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Evaluation of a physical activity and nutrition program for older people.

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made. This thesis contains no material which has been accepted for any other degree or diploma in any university.

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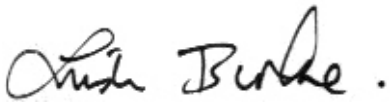
Signature: 

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Abstract

The Australian population is becoming increasingly obese with more than 79% of its' ageing population now classified as obese or overweight. Australians are also becoming less active with over one third of older adults not taking part in any physical activity. Along with reduced levels of physical activity the average Australians' mean energy consumption has increased.

Currently there are only a limited number of low-cost, home-based programs aimed at improving both physical activity and nutrition in a large group of otherwise 'healthy' sedentary seniors within the community. Therefore, the present study trialled a program aimed at increasing levels of physical activity and improving nutrition in seniors, investigating innovative resources.

The National Health and Medical Research Council (NHMRC) funded a 6-month suburban-based randomised control trial that promoted a nutritional and physical activity intervention for insufficiently active people aged 60 to 70 years from low to medium socio-economic-status (SES) groups. Over six hundred subjects in Perth Western Australia were recruited from the Australian Federal Electoral Role and randomly assigned to the intervention (n=314) and control (n=303) groups. The initial response rate was 79% (248) in the intervention group and 76% (230) in the control group. The data was collected via a self-administered questionnaire based on a number of validated questionnaires. Outcome measures included physical activity, energy intake, self-efficacy, mental and physical health, social support, loneliness and demographics (age, body mass index, education marital status, employment status and co-morbidities). The questionnaires were self-completed by the intervention and control group participants over two time points at pre-intervention (baseline) and post-intervention (six months). Results were analysed using SPSS and STATA packages. Univariate statistics were applied first to compare the intervention and control groups followed by mixed regression modelling.

Qualitative data on the resources was collected during the program, in a booklet (n=177), supplementary resources (n=167) and through post-program one-on-one interviews (n=20).

The results showed that:

1. At the end of the intervention period after controlling for demographic and other confounding factors, the intervention group demonstrated increased participation in strength exercise ($p<0.001$), walking ($p=0.029$) and vigorous activity ($p=0.015$), together with a significant reduction in mean sitting time ($p<0.001$) relative to controls.

2. Post-intervention improvements in nutritional behaviours for the intervention group included evidence of fat avoidance ($p<0.001$), reduced fat intake ($p=0.021$) and prevalence of frequent fruit intake ($p=0.008$).

3. Over 70% of participants stated they would continue to use the materials to maintain their fitness and 84% of respondents reported increased awareness of their health and well-being since commencing the program. Brief questionnaires on the booklet and supplementary program resources were returned by almost 60% of participants. Almost 90% of these confirmed the booklet provided them with useful advice and information, was easy to understand and suitable for their age group. More than 80% of the respondents found the booklet attractive and reported that it contained interesting advice. They agreed the booklet helped them to think more about their physical activity (78%) and nutrition behaviours (70%).

4. The intervention group demonstrated a small (0.02) but significant reduction in waist- to-hip ratio (WHR) ($p=0.03$) compared to controls. The 0.02 reduction in mean WHR corresponded to a 2.11cm decrease in waist circumference for a typical hip circumference. These results suggest that waist-to-hip ratio can be reduced through participation in a home-based physical activity and nutrition program.

The results suggest that the intervention was successful in improving seniors' health via a home-based program. It confirms the usefulness and practicality of developing home-based programs that are accessible for insufficiently active seniors from low and medium SES groups. Further, it could be replicated in future physical activity and nutrition programs aimed at older adults.

Based on the findings of the present research, future interventions should consider: home-based programs, flexibility in programs, some sort of contact or support for participants, written, posted materials and goal setting.

Table of Contents

Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
BMI	Body Mass Index
CATI	Computer Assisted Telephone Interview
FER	Federal Electoral Roll
GEE	General Estimating Equation
HBM	Health Belief Model
HDL	High Density Lipoproteins
LDL	Low Density Lipoproteins
MET	Metabolic Equivalent of Task
NCDs	Non-Communicable Diseases
NHMRC	National Health and Medical Research Council
OR	Odds Ratio
PANS	Physical Activity and Nutrition for Seniors
RCT	Randomised Controlled Trial
RR	Relative Risk
SCT	Social Cognitive Theory
SEIFA	Socio-Economic-Indexes-For-Area
SES	Socio-Economic-Status
TTM	Transtheoretical Model
UK	United Kingdom
US	United States of America
WHO	World Health Organisation
WHR	Waist-to-Hip Ratio

Glossary

Body mass index (BMI): Is a measure of a person's weight in relation to their height, calculated as weight in kilograms, divided by height in metres squared. The self-reported BMI of each subject was classified as normal (18.5-24.9 kg/m2), overweight (25.0-29.9 kg/m2) and obese (30.0 kg/m2), based on WHO recommended guidelines (WHO 2000).

Duration: Is the length of time (hours/minutes) spent participating in physical activity (McCormack et al. 2003).

Exercise: Is considered a subset of physical activity and is described as structured and repetitive body movements to maintain function (McCormack et al. 2003).

Fitness: Usually refers to the cardio-respiratory capacity of the individual to perform physical activity (McCormack et al. 2003).

Health: The WHO defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity" (WHO 1948).

Incidence: Is the number of new cases of a disease in a population at a given time, within a population at risk of developing the disease (Gordis 2008).

