not of a sufficient level needed to satisfactory improve balance and agility measures in this population.

5.6. Aerobic Capacity

Aerobic capacity in the elderly was evaluated using the 6 minute walk test. The results indicate a significant improvement in aerobic capacity following the intervention protocol. The average distance covered in 6 minutes increasing from 348.40 meters prior to intervention to 402.38 meters post intervention. Declines in aerobic capacity occur throughout the lifespan, accelerating much faster in later years. The rate of decline in aerobic capacity appears to decline by a rate of 5 to 15% per decade (Weiss et al., 2006,

Hollenberg et al., 2006). This age related decline in aerobic capacity has the potential to predispose the elderly to common comorbidities such as pulmonary, cardiac and peripheral arterial diseases, while aerobic type activities have been shown to exert beneficial effects on blood pressure, lipids, glucose tolerance, bone density, depression and quality of life (Maguire and Slater, 2013, Fleg, 2012). Reference equations and tables are often used to predict the 6 minute walk test distance in healthy elderly subjects, with the gender, age, weight and height of participants often explaining the large proportion of variability in the distances covered (Hulens et al., 2003). However, progressing age is supplemented by an increase in pathologies and "apparently healthy" older citizens can present a larger diversity when it comes to health status. This infers that exercise capacity and the risk for complications during exercise may not necessarily be the same for each person, especially the elderly who consider themselves capable of performing physical activity (Izaks and Westendorp, 2003). Ideally, the exercise program should be tailor-made for each individual, taking into account all facets of the individual's health condition. But, the influence of health status to the variability of distance covered in the 6 minute walk test has yet to be meticulously and extensively described (Bautmans et al., 2004). The improvements in aerobic capacity found in this study is consistent with the findings by Hallage et al (2010) who also reported an increase in 6 minute walk distance following a 12 week intervention exercise program.

5.7. Frequency of Exercise

When comparing both groups of participants the results indicate no significant difference in functional fitness levels between Group 1 (exercise undertaken 3 times per week) and Group 2 (exercise undertaken 2 times per week). Although a statistical significance was observed in the back scratch test ($p < 0.05$), Cohen's d ES suggests only a trivial to small magnitude of effect. In a study conducted by Stiggelbout et al. (2004) the effects of a group exercise program on the functional fitness of independently living older adults was evaluated. Their findings indicate that although the group exercise program was well suited to this population, participation only two times a week without additional regular physical exercise, did not provide the stimulus needed to bring about improvements in functional fitness levels. Similar findings were also produced by Puggard (2003), who reported that

participation in exercise programs twice a week is insufficient for this population group, while Nakamura et al. (2007) suggested that older woman who participated in an exercise program three times per week gain greater functional fitness benefits than those who exercise less frequently. However, this study has shown that improvements in functional fitness levels may not necessarily be achieved with a greater frequency of participation in group exercise programs. The results indicate that participation in group exercise programs just twice a week can provide the required dosage deemed necessary to elicit improvements in functional fitness levels in the elderly.

CHAPTER 6 – CONCLUSION

6.1. Introduction

In addition to describing the demographic profile of the participants, the main objectives of the study were to determine the effects of an intervention on functional fitness levels in the elderly and to assess the frequency of exercise on functional fitness levels in this population.

6.2. Conclusion

It is of vital importance for older adults to improve and maintain functional fitness levels, especially over a long period of time. Voorips et al. (1993) found that moderate activity is of greater value than a sedentary state, and that higher-intensity activity is of greater value than moderate intensity activity to improve flexibility and aerobic endurance. Further studies indicate that aerobic endurance, strength, and dynamic balance contribute significantly to the prediction of disabilities in the elderly and further conclude that increasing and maintaining physical activity levels can lengthen lifespans in this population (Van Heuvelen et al., 2000, Gregg et al., 2003, Smith and Kasper, 2013). This can be observed from the results of moderately active and highly active groups having continued physical activity over many years when compared to their sedentary counterparts and the high numbers of physically fit and healthy elderly population having fewer risk factors for cardiovascular disease than less active populations. This study concurs with these findings regarding the importance of physical activity in improving functional fitness levels in the elderly, and thus their overall health. The intervention program used in this study increased in intensity and volume over the 12 week period. The initial consensus was that the anticipated increase in intensity and volume after every 4 weeks would not be tolerable for this population. However, our results indicate that the 12 week intervention with incremental increases in intensity and volume was more than adequate to bring about improvements in functional fitness levels in this population. The results demonstrated that 12 weeks of multifaceted group exercise increased strength, flexibility and aerobic endurance levels in the elderly. It is therefore recommended that 12 weeks of multifaceted

group exercise training can be used as an effective strategy to promote functional fitness in the elderly population. Its low operational cost, easy applicability, together with the fact that it can be performed by many individuals of different fitness levels at the same time make this modality a viable option that can be easily implemented in any aged care facility.