Insufficient physical activity: Some activity but not enough to reach the levels required for health benefits (McCormack et al. 2003).

Intensity: Is the perceived intensity at which an activity is carried out, such as light, moderate and vigorous (McCormack et al. 2003).

MET (metabolic equivalent of task): Is the energy expenditure required to conduct an activity.

Moderate levels of physical activity: Physical activity that causes the heart to beat faster and results in some shortness of breath, but a person is still able to speak; it is equivalent to 3-6 METs (McCormack et al. 2003).

Odds ratio: Is a measure of effect size. It indicates the odds of an event occurring in one group compared to the odds of it occurring in another group. The number of people exposed (Ie) over those with the condition who were not exposed (Io), divided by those with the condition who were exposed (Ne) over those without who were not exposed (No) (Gordis 2008).

Older adults: It is difficult to define the chronological age of an 'older person', as there is great variability in health status at any age. For the purposes of the present research 'older people' are defined as aged over 60 years.

Physical activity: Physical activity is defined as any bodily movement produced by skeletal muscles that result in energy expenditure, which may include walking, gardening, playing sport and any work-related activity (Bauman et al. 2002).

Prevalence: The total number of all individuals who have a disease at a particular time, divided by the population at risk of having the disease at this point in time (Gordis 2008).

Regular physical activity: Physical activity is regular if an accumulated 30 minutes of moderate physical activity is performed on most days of the week and preferably daily (McCormack et al. 2003).

Sarcopenia: a loss of skeletal muscle mass that often accompanies ageing and results in reduced strength and balance (Harris et al. 2006).

Sarcopenic obesity: sarcopenia, combined with excess weight in the elderly.

Socio-economic-indexes-for-area: Are derived from four summary measures (income, education level, employment status and skill level) created from Census information to determine how relatively 'disadvantaged' an area is compared to other areas in Australia (Australian Bureau of Statistics 2008b).

Sufficient physical activity: Undertaking 150 minutes of moderate intensity physical activity over five or more sessions in a week, or undertaking 60 minutes of vigorous intensity physical activity per week (McCormack et al. 2003).

Vigorous physical activity: Physical activity that causes huffing and puffing. In technical terms this is exercise at a heart rate of 70-85% of maximum heart rate (where maximum heart rate is 220 minus your age) (Department of Health and Aged Care 1999).

CHAPTER 1: Introduction

1.1 Study location

The present Randomised Controlled Trial (RCT) was set in Perth, the capital of Western Australia. With a population of over 1.7 million and the largest city in the state, Perth provided an opportunity to target a large population of older adults. The study was conducted in low and medium socio-economic-status (SES) suburbs and neighbourhoods in the metropolitan area, based on the socio-economic-indexes-for-area (SEIFA) levels. The temperature in Perth is fairly mild throughout most the year, providing a good climate for outdoor physical activity such as walking, with warm to hot / dry summers (December to March) and mild to cool / wet winters (July to August).

1.2 Statement of the problem

The proportion of older adults in Australia is increasing. It is estimated that 24% of the population will be aged over 65 years by 2056 (ABS, 2008b). Within the older Australian population (65-74 years) 75% are now classified as overweight or obese (ABS, 2009). The rise in overweight and obesity levels has been linked to reduced physical activity levels (Saarloos et al., 2008; Sims et al., 2010) and an increase in mean energy intake (Flood et al., 2010). The increase in the prevalence of overweight and obesity is of considerable concern due to the strong association between excess body weight and chronic health problems, such as hypertension, type 2 diabetes, stroke, osteoarthritis, some cancers, respiratory disease and musculoskeletal problems and the exacerbation of existing health conditions (Popkin, 2006a; Sassi et al., 2010). The rising proportion of older adults in the Australian population highlights the need to address their health issues.

Recent statistics have confirmed that older Australian adults' physical activity levels have reduced, reaffirming that as age increases, physical activity declines. Of adults aged 60-75, 51% are insufficiently active and almost one-third of older adults are

completely sedentary (ABS, 2009). In Australia, food and mean energy consumption has increased over recent decades (Flood et al., 2010), with worldwide diet trends also shifting towards an increased consumption of saturated fats (World Health Organization, 2012). The level of fat consumed is now exceeding the recommended daily energy intake of less than 30% (Artinian et al., 2010; Kearney, 2010). This, combined with a worldwide trend towards insufficient levels of physical activity for health benefits (Matsudo et al., 2004; Sims et al., 2010; Sims et al., 2006) and an ageing population (ABS, 2008b; World Health Organization, 2012), makes nutrition and physical activity in older people a priority health issue.

As the results of many of the interventions aimed at increasing older adults' activity levels (Jancey et al., 2008) and the adoption of a healthy diet are inconclusive (Lee et al., 2011), there is limited evidence of the effectiveness of strategies aimed at older adults, in the general population, to adopt healthier behaviours. Yet, some programs that have provided support within the general population have resulted in positive physical activity (Jancey et al., 2008; Kolt et al., 2009; Lee et al., 2011; Schneider et al., 2011) and nutritional outcomes (Greene et al., 2008; Morey et al., 2009; Wright et al., 2011; Young et al., 2011).

To date, most of the intervention research for older adults, has been conducted largely with volunteers recruited from worksites, health organisations, or via community advertisements (Bourke et al., 2011; Clark et al., 2005; Greaney et al., 2008; McClure et al., 2011; Morey et al., 2009; van Keulen, 2010; Villareal et al., 2011). The selection of participants from a restricted or small sub-section of the population places limitations on research results, making the intervention less likely to be applicable to the larger population. Only a limited amount of intervention research aimed at improving older adults' physical activity and nutrition has been completed with participants who were randomly selected from the population (Burke et al., 2008; Jancey et al., 2008; Jancey et al., 2011).

The benefits of regular physical activity for older adults are well recognised, with physical activity associated with an increase in longevity and a decreased risk of

many common diseases (Christensen et al., 2006; Lee et al., 2012; Nelson et al., 2007). A significant positive correlation exists between physical activity and physical function for older adults, with those who take part in higher levels of physical activity less inclined to have functional limitations, compared to those who are less active (Yorston et al., 2012).

Increased levels of physical activity and improvements in dietary behaviour can effectively decrease levels of overweight and obesity in older adults (Burke et al., 2012; Villareal et al., 2011; World Health Organization, 2012). Tackling the increased levels of obesity in older adults could lead to dramatic reductions to public health costs (Sassi et al., 2010).

1.3 Scope of the project

The present thesis is part of a funded, larger, three-year intervention study. The scope of this PhD was limited to analyses of the baseline and post-program data. It did not include the 6 month post-program follow-up data. This has subsequently been analysed and published. The candidate was the Project Co-ordinator and was responsible for the development of the intervention, evaluation instruments, the implementation of the intervention, data collection and some data analysis.

1.3.1 Project aim

The aim of the program was to develop, implement and evaluate a low cost, accessible, sustainable and replicable physical activity and nutrition program for older adults aged 60-70 years that would ultimately reduce chronic disease.

1.3.2 Project objectives

It was hypothesised that by the end of the program, the intervention group participants, compared to the control group participants, would record data that was demonstrated to be significantly different in the areas of:

Physical activity behaviour

- Increased minutes of walking per week
- Increased minutes of moderate activity per week
- Increased minutes of vigorous activity per week
- Reduced minutes of sedentary time per week
- Increased minutes of strength activities per week

Dietary behaviours

- Reduced fat intake
- Increased fat avoidance
- Increased fibre intake
- Increased frequency of fruit intake (at least two serves per day)
- Increased frequency of vegetable intake (at least two serves per day)

Anthropometric measures

- Reduced body-mass-index
- Reduced waist-to-hip ratio

1.4 Outline of the thesis

This thesis is presented in seven chapters comprised of: an introduction, a literature review, methodology, three published papers and a conclusion. Copyright permission has been obtained to use the published papers.

Chapter One introduces the issues relating to reduced levels of physical activity, increased mean energy consumption and obesity in Australian older adults. The significance, limitations, scope and objectives of the study are also described.

Chapter Two is a literature review of interventions for older adults that aimed at improving physical activity and nutrition. It discusses the importance of targeting these behaviours in the older population.

Chapter Three outlines the methodology with reference to Appendix A, a published paper that explains the project protocol.

> Physical activity and nutrition program for seniors (PANS): protocol of a randomised controlled trial. Burke L, Jancey J, Howat P, Lee A, Kerr D, Shilton T, Hills A, Anderson A 2010, BMC Public Health, 10:751.

Chapters 4-6 consist of three published papers at the time of submission of the present thesis. Although other authors contributed to the paper, the present researcher was responsible for all decisions related to the design, planning and implementation of the aspect of the project addressed in the paper, and was responsible for drafting the paper and making decisions for the content and construction.

Chapter Four, a published paper, discusses the process evaluation employed for the program.

> Physical activity and nutrition program for seniors (PANS): Process evaluation. Burke L, Jancey J, Howat P, Lee AH, Shilton T 2012, Health Promotion Practice doi:.10.1177/1524839921461504.

Chapter Five, a published paper, discusses changes in behavioural outcomes of physical activity and nutrition in participants.

> Physical activity and nutrition behavioural outcomes of home-based intervention program for seniors: A randomized controlled trial. Burke L, Lee AH, Jancey J, Xiang L, Kerr DA, Howat P, Hills A, Anderson AS 2013, International Journal of Behavioral Nutrition and Physical Activity, 10:14.

Chapter Six, a published paper, reports the results of changes to participants' body mass index and waist-to-hip ratio

> Effects of a physical activity and nutrition program for seniors on body mass index and waist-to-hip ratio: A randomised controlled trial. Burke L, Lee AH, Pasalich M, Jancey J, Kerr D, Howat P 2012, Preventive Medicine, (54)6, 397-401.

Chapter Seven outlines conclusions and suggests recommendations based on the results of the project.

1.5 Significance of the study

Maintaining recommended levels of physical activity for health (Sims et al., 2010), as well as maintaining an appropriate diet (World Health Organization, 2012), are important public health goals to minimise the adverse physiological changes associated with ageing and are key to addressing obesity. Yet, there remains a need for more systematic assessment of different implementation and dissemination strategies, to improve health outcomes in the ageing/older adult/elderly population (Green, Ottoson, et al., 2009; Van Acker et al., 2011). Home-based nutrition and physical activity programs for older adults, an increasing proportion of the population in society, can help to reduce future costs of health care (Kamp et al., 2010). Beneficial results from participation in these programs, including improvements in older adults' physical activity, nutrition behaviours and well-being, will result in a decrease in health care costs related to older adults (Sassi et al., 2010). This study is unique compared to other physical activity and nutrition research previously carried out with older people for a number of reasons:

- The target group was selected from older adults aged 60-70 years of low and medium socio-economic-status (SES) groups and not high SES groups.
- Participants in Western Australia were randomly selected through the Australian Federal Electoral Roll (FER) and were not community volunteers recruited through advertising.
- The project was aimed at improving both the physical activity level and diet of older adults using minimal intervention.
- Evaluation data was collected from the participants in their own communities and not in a research centre, making it relevant to the normal population and not just a clinical group.
- Process evaluation data provided information on the development, implementation and evaluation of a minimal, home-based, tailored

intervention aimed at increasing physical activity and improving dietary intake within the community.