Several researchers reveal significant improvements in various functional fitness areas after exercise intervention, e.g. in strength (Nichols et al., 1993), in dynamic balance (Shumway-Cook et al., 1997), as well as flexibility and muscular coordination (Rikli and Edwards, 1991). In the same manner, this study revealed improvements in strength, flexibility and aerobic capacity following the 12 week intervention. It is thus very evident that exercise programs can improve the functional fitness practiced in this and other studies. However, for many people functional fitness tends to decline into older age, suggesting that it may not be enough to improve any single function through an exercise program (Nelson et al., 2007). While it was assumed that this exercise program would bring about overall improvements in functional fitness levels, it was also vital to investigate how often the exercise program should be performed, as much of the literature reviewed did not refer to frequency of exercise. It was therefore imperative to assess if two versus three times per week of exercise would be most beneficial to this population. This study has shown that participation in a group exercise program just two times a week was an adequate dose to improve overall functional fitness levels in this population. It is also of vital importance for the design of the program to include a combination of the various elements of exercise together with sufficient increases in intensity and volume.

The Senior Functional Test protocol has six items that assess physical fitness levels of the elderly with daily activities such as walking, climbing, getting out of a car, chair or tub, carrying and lifting objects, dressing one's self, reaching for things etc. The results of this study further offer empirical support to justify the use of the Senior Functional Test protocol. It appears to be a practical and suitable test for this population that can be easily used by both researchers and clinicians. It provides a unique and previously unavailable method to evaluate physical fitness in this population, and the consequent planning of exercise interventions that target areas of weakness. However, this study underlies the need to develop criterion standards in a South African setting, which can provide

standardised reference points that can indicate when fitness indices in the elderly may predict the risk of premature loss of physical independence.

6.3. Limitations

A major limitation in this study is related to sample size. The sample size was relatively small and these results will need confirmation in a larger sample. Due to time and funding constraints the study was only conducted in five old age facilities within the eThekwini Municipality. It would be advantageous for future studies to consider the functional fitness levels of the elderly, in all aged care facilities within South Africa.

The study was also limited to institutionalized older people only and excludes community dwelling individuals who are aged. Therefore, generalization of the findings may be limited to older persons living in aged care facilities.

The data for this research was collected on mostly South African Indians (74%). South Africa is made up of a diverse multiracial and multicultural population – additional studies are required to determine the degree to which results can be generalized to other race groups in South Africa.

With a growing geriatric population in South Africa, any exercise program that can improve functional fitness and thus independence and quality of life has the potential to confer significant health benefits to this population. Further larger scale studies of group exercise training in aged care facilities are needed to determine the ideal frequency, intensity and duration of exercise for this population.

To our knowledge, this is the first attempt at assessing functional fitness levels of the elderly in aged care facilities in South Africa. There is undoubtedly a need for additional studies to confirm, clarify and expand this initial work.

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28 February 2014

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PROTOCOL: The effects of a Structured Group Exercise Program on Functional Fitness of older Persons living in Old Age homes within the eThekwini Municipality. REF: BE080/14

EXPEDITED APPLICATION

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 07 November 2013. The Committee has noted that this is a **sub-study of BE251/11.**

The conditions have now been met and the study is given full ethics approval and may begin as from 28 February 2014.

This approval is valid for one year from **28 February 2014.** 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 (2004), 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/Research-Ethics/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 **RATIFIED** by a full Committee at its next meeting taking place on **08 April 2014.**

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

Yours sincerely

Professor D.R Wassenaar
Chair: Biomedical Research Ethics Committee

cc: Supervisor: Ramlassa@ukzn.ac.za

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INSPIRING GREATNESS

APPENDIX B

INFORMED CONSENT FORM

Consent to Participate in Research

Dear _____

You have been invited to participate in a study entitled "The Effects of a Structured Group Exercise Program on Functional Fitness of Older Persons Living in Old Age Homes within the Ethekwini Municipality, South Africa."

The study will recruit 20 participants aged ≥ 60 years, from five designated aged care facilities within the eThekwini Municipality. Volunteers will be excluded if they do not fit the inclusion and exclusion criteria or are medically excluded (see information sheet).

Plan and procedures:

Data gathering

(a) Contact Details: I agree to give basic information and contact details about myself to the researcher including my name, age (date of birth), address and phone number.
(b) Medical screening: I agree to be screened by a medical doctor for the purpose of determining my eligibility for the study.
(c) Exercise Intervention: I agree to participate in a supervised group exercise program either 3days/ week or 2 days/ week depending on the group I am randomly assigned to. I agree to participate in this intervention for the duration of 12 weeks.

Termination of participation

I understand that if the screening and data collection procedures provide evidence that the tests or activities cannot be safely performed , or if I have a pre-existing condition which will

not allow me to participate in the study, I will be informed at that time and will not be included in the study. I understand that the investigator will explain the reason for my exclusion.

Costs/compensation

The policy of the University of KwaZulu-Natal does not provide for compensation or medical treatment to participants who are injured as a result of this research study. However, every effort will be made to make the tests and activities as safe as possible, with little risk of injury.

Confidentiality

All data and information collected in this study will be maintained in complete confidence and privacy will be maintained. I will not be identified in any report or presentation by name as a result of this study.

_____

You have been informed about the study in detail by_____.

You may contact the investigators of this study, Masters Candidate Levin Chetty (031-2608949) or Dr Serela Ramklass (031-2604123), at any time if you have questions about the research or if you are injured as a result of the research.

You may contact the **Biomedical Research Ethics Office** on **031-260 4769 or 260 1074** if you have questions about your rights as a research participant.