1.6 Limitations of the study

A potential limitation of the study is that anthropometric measures were self-reported. Despite this, any inherent inaccuracies were expected to be similar between the intervention and control groups. To standardise measures clear written instructions were provided to participants on *how* to take the measurements required. Moreover, in large scale community trials self-reported data are deemed to be adequately reliable for monitoring changes over time and have been considered as valid proxies to reduce cost and attrition rates by minimising subject burden (Burton et al., 2010; Dhaliwal et al., 2010; Fillenbaum et al., 2010; Stommel & Schoenborn, 2009).

The similarity of the two groups at baseline could have imposed limitations on further dietary gains, i.e., ceiling effect (de Vreede et al., 2007; Lee et al., 2011). Results confirmed that the older adults in the intervention and control groups had similar eating habits at baseline. Also, both groups reported a varied diet and low consumption of take-away foods. The questionnaire was kept short to reduce subject burden although it may have been improved by including extra questions to gather more specific information on the older adults' nutritional intake.

Data was collected via mailed self-report; therefore, reporting bias may have affected the validity of outcomes due to overestimation. Mailed self-report data collection was employed as it had proven effective in previous interventions conducted by the research team (Burke et al., 2008; Lee et al., 2011). Based on feedback from the target group it was considered less intrusive than face-to-face interviews and enabled completion of the questionnaire at the participants' own convenience.

CHAPTER 2: Literature Review

2.1 Introduction

The increase in the proportion of older adults in Australia is expected to continue in the future, with an estimated 24% of the population being over 65 years of age by 2056 (ABS, 2008b). An older population is likely to place high demands on health care as a result of their health issues. Older Australians' physical activity levels have decreased (Saarloos et al., 2008; Sims et al., 2010) and mean energy consumption has increased over the past two decades (Bennett et al., 2004). More than 79% of older Australians are now obese or overweight (ABS, 2009). In the health context, an ageing population contributes to higher overall mortality and morbidity rates which places greater burdens on health care (AIHW, 2010) and can result in substantial cost to individuals, families and the community. With the increasing impact of the older population on health expenditure, there is a great need for intervention programs aimed at reducing public health costs of older adults (Sahyoun et al., 2004).

Research has linked physical activity and improved dietary behaviours to a number of health benefits (Prochaska et al., 2010) and improvements in both of these behaviours with older adults have generated positive results (Morey et al., 2009; Villareal et al., 2011). Gaps still remain in the research, however, including a lack of interventions that are home-based and target otherwise healthy older adults aged 60-70 years as well as interventions that target combined improvements in both physical activity and nutrition of older adults from low to middle socio-economic-status (SES).

2.1.2 Methods

Search strategy

Relevant publications were identified through a search of the following databases: Cochrane Library, CINAHL, EMBASE (Ovid), Medline (PubMed), Pro Quest,

Science Direct (Scopus) and Web of Knowledge (Web of Science). Search terms were in four categories:

i) age-related search terms (“seniors” OR “older adults” OR “older people” OR “senior citizens” OR “elderly people”) AND
ii) intervention search terms (“strategies” OR “interventions” OR “home-based interventions”) AND
iii) general food-related terms (“nutrition” OR “diet” AND
iv) general exercise-related terms (“physical activity” “exercise”).

Other sources for appropriate literature included reference lists of articles, international reports and recommendations. Appendix B contains a summary table of literature reviewed.

Eligibility criteria

Search fields were title, abstract and keywords. Limits were narrowed to those published from January 2001 to May 2012 and included only human studies (CINAHL, EMBASE (Ovid) databases) and restricted to people aged 45-64 years; aged 65+years (CINAHL, databases), <18-64 years; <65+ years (EMBASE (Ovid)).

Selection of articles

The review included interventions that were designed to increase participants’ physical activity and/or improve their nutrition and reported data to support these health behaviours.

2.2 Ageing population

It is estimated that by 2050 people aged 60 years and over will constitute 21.4% of the world’s population (Cohen, 2003). In the US the projected number of people aged 65 years and over is expected to increase by more than 50% to 88.5 million by 2050 (Vincent & Velkoff, 2010).

Over the last 20 years the proportion of the Australian population aged 65 years and over has increased from 11.3% to 13.7% (ABS, 2011). Australia's ageing population has influenced the increasing prevalence of chronic health conditions and has had a subsequent negative impact on the health care system (Matthews et al., 2009), resulting in higher health care costs. A majority of people aged 65 and over reported having at least one long-term health condition in the 2007-08 National Health Survey and more than 80% reported having three or more long-term conditions (Department of Health and Ageing, 2009). The ageing population's demands on the health care system will increase in the future, if a range of preventive measures is not considered.

2.2.1 Physiological changes associated with ageing

Physiological changes that occur in older adults include the loss of lean body mass and an increase in fat mass and bone demineralisation (Devereux, 2005; Mann & Truswell, 2007). Physiological changes between individuals vary widely (Haveman Nies et al., 2003). Changes in body composition, strength and aerobic capacity can substantially affect the health of older adults (Chodzko-Zajko et al., 2009), negatively impacting their ability to participate in physical activity. As a result their risk of developing disability and disease increases. Physiological changes can increase the susceptibility of individuals to health events and conditions including sarcopenia, cardiovascular disease and osteoporosis (Crisp & Taylor, 2009).

The human body changes continuously throughout the ageing process. The negative impacts of these changes can often be positively counteracted by improving health and lifestyle behaviours (Crisp & Taylor, 2009). Chodzko-Zajko et al. (2009) reported that regular exercise can improve the physiological effects of sedentary lifestyles and increase 'active' life expectancy, by reducing the development and advancement of chronic disease and disabling conditions. As a result of their research it was recommended that exercise programs for older adults include flexibility and muscle strengthening exercises and aerobic exercise. They also claimed there was emerging evidence of significant psychological and cognitive

benefits from regular participation in physical activity by older adults (Chodzko-Zajko et al., 2009).

2.3 Overweight and obesity

Obesity has more than doubled since 1980 (World Health Organization, 2012) to the extent that there are more obese and overweight people than malnourished or underweight people worldwide, with the burden of obesity increasingly shifting to the poor (Popkin, 2006a). Globally over 2.8 billion people die each year as a result of health complications associated with being overweight or obese (World Health Organization, 2012). Overweight and obesity are the fifth leading behavioural and physiological risk factors attributable to deaths worldwide (World Health Organization, 2012).

Obesity is a major contributor to the global burden of chronic disease and disability (World Health Organization, 2012). The main causes of overweight (BMI$\geq$25kg/m^2) and obesity (BMI$\geq$30kg/m^2) are reduced physical activity and changes in diet, including an increased consumption of energy-dense foods (Walls et al., 2011; Wang & Brownell, 2005; World Health Organization, 2009).

Overweight and obesity cause significant morbidity and mortality in the Australian community (NHMRC, 2009). In Australia from 1995 to 2008 the proportion of adults (aged 18 years or over) classified as obese or overweight increased from 56% to 61% (ABS, 2010). From 2007-2008, the incidence of obesity in the US was 32% in adult men and 36% for adult women (Flegal et al., 2010). The 2009 Health Survey for England data (National Archives Department of Health, 2011) reported that 61% of adults (aged 16 years or older) were overweight or obese, and 23% of these were obese. Developed countries have begun targeting overweight and obesity in an effort to improve public health (Backholer et al., 2010; Walls et al., 2011).

As people age their body composition changes and this combined with a sedentary lifestyle may result in sarcopenia or reduced muscle strength or mass (Li & Heber, 2012). Sarcopenia, combined with excess weight in the elderly, is referred to as

sarcopenic obesity (Li & Heber, 2012; Zamboni et al., 2008). This has a detrimental impact on older adults' health in terms of disability, morbidity and mortality (Li & Heber, 2012). Of utmost importance is the need to address obesity in older adults as the negative effects of obesity can exacerbate their existing health issues.

2.3.1 Chronic disease and overweight and obesity

There is a strong association between overweight and obesity and chronic health problems such as type 2 diabetes, cardiovascular disease, osteoarthritis, respiratory disease, musculoskeletal problems and some cancers (AIHW, 2004; Christensen et al., 2006). The risk of developing one or more chronic health conditions increases with age, as does the proportion of people reporting more than one chronic condition (Department of Health and Ageing, 2009). Results of the 2007-08 National Health Survey signify a high incidence of chronic diseases among older Australians, including cardiovascular disease (16%), arthritis (15%), diabetes (4%), asthma (10%), cancer (2%) and long-term mental or behavioural conditions (11%) (ABS, 2009).

Adams et al. (2006) reviewed the relationship between body mass index (BMI) and the increased risk of death. Figures were examined from the National Institutes of Health cohort of US men and women aged 50-71 years old (at enrolment 1995-1996). Results from the 10 year follow-up confirmed that overweight and obesity during midlife was associated with a higher risk of death due to chronic disease.

Australian Bureau of Statistics figures have shown that Australia's ageing population was heavier than a generation ago and heavier than younger age groups (ABS, 2009). Over 75% of older adults (aged between 65-74 years) were categorised as overweight or obese, in comparison to 25% of adults aged 18 years and over being categorised as obese and 37% overweight (ABS, 2009). Results from the 2007-08 Department of Health and Ageing survey confirm that risk factors for overweight and obesity, including physical inactivity and a poor diet have led to a substantial growth in the number of people with associated conditions, especially in the older age groups (Department of Health and Ageing, 2009).

Chronic diseases, including heart disease and diabetes, have been associated with lifestyle behaviours, such as physical inactivity, poor nutrition and obesity (Cummings et al., 2009). The WHO (2012) reported that one of the most common causes of morbidity and mortality in the 65-84 year age group was cardiovascular disease. Type 2 diabetes, or non-insulin dependent diabetes mellitus, was more likely to occur in adulthood, after 50 years of age (AIHW, 2008). One in two Australians were diagnosed with cancer by the age of 85 with people over 60 years of age more than four times more likely to be diagnosed with cancer, than those aged less than 60 years (AIHW, 2008). Recommendations to prevent cardiovascular disease, type 2 diabetes and cancers include physical activity, maintenance of a healthy diet, achieving and maintaining a healthy body weight, and avoiding tobacco use (AIHW, 2008; World Health Organization, 2012).