Your participation in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to stop at any time.
If you agree to participate, you will be given a signed copy of this document and the participant information sheet which is a written summary of the research.

The research study, including the above information, has been described to me verbally. I understand what my involvement in the study entails and I voluntarily agree to participate. I have been given an opportunity to ask any questions that I might have about participation in the study.

_____ _____

Signature of Participant **Date**

_____ _____

Signature of Witness **Date**

APPENDIX C

MEDICAL HISTORY QUESTIONNAIRE

Explain "Yes" answers on second page		Y	N			Y	N
1	Has a doctor even denied or restricted your participation in sports for any reason?	☐	☐	17	Have you ever used an inhaler or taken asthma medicine?	☐	☐
2	Do you have an ongoing medical condition (like diabetes or asthma)?	☐	☐	18	Were you born without or are you missing a kidney, an eye, a testicle, or any other organ?	☐	☐
3	Are you currently taking any prescription or non-prescription (over-the-counter) medicines or pills?	☐	☐	19	Have you had infectious mononucleosis (mono) within the last month?	☐	☐
4	Do you have allergies to medicines, pollens, foods, or stinging insects?	☐	☐	20	Do you have any rashes, pressure sores, or other skin problems?	☐	☐
5	Have you ever passed out or nearly passed out DURING exercise?	☐	☐	21	Have you had a herpes skin infection?	☐	☐
6	Have you ever passed out or nearly passed out AFTER exercise?	☐	☐	22	Have you ever had a head injury or concussion?	☐	☐
7	Have you ever had discomfort, pain, or pressure in your chest during exercise?	☐	☐	23	Have you been hit in the head or been confused or lost your memory?	☐	☐
8	Does your heart race or skip beats during exercise?	☐	☐	24	Have you ever had a seizure?	☐	☐
9	Has a doctor ever told you that you have (check all that applies)? ☐ High Blood pressure ☐ High Cholesterol ☐ A heart murmur ☐ A heart infection	☐	☐	25	Do you have headaches with exercise?	☐	☐
10	Has a doctor ever ordered a test for your heart?(for e.g. ECG)	☐	☐	26	Have you ever had numbness, tingling, or weakness in your arms or legs after being hit or falling?	☐	☐
11	Has anyone in your family died for no apparent reason?	☐	☐	27	Have you ever been unable to move your arms or legs after being hit or falling?	☐	☐
12	Does anyone in your family have a heart problem?	☐	☐	28	When exercising in the heat do you have severe muscle cramps or become ill?	☐	☐
13	Has any family member or relative died of heart problems or of sudden death before age 50?	☐	☐	29	Has a doctor told you that you or someone in your family has sickle trait or sickle cell disease?	☐	☐
14	Does anyone in your family have Marfan's syndrome?	☐	☐	30	Have you had any problems with your eyes or vision?	☐	☐
15	Have you ever spent the night in a hospital?	☐	☐	31	Do you wear glasses or contact lenses?	☐	☐
16	Have you ever had surgery?	☐	☐	32	Do you wear protective eyewear, such as goggles or a face shield?	☐	☐

33	Are you happy with your weight?	☐ ☐	40	Do you cough, wheeze or have difficulty breathing while you exercise?	☐ ☐
34	Are you trying to gain or lose weight?	☐ ☐	41	Is there anyone in your family who has asthma?	☐ ☐
35	Has anyone recommended you change your weight or eating habits?	☐ ☐	42	Do you limit or carefully control what you eat?	☐ ☐
36	Have you ever had a stress fracture?	☐ ☐	43	Do you have any concerns that you would like to discuss with a doctor?	☐ ☐
37	Have you been told that you have or have you had an x-ray for atlantoaxial (neck) joint?	☐ ☐	44	**FEMALES ONLY** Have you ever had a menstrual period?	☐ ☐
38	Do you regularly use a brace or assistive device?	☐ ☐	45	How old were you when you had your first menstrual period?	☐ ☐
39	Has a doctor ever told you that you have asthma or allergies?	☐ ☐	46	How many periods have you had in the last year?	☐ ☐

Explain "Yes" answers from previous page here:

_____

_____

_____

_____

_____

List all *previous injuries* and *approximate dates*. Check N/A if not applicable

N/A ☐	**Previous Injury**	**Date:**
N/A ☐	**Shoulder/elbow (dislocation, rotator cuff, AC separation)**	**Date:**
N/A ☐	**Arm/wrist/Hand (fractures)**	**Date:**
N/A ☐	**Neck(burners, pinched nerve)**	**Date:**
N/A ☐	**Ribs/Abdomen**	**Date:**
N/A ☐	**Low back pain (herniated disc)**	**Date:**
N/A ☐	**Leg (Quadriceps, hamstring pain)**	**Date:**
N/A ☐	**Knee (Ligament, meniscus, patella)**	**Date:**
N/A ☐	**Lower leg (shin splints, calf strain)**	**Date:**
N/A ☐	**Ankle/calf/foot (sprain, Archilles)**	**Date:**
N/A ☐	**Stress Fractures**	**Date:**
N/A ☐	**Concussions**	**Date:**
	If "yes" have you ever been knocked out (unconscious)	**Yes** ☐ **No** ☐
	How many times?_____	
	How long were you unconscious?_____	