There was evidence that with an increasing ageing population, higher numbers of people were being admitted to hospital with fractures due to osteoporosis (osteoporotic fracture) leading to complications including postural changes, deformity of the spine, chronic pain, loss of independence, disability and premature death (AIHW, 2011). About 16% of Australians aged 65 and over claimed to have osteoporosis, and over 48% from this age group reported having arthritis (ABS, 2009). Osteoporosis can be prevented by consuming adequate calcium, participating in regular physical activity and getting adequate vitamin D (AIHW, 2011).

2.3.2 Costs of obesity

Access Economics (2008) estimated the total annual cost of obesity in Australia for 2008, including productivity declines, carers' costs and health system costs, to be AUD$58 billion (ABS, 2010). In 2008 the medical cost of obesity in the US was US$147 billion (Finkelstein et al., 2009). A recent study in the US (Cawley & Meyerhoefer, 2012) reported that medical costs for an obese person was more than US$2,700 higher than for a non-obese person. This translates to over US$190 billion per year nationwide, or 20.6% of national health spending.

An estimated cost saving of 2% of the annual Australian health expenditure may be achieved with reductions in common behavioural risk factors such as inadequate fruit and vegetable consumption, physical inactivity and high body mass index (Cadilhac et al., 2011). Based on simulation models Cadilhac et al. (2011) developed for the 2008 Australian population, if sufficient reductions in the risk factors mentioned above, were achieved, total cost savings of AUD$2.3 billion could arise over the lifetime of the 2008 population.

The growing demographic of older adults and their increasing burden on health care costs, along with the rising prevalence of obesity and lifestyle-related chronic diseases worldwide, confirms the need for wellness initiatives specifically designed for the 60-70 year old age group (Coberley et al., 2011). Studies reviewed by Coberley et al. (2011) found that people who took part in senior wellness programs showed health improvements, including improved nutrition, increased physical activity and smoking cessation. Large-scale senior wellness programs that successfully engage seniors and change behaviour as a direct result of involvement provided strong evidence that health improvements can positively affect health care expenditures. Further issues need to be addressed, including increasing enrolment of people in these programs and sustaining their participation. The review demonstrated that further research is required to develop more effective ways to implement such initiatives.

A systematic review by Withrow and Alter (2010), examined the direct costs related to obesity. The review reported that obesity accounted for approximately 0.7% to 2.8% of a country's total health-care expenditure and that the medical costs of obese individuals were three times greater than that of normal weighted individuals (Withrow & Alter, 2011). The review confirms the pressure that is being placed on health-care expenditure worldwide as a result of rising levels of obesity.

2.3.3 Measuring obesity

The anthropometric measures generally used to measure obesity in epidemiological studies are body mass index (BMI) and waist-to-hip ratio (WHR). The degree of

excessive weight for a given height is assessed by BMI, whereas abdominal, or central obesity indirectly measures the distribution of body fat, using the measures of waist circumference and WHR, considered to be an important measurement of obesity (Dhaliwal & Welborn, 2009). WHR has been reported to be superior to BMI in the prediction of cardiovascular disease (Burke et al., 2012; Dhaliwal et al., 2010; Welborn & Dhaliwal, 2007), trunk fat mass (Taylor et al., 2000) and all-cause mortality (Burke et al., 2012; Welborn & Dhaliwal, 2007). Although accurate clinical measurements are preferable, in large community-based trials self-reported data has been taken as a proxy, to reduce attrition rates and costs (Burke et al., 2012; Dhaliwal et al., 2010).

2.3.4 Review of overweight and obesity interventions

To date, overweight and obesity interventions have focused on how to prevent and treat obesity, with some positive results achieved such as weight loss and reduced incidence of type 2 diabetes (Howard et al., 2006; Lindström et al., 2006; Lindström et al., 2003; Simkin-Silverman et al., 2003) and discussed elsewhere below. Interventions have also been successful in significantly reducing cardiovascular risk factors, including decreasing body weight, waist circumference and blood glucose levels in overweight and obese people (Galani & Schneider, 2007).

Galani and Schneider et al. (2007) conducted a review and meta-analysis of lifestyle interventions for the prevention and treatment of obesity, to assess mid- to long-term effectiveness. The lifestyle interventions included those designed for patients according to their risk factors or needs and consisted of dietary counselling, promoting healthy lifestyle habits, physical exercise training and behavioural change. The authors selected 30 studies on prevention (n=13) and treatment (n=17) of obesity, finding that lifestyle interventions, compared to standard care, with a follow-up time of three years, can significantly reduce cardiovascular risk factors and body weight. Lifestyle interventions significantly reduced BMI, body weight and waist circumference, blood lipids and blood glucose in overweight and obese people, in comparison to those in standard care. The authors concluded that lifestyle interventions were effective in the treatment and prevention of obesity in the mid- to

long-term and significantly reduced cardiovascular risk factors and body weight. The results confirmed that lifestyle interventions can effectively treat or prevent obesity.

A systematic literature review on obesity prevention interventions among adults, conducted by Lemmens et al. (2008), reported there was limited evidence on the efficacy of obesity prevention interventions. Although some studies showed positive impact on weight status or body mass index (BMI), the comparability of studies is limited due to differences in target population, theoretical basis and study design. The researchers concluded that there still remains a large gap in the evidence for obesity prevention because of the difficulty in comparing such studies. Clear, explicit information needs to be provided when sharing research findings to enable others to make effective comparisons so that new interventions can be developed and trialled.

An example of helpful, clear and explicit information is the study by Galani and Schneider et al. (2007) on prevention and treatment of obesity. They clearly defined inclusion criteria for studies such as type of trial, participant's age, observation recorded, follow-up and a comparison of outcome results including body weight, BMI and waist circumference. The authors were able to make effective comparisons of research findings by defining how they compared the studies.

The Obesity Society, a technical review and position statement of the American Society for Nutrition and NASSO (Villareal et al., 2005), concluded that weight loss could potentially have harmful effects on the older population, leading to the loss of muscle and bone mass. This is due to the changes in body composition that occurs beyond 30 years of age, as fat-free mass (skeletal muscle) progressively decreases and fat mass increases until the age of 60-70, when they both start to decline. The review implied that appropriate treatment for obesity in adults is controversial, as weight-loss in obese older adults could be detrimental to their health (Villareal et al., 2011). Interventions that encourage healthy living through improved diet and increased physical activity would perhaps be more beneficial (Frimel et al., 2008; Li & Heber, 2012; Villareal et al., 2005; Villareal et al., 2011). Care needs to be taken with interventions for older adults who are overweight or obese. Although weight

loss can be justified to improve their health, there may be other detrimental side effects. It is preferable to develop intervention programs for older adults that are a combination of both diet and physical activity (Li & Heber, 2012). Physical activity is essential to ensure muscle mass is retained or increased as body fat is reduced, to maintain or improve health and specifically in managing sarcopenic obesity (Frimel et al., 2008).

Overweight and obesity interventions have had positive results although many have been targeted to specific populations including pre-menopausal women, post-menopausal women and people with impaired glucose intolerance (or people at high risk of developing type 2 diabetes). For example, Simkin-Silverman et al. (2003) conducted a study to see if a dietary and physical activity intervention could prevent weight gain and elevations in cardiovascular disease (CVD) risk factors during menopause. The five-year randomised controlled trial (RCT) with pre-menopausal women (n=535) aged 44-50 years at study entry found that after 4.5years, 55% of the intervention group were at or below baseline weight, compared to the control group, with only 26%. Howard et al. (2006) reported on a long-term, low-fat, seven-year randomised intervention trial, with post-menopausal women (n=48835), aged 50-79 years at baseline. The intervention targeted a reduction of fat intake and increased consumption of fruit, vegetables and grains, with no weight loss or caloric restriction goals. Women in the intervention group lost weight in the first year of the trial and maintained lower weight than the control group, during an average 7.5 years of follow-up. The Finnish Diabetes Prevention study (Lindström et al., 2006; Lindström et al., 2003) aimed to promote lifestyle changes to reduce diabetes incidence. The participants (n=522) were overweight and middle-aged men and women with impaired glucose tolerance. The one- and three-year study results demonstrated significant weight loss with reductions of 4.5 and 3.5kg for the intervention group and 1.0 and 0.9kg for the control group (Lindström et al., 2003). The six-year study results showed a reduction in relative risk for diabetes of 43%. The incidence of type 2 diabetes per 100 person-years was 4.3 in the intervention group and 7.4 for the control group (Lindström et al., 2006). At follow-up the intervention group participants maintained beneficial lifestyle changes including weight loss, reduced

intake of fat, increased intake of dietary fibre and increased physical activity, with incidence rates of 4.6 post-intervention and 7.2 at follow-up (p=0.0401), indicating a 36% reduction in relative risk (Lindström et al., 2006). The Finnish Diabetes Prevention study was not designed for use in community settings, but designed for use in general health-care. Although these trials have been somewhat successful, their target groups were specific, which restricts the ability to generalise the results to the general population.

2.4 Physical Activity

Benefits of regular physical activity for older adults are well recognised (Kolt et al., 2009; Nelson, 2007; Spring, 2010), regardless of BMI (Blair et al., 1996). As individuals progress through the years of older adulthood, the potential to maintain good health is reduced because ageing itself is a risk factor for ill health (AIHW, 2009). Physical activity is vital for the 60-70 year age group, not only in relation to chronic disease, but also to help maintain and improve health and well-being, prevent falls and fractures and prevent loss of balance and bone mass (AIHW, 2009). The greatest health improvements occur when a person moves from being sedentary to participating in a small amount of physical activity (Diehr & Hirsch, 2010) (< 100 mins/week), or when one moves from being involved in light activity (1-2.9 METs-metabolic equivalent of task) to undertaking moderate activity (>3 METs) (CATI Technical Reference Group: National Public Health Partnership, 2003). Research confirms that regular participation in physical activity is associated with improved longevity and decreased risk of obesity and lifestyle diseases, including stroke, type 2 diabetes, cardiovascular disease and some cancers (Christensen et al., 2006; World Health Organization, 2012).

Regular physical activity can improve psychological well-being by reducing anxiety, stress and depression (Warburton et al., 2006) and also improves sleep (Centers for Disease Control and Prevention, 2011). It can lead to improved efficiency of the heart muscle, as it adapts to exercise, becoming stronger and able to work with less effort (Warburton et al., 2006).