	Have you ever lost your memory?	Yes ☐ No ☐
	How many times?_____	
	Did you have problems in the days afterward (confusion, headache, concentration?)	Yes ☐ No ☐
	How long did it take you to recover?_____	
	Are you still having problems?	Yes ☐ No ☐
	Do you have any unhealed or chronic injuries? Please list: _____ _____ _____	

I hereby state that, to the best of my knowledge, my answers to the above questions are complete and correct.
Signature of participant _____Date_____

DOCTOR'S REPORT – INDICATE RESPONSE WITH A CROSS

Subject is eligible for participation on exercise program	
Subject is not eligible for participation on exercise program	
Date	
Signature	
Name in full	

APPENDIX D

1. CHAIR STAND TEST

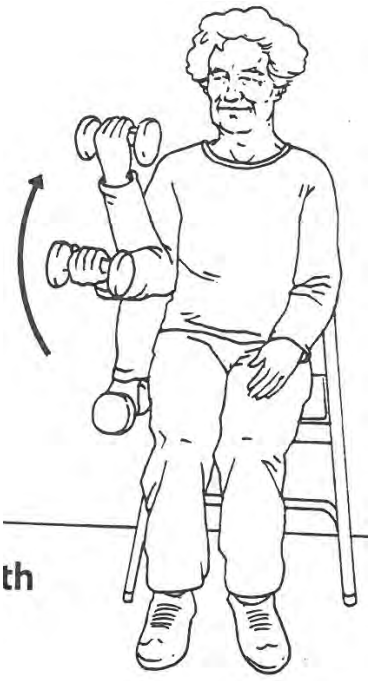
Purpose: To measure lower-body strength

Equipment: Straight – back chair (17 in. or 43.18 cm seat height); stopwatch

Procedure:

- Have the participant sit in the middle of the chair, feet flat on the floor, arms across chest.
- On signal “go” have the participant rise to a full stand, then return to a fully seated position.
- After a warm-up trial to check for correct form, administer one test trial.
- The score is the number of stands completed in 30 seconds.

2. ARM CURL TEST



Purpose: To measure upper body strength

Equipment: Straight- back or folding chair without arms, stopwatch, 5-lb (3 kg; rounded off) and 8-lb (4 kg; rounded off) dumbbells

Procedure:

- Have the participant sit in the chair (slightly to the dominant side), with feet flat on the floor.
- The participant should hold the weight down at the side, perpendicular to the floor, in a handshake grip.
- On the signal "go" have the participant curl the weight through a full range of motion as many times as possible in 30 seconds. The palm should rotate up during the curl-up phase, and then should return to the handshake position at extension. The upper arm must remain still throughout the test.
- After one or two warm-up curls without the weight to check for correct form, administer one test trial.
- The score is the number of curls completed in 30 seconds.

3. CHAIR SIT-AND-REACH TEST

Purpose: To assess lower-body (primarily hamstring) flexibility

Equipment: Folding chair with a seat height of 17 in. (43.18 cm) that will not tip forward, 18 in. (45.72-cm) ruler

Procedure:

- Have the participant sit on the edge of the chair, with the crease at the top of the leg even with the chair
- The preferred leg should be extended straight out in front of the hip, with the heel on the floor and the ankle flexed at 90°; the other leg is bent and off to the side, with the foot flat on the floor (the preferred leg is the one resulting in the better score).
- With hands overlapping and the middle fingers even, have the participant reach forward toward the toes as far as possible.
- After two practice trials, administer two test trials and record scores to the nearest half inch. Record a minus (-) score if the reach is short of the toes and a plus (+) score if the reach goes beyond the toes.
- The knee of the extended leg must remain straight.

4. BACK SCRATCH TEST

Purpose: To measure upper- body flexibility

Equipment: 18 in. (45.72 cm) ruler

Procedure:

- Have the participant reach one hand over the shoulder and down the back; the other around the back and up the middle.
- Have the participant practice to determine the preferred position (best hand over the top).
- After two warm-up practice trials, administer two test trials, measuring the distance between the middle fingers.
- Record scores to the nearest 1 cm. Negative scores (-) represent the distance short of touching the middle fingers; plus scores (+) indicate the degree of overlap. Circle the better score.

5. 8 – FOOT UP-AND-GO TEST

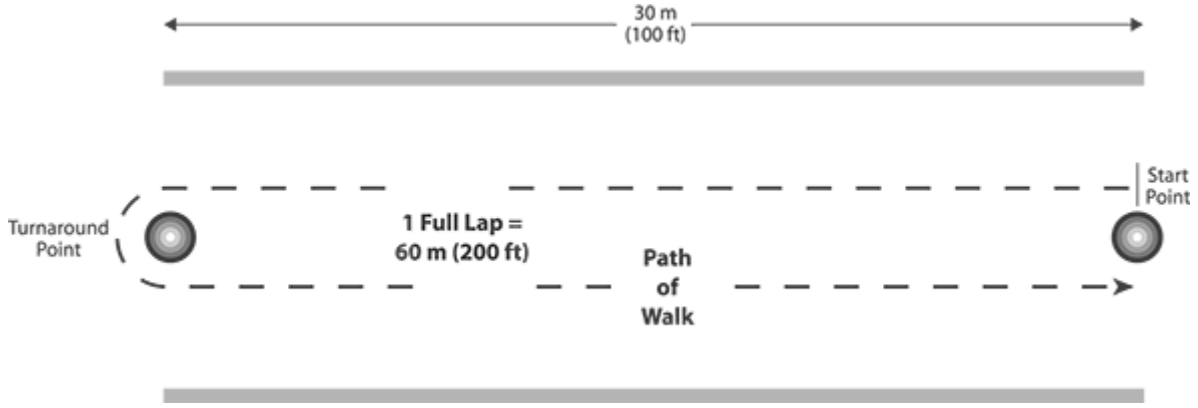
Purpose: To assess agility and dynamic balance

Equipment: Folding chair with 43.18 cm seat height, stopwatch, tape measure, cone

Procedure:

- Have the participant sit in the middle of the chair, hands on thighs, one foot slightly ahead of the other, body leaning slightly forward.
- On the signal ‘go’ have the participant get up from the chair, walk as quickly as possible around a cone placed 8 feet (2.44m) away, and return to the chair.
- After one practice trial, administer two test trials. The score is the best of two trials, recorded to the nearest tenth of a second.

6. 6-MINUTE WALK TEST



Purpose: To assess aerobic endurance

Equipment: Measuring tape, two stopwatches, cones, masking tape, index cards and pencils (to mark laps), chairs for waiting participants, name tags

Setup: Mark off an area 30m in length, into 3m segments. The turnaround points should be marked off with a cone. A starting line, which marks the beginning and the end of each lap, should be marked on the floor using brightly coloured tape.

Procedure:

- Position the participant at the starting line, after disseminating instructions for the test.
- Research assistants/testers appointed, count laps each time a lap is completed by marking laps on a card.
- On the signal 'go walkers', participants start and walk as fast as they can (within their comfort zone) trying to cover as many laps as possible in 6 minutes.
- At the end of 6 minutes, stop walkers. The score is the number of laps walked multiplied by 60m, plus the number of extra metres (indicated by the closest 3m marker).

APPENDIX E

EXERCISE PRESCRIPTION

Phase 1: Weeks 1-4 (Frequency: Group 1 – 3X/week; Group 2 – 2X/week)

ACTIVITY	REPS	SETS	RESISTANCE	INTENSITY (RPE)
Warm Up & Stretch				
• Forward Walk & Turn	2 min			1-2
• Semi Tandem Walk (Stride Balance)	2 min			1-2
• Tandem Walk (Heel-toe)	2 min			1-2
• Circle Walking	2 min			1-2
• Sit to Stand	10	1		1-2
• Double Side Arm Raise (seated)	10	1		1-2
• Neck Flexion (seated)	10	1		1-2
• Neck Rotation (seated)	10	1		1-2
• Ankle – 4 way (seated)	10	1		1-2
Endurance – 2.5 minutes/station				
• Weaving (Station 1)				1-2
• Step Up and Over (Station 2)				1-2
• Shuttle Walk (Station 3)				1-2
• High Knees/Butt Kicks (Station 4)				1-2
Resistance Circuit				
• Ball Squat	10	1	Body Weight	1-2
• Wall Push up	10	1	Body Weight	1-2
• Hip Extension	10	1	Theraband (Yellow/Red)	1-2
• Seated Bicep Curl	10	1	1-2 kg	1-2
• Calf Raises	10	1	Body Weight	1-2
• Seated Tricep Extension	10	1	1-2 kg	1-2
• Seated Lateral Shoulder Raises	10	1	Theraband (Yellow/Red)	1-2
• Seated Arm/Leg March	10	1	No Weight	1-2
• Seated Rowing	10	1	Theraband (Yellow/Red)	1-2
• Seated Abdominal Crunches	10	1	Theraband (Yellow/Red)	1-2
Cool Down & Stretch				
• Forward Walk/March	2 min			1-2
• Neck/Shoulder/Chest	15 sec	2		1-2
• Seated Rhomboid	15 sec	2		1-2
• Seated Tricep	15 sec	2		1-2
• Lats/Oblique	15 sec	2		1-2

• Hamstring	15 sec	2		1-2
• Gastrocnemius	15 sec	2		1-2

Phase 2: Weeks 5-8 (Frequency: Group 1 – 3X/week; Group 2 – 2X/week)

ACTIVITY	REPS	SETS	RESISTANCE	INTENSITY (RPE)
Warm Up & Stretch				
• Forward Walk & Turn	2 min			3-4
• Semi Tandem Walk (Stride Balance)	2 min			3-4
• Tandem Walk (Heel-toe)	2 min			3-4
• Circle Walking	2 min			3-4
• Sit to Stand	10	2		3-4
• Double Side Arm Raise (seated)	10	2		3-4
• Neck Flexion (seated)	10	2		3-4
• Neck Rotation (seated)	10	2		3-4
• Ankle – 4 way (seated)	10	2		3-4
Endurance – 3.5 minutes/station				
• Weaving (Station 1)				3-4
• Step Up and Over (Station 2)				3-4
• Shuttle Walk (Station 3)				3-4
• High Knees/Butt Kicks (Station 4)				3-4
Resistance Circuit				
• Ball Squat	10	2	Body Weight	3-4
• Wall Push up	10	2	Body Weight	3-4
• Hip Extension	10	2	Theraband (Green/Blue)	3-4
• Seated Bicep Curl	10	2	3-4 kg	3-4
• Calf Raises	10	2	Body Weight	3-4
• Seated Tricep Extension	10	2	3-4 kg	3-4
• Seated Lateral Shoulder Raises	10	2	Theraband (Green/Blue)	3-4
• Seated Arm/Leg March	10	2	No Weight	3-4
• Seated Rowing	10	2	Theraband (Green/Blue)	3-4
• Seated Abdominal Crunches	10	2	Theraband (Green/Blue)	3-4
Cool Down & Stretch				
• Forward Walk/March	2 min			3-4
• Neck/Shoulder/Chest	15 sec	2		3-4
• Seated Rhomboid	15 sec	2		3-4
• Seated Tricep	15 sec	2		3-4
• Lats/Oblique	15 sec	2		3-4

• Hamstring	15 sec	2		3-4
• Gastrocnemius	15 sec	2		3-4

Phase 3: Weeks 9-12 (Frequency: Group A – 3X/week; Group B – 2X/week)

ACTIVITY	REPS	SETS	RESISTANCE	INTENSITY (RPE)
Warm Up & Stretch				
• Forward Walk & Turn	2 min			5-6
• Semi Tandem Walk (Stride Balance)	2 min			5-6
• Tandem Walk (Heel-toe)	2 min			5-6
• Circle Walking	2 min			5-6
• Sit to Stand	10	2		5-6
• Double Side Arm Raise (seated)	10	2		5-6
• Neck Flexion (seated)	10	2		5-6
• Neck Rotation (seated)	10	2		5-6
• Ankle – 4 way (seated)	10	2		5-6
Endurance – 5 minutes/station				
• Weaving (Station 1)				5-6
• Step Up and Over (Station 2)				5-6
• Shuttle Walk (Station 3)				5-6
• High Knees/Butt Kicks (Station 4)				5-6
Resistance Circuit				
• Ball Squat	10	2	Body Weight	5-6
• Wall Push up	10	2	Body Weight	5-6
• Hip Extension	10	2	Theraband (Green/Blue)	5-6
• Seated Bicep Curl	10	2	3-4 kg	5-6
• Calf Raises	10	2	Body Weight	5-6
• Seated Tricep Extension	10	2	3-4 kg	5-6
• Seated Lateral Shoulder Raises	10	2	Theraband (Green/Blue)	5-6
• Seated Arm/Leg March	10	2	No Weight	5-6
• Seated Rowing	10	2	Theraband (Green/Blue)	5-6
• Seated Abdominal Crunches	10	2	Theraband (Green/Blue)	5-6
Cool Down & Stretch				
• Forward Walk/March	2 min			5-6
• Neck/Shoulder/Chest	15 sec	2		5-6
• Seated Rhomboid	15 sec	2		5-6
• Seated Tricep	15 sec	2		5-6
• Lats/Oblique	15 sec	2		5-6

• Hamstring	15 sec	2		5-6
• Gastrocnemius	15 sec	2		5-6

Warm-Up Exercises

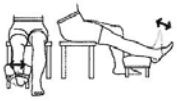
Exercise Program For: Date:2013/02/07
Warm-up Page:1

Sit to stand

- Begin by sitting on the front half of a chair, feet shoulder width apart.
- Stand up with a straight back to full upright position.
- Sit back down.
- Repeat.

Perform 1 set of 10 Repetitions, M,W,F.

Ankle 4 way



- Sit with good posture, one leg straight out.
- Move foot up (toward shin), then down (pointing toes).
- Move foot to left, then to right.
- Repeat 5x.
- Perform 5x with other leg out.

Perform 1 set of 10 Repetitions, M,W,F.

Walking

- Walk around a circle at a comfortable pace.
- Maintain good posture.
- Walk for 1 min..

Perform 1 set of 1 Minute, M,W,F.

Neck forward bend

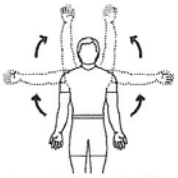
- Sit with good posture, back supported, head facing forward.
- Move chin down to chest.
- Return to start position.
- Repeat.

Special Instructions:

Move in painfree range.

Perform 1 set of 10 Repetitions, M,W,F.

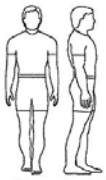
Double side arm raise



- Sit with good posture, arms at side, palms forward.
- Lift arms out and upward above head as shown.
- Return to start position.

Perform 1 set of 10 Repetitions, M,W,F.

Standing stride balance



- Stand with good posture, feet in contact with heel of left foot in line with big toe of right.
- Step forward with heel of right foot in line with bog toe of left, keeping feet in contact.
- Walk for 1 min.
- .

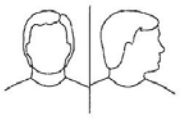
Perform 1 set of 1 Minute, M,W,F.

Heel toe walk

- Begin by standing as shown (left foot in front, in line with right, heel and toe in contact).
- Step forward with right foot, placing it in line with left foot.
- Continue to step, placing left foot in front of right.
- Repeat sequence for 1 min..

Perform 1 set of 1 Minute, M,W,F.

Neck twist



- Sit with good posture, back supported, head facing forward.
- Turn head to right, return to start.
- Turn head to left, return to start
- Repeat.

Special Instructions:

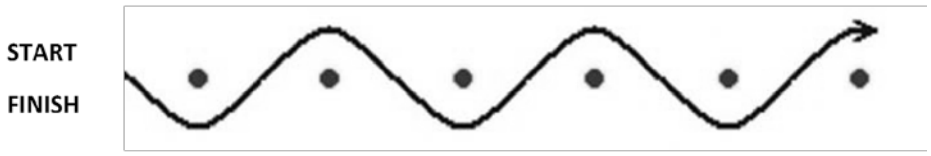
Stay in painfree range.

Perform 1 set of 10 Repetitions, M,W,F.

Endurance Exercises

Exercise 1 – Weaving between cones

- Participants weave between 6 cones set approximately 1 meter apart.
- Participants continue to weave until they are requested to stop.



Exercise 2 – Step up and over

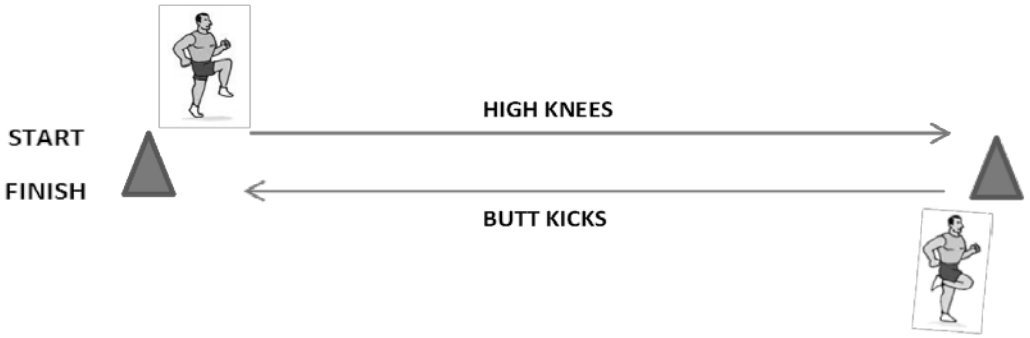
- Participants step up and over 5 aerobic steps whilst walking. The aerobic steps are placed 1 meter apart. The start is designated by a cone, placed 1 metre before the first step.

Exercise 3 – Shuttle walk

- 6 cones are placed 1 meter apart. Cone 1 is the start (designated by a different colour). Participants are instructed to walk to cone 2 and return to the start, then to cone 3 and return to the start, then to cone 4 and return to the start, then to cone 5 and return to the start and finally cone 6 and back to the start. This sequence is continued until the participant is requested to stop.

Exercise 4 – High knees/butt kicks

- Two cones are placed approximately 6 meters apart. Participants proceed to cone 2 whilst performing high knees and return to cone 1 performing butt kicks. This sequence is continued until the participant is requested to stop.

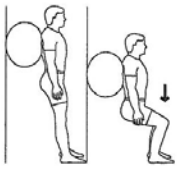


Resistance Exercises

Exercise Program For: Date:2013/02/08

Resistance exercises (weeks 1- 4) Page:1

Ball 90 wall slide



- Place ball between back and wall, feet shoulder width apart.
- Slowly bend knees to 60-90 degrees.
- Keep knees behind line of toes during bend.
- Return to standing position.
- Repeat.

Special Instructions:

Maintain proper low back posture.

Perform 1 set of 10 Repetitions, M,W,F.

Use Ball.

Elastic thigh extend

- Stand with good posture alongside a wall.
- Use the wall for balance and support.
- Attach elastic to secure object at knee level in front.
- Loop elastic around thigh just above knee.
- Stand, facing toward the pull.
- Extend leg backward, keeping knee straight.
- Return to start position and repeat.

Special Instructions:

Keep knee slightly bent on leg that you are standing on.

Perform 1 set of 10 Repetitions, M,W,F.

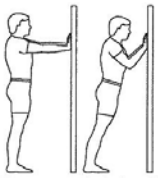
Use yellow/red Elastic.

Double heel raise

- Stand with good posture, using chair for balance.
- Raise up on toes, through full range.
- Return to start position and repeat.

Perform 1 set of 10 Repetitions, M,W,F.

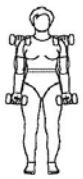
Wall push up



- Stand facing wall, 30-45 cm away, feet shoulder width apart.
- Place hands slightly wider than shoulder width on wall at shoulder height.
- Slowly bend elbows, bringing face and chest to wall.
- Push back up to start position and repeat.

Perform 1 set of 10 Repetitions, M,W,F.

Double DB biceps curl



- Sit with good posture.
- Begin with arms at side, elbows straight, palms up, weights in hand.
- Bend elbows upward.
- Return to starting position.

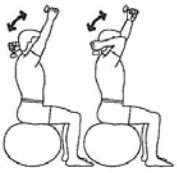
Special Instructions:

Keep elbows close to sides through entire movement.

Perform 1 set of 10 Repetitions, M,W,F.

Use 1-2 Kilograms.

DB Triceps lift on ball



- Sit on chair with good posture, back supported, weights in hands.
- Raise arms as shown, with elbows bent.
- Straighten one elbow, return to start.
- Straighten other elbow, return to start.
- Alternate arms.

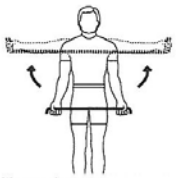
Special Instructions:

Maintain proper low back position.

Perform 1 set of 10 Repetitions, M,W,F.

Use 1-2 Kilograms.

Tubing double arm raise



- Sit forward on chair with good posture.
- Begin with arms at side, elbows straight, holding elastic which is beneath thighs, palms forward.
- Raise arms upward, out to side to shoulder height.
- Return to starting position.

Perform 1 set of 10 Repetitions, M,W,F.

Use yellow/red Elastic.

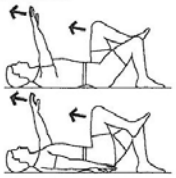
Close elbow rows

- Sit with good posture.
- Secure elastic at waist level.
- Hold elastic in hands with arms extended.
- Pull back, bending elbows and squeezing shoulder blades together, keeping elbows close to sides.
- Return to start position and repeat.

Perform 1 set of 10 Repetitions, M,W,F.

Use yellow/red Elastic.

Supine marching arm salute



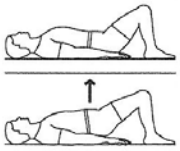
- Lie on back with knees bent, low back in neutral.
- Tighten abdominal muscles.
- Raise left leg and right arm off floor as shown.
- Return to start position.
- Repeat with right leg and left arm.

Special Instructions:

Maintain neutral spine without twisting or rotating hips. Move in smooth and controlled movements.

Perform 1 set of 10 Repetitions, M,W,F.

Bridging



- Lie on back with knees bent.
- Tighten abdominal muscles.
- Lift buttocks off floor, maintaining neutral spine.
- Return to start position.

Special Instructions:

Maintain neutral spine.

Perform 1 set of 10 Repetitions, M,W,F.

Cool Down Exercises

Exercise Program For: Date:2013/02/08
Cool down stretches Page:1

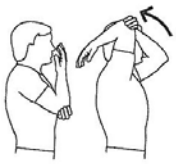
Rhomboid stretch

- Sit with good posture, back supported.
- Bring left arm across in front of body as shown.
- Hold elbow with right arm.
- Gently pull across chest until a stretch is felt in the back of shoulder.
- Repeat with other arm

Perform 1 set of 1 Repetition, M,W,F.

Hold exercise for 15 Seconds.

Triceps stretch



- Sit with good posture, back supported.
- Lift arms overhead.
- Bend elbow of one arm.
- With other arm, slowly push down on ebow, keeping elbow bent.
- Repeat with other arm.

Perform 1 set of 1 Repetition, M,W,F.

Hold exercise for 15 Seconds.

Plexus stretch

- Stand with good posture, left arm on wall, hand backward as shown, feet shoulder width apart.
- Slowly turn body outward until as stretch is felt across chest.
- Slowly turn neck to right until a stretch is felt down the front of arm.
- Repeat on other side.

Perform 1 set of 1 Repetition, M,W,F.

Hold exercise for 15 Seconds.

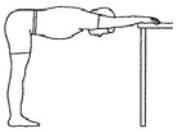
Sidebend stretch

- Stand with good posture, feet shoulder width apart.
- Raise right arm overhead behind head, holding with left arm.
- Bend knees slightly to provide better balance.
- Pull arm as you bend trunk to left.
- Repeat with other side.

Perform 1 set of 1 Repetition, M,W,F.

Hold exercise for 15 Seconds.

Bent 90 ham stretch

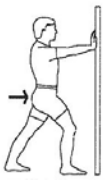


- Stand in front of table with feet shoulder width apart.
- Place hands on table.
- Bend at hips and tighten the muscles in fronts of thighs, keeping the knees straight.
- Keep low back straight.

Perform 1 set of 2 Repetitions, M,W,F.

Hold exercise for 15 Seconds.

Runner stretch



- Stand facing wall, hands on wall, elbows straight.
- Step forward with foot of one leg, bending knee and leaning hips toward wall.
- Keep rear leg straight with heel on floor.
- Keep feet facing forward.
- Repeat on other side.

Perform 1 set of 1 Repetition, M,W,F.

Hold exercise for 15 Seconds.

Rating of Perceived Exertion

Rating	Verbal Anchor
0	Rest
1	Very easy
2	Easy
3	Moderate
4	Sort of hard
5	Hard
6	
7	Very hard
8	Very, very hard
9	Near maximal
10	Maximal

APPENDIX G

DATA RECORDING SHEET – FUNCTIONAL FITNESS

Name of Participant: _____

Sex: ____

Age: ____

Name of Aged Care Facility: _____

Functional Fitness Scores

	Before Intervention	**After Intervention**
Lower Body Strength		
Chair Stand		
Upper Body Strength		
Arm Curl (Right)		
Arm Curl (Left)		
Lower Body Flexibility		
Chair Sit and Reach Test		
Upper Body Flexibility		
Back Scratch Test		
Agility and Dynamic Balance		
8-Foot Up and Go Test		
Aerobic Endurance		
6-Minute Walk Test		