Regular physical activity increases blood circulation and helps to dilate narrowed arteries (Centers for Disease Control and Prevention, 2011; Warburton et al., 2006). Body composition and muscle tone can improve through regular physical activity, as it reduces abdominal adiposity and helps to regulate weight control (Warburton et al., 2006) and can increase, or contribute to the maintenance of muscle mass and strength (Centers for Disease Control and Prevention, 2011). Regular physical activity assists the body to use glucose efficiently and reduces the risk of developing, or can delay, the onset of type 2 diabetes (Centers for Disease Control and Prevention, 2011). Physical activity also helps people who already have type 2 diabetes to maintain their blood glucose levels within normal limits (Warburton et al., 2006; World Health Organization, 2012). Blood cholesterol can be improved through physical activity, as it helps to increase high density lipoproteins (HDL) or 'good cholesterol', which helps to remove low density lipoproteins (LDL), or 'bad cholesterol' from the arteries (Centers for Disease Control and Prevention, 2011; Warburton et al., 2006). Regular physical activity can reduce the risk of developing colon and breast cancer (Centers for Disease Control and Prevention, 2011; World Cancer Research Fund / American Institute for Cancer Research, 2007). Physical activity helps to maintain bone density and strength and reduces the risk of developing osteoporosis (Centers for Disease Control and Prevention, 2011). Regular physical activity maintains and improves muscle strength, joint movement, flexibility and balance and can help prevent falls which can cause significant injury and long term detrimental health effects in the older adult age group (Centers for Disease Control and Prevention, 2011).

2.4.1 Recommended levels of physical activity

Over recent years recommended levels of physical activity have been updated and made more specific to age groups, with the aim of decreasing levels of overweight and obesity and reducing the risk of lifestyle diseases (Canadian Society for Exercise Physiology, 2011; Department of Health and Ageing, 2010; Department of Health Social Sciences and Public Safety; The Scottish Government; Welsh Government;

Department of Health, 2011; Office of Disease Prevention and Health Promotion, 2008; World Health Organization, 2011). The revised recommendations enable more flexibility for individual circumstances, such as older people with injuries or those new to physical activity (Department of Health and Ageing, 2010; Office of Disease Prevention and Health Promotion, 2008).

The current physical activity guidelines for older adults in Australia (Department of Health and Ageing, 2010), the US (Office of Disease Prevention and Health Promotion, 2008), Canada (Canadian Society for Exercise Physiology, 2011) and in the UK (Department of Health Social Sciences and Public Safety; The Scottish Government; Welsh Government; Department of Health, 2011) encourage all older adults to do some form of physical activity.

The Australian, US, Canadian and UK guidelines recommend that older adults:

- Aim to do 150 minutes of moderate-intensity physical activity a week (in periods of at least 10 minutes), spread over all seven days of the week;
- Take part in muscle and bone strengthening activities on two or more days a week;
- Perform physical activities to improve balance and prevent falls.

There are also specific recommendations within individual countries' guidelines, including:

- How to recommence physical activity after a long period of inactivity (Department of Health and Ageing, 2010);
- The amount of vigorous-intensity physical activity to perform (Canadian Society for Exercise Physiology, 2011; Department of Health Social Sciences and Public Safety; The Scottish Government; Welsh Government; Department of Health, 2011; Office of Disease Prevention and Health Promotion, 2008);
- How to avoid sedentary behaviour (Department of Health Social Sciences and Public Safety; The Scottish Government; Welsh Government;

Department of Health, 2011; Office of Disease Prevention and Health Promotion, 2008).

The updated physical activity guidelines confirm that older adults need to be encouraged to perform regular physical activity and reduce sedentary behaviour.

2.4.2 Physical activity patterns

Levels of physical activity amongst the ageing Australian population have been declining over recent decades (Saarloos et al., 2008; Sims et al., 2006). Data from the Australian Bureau of Statistics (ABS) confirms that as age increases, physical activity declines, with 51% of Australian adults aged 60-75 years being insufficiently active and 33% being completely sedentary (ABS, 2009). Rates of physical activity in adults aged 60 years and older in the US have been reported to be low; only 25% of men and 20% of women met the national physical activity guidelines (Office of Disease Prevention and Health Promotion, 2008), while 26% of those in the 65-74 year age group did not participate in any physical activity (Centers for Disease Control and Prevention, 2007).

In recent years, sedentary behaviour has become a focus of studies into physical activity patterns. Research has shown that sitting for long periods of time can have a detrimental effect on the body's physiology and in the future, sitting is likely to be recognised as a serious health hazard (Hamilton et al., 2008) that may be linked to a number of chronic diseases (Balboa-Castillo et al., 2011; Hamilton et al., 2007; Katzmarzyk, 2009; Patel, 2010; Touvier et al., 2010).

The World Health Organisation (WHO) has ranked physical inactivity as the fourth leading cause of death (Kohl et al., 2012). The minimisation of sedentary behaviour is encouraged in the most recent physical activity guidelines for older adults in the US (Office of Disease Prevention and Health Promotion, 2008) and in the UK (Department of Health Social Sciences and Public Safety; The Scottish Government; Welsh Government; Department of Health, 2011).

2.4.3 Barriers, enablers, motivators and program design

Barriers

People may experience a variety of barriers to physical activity over time as barriers vary between individuals and do not remain static (Jancey et al., 2009; Moschny et al., 2011).

Jancey et al. (2009) reported that a major factor influencing some older people's participation in physical activity was pain, including arthritis. Other barriers reported were inclement weather, lack of balance and confidence, loss of flexibility, shortness of breath and poor body image. Older adults share common barriers to participating in physical activity programs and sometimes lack the understanding of the benefits of physical activity as a means of preventing disease, and can lack experience and knowledge to be able to effectively exercise alone (Dorgo et al., 2011; Schutzer & Graves, 2004). A program that provides information on the benefits of physical activity and allows tailoring to accommodate for individual needs would be suitable for older adults.

Moschny et al. (2011) investigated barriers to physical activity by questioning only the participants who claimed to be insufficiently active (n=286/1937) about their barriers to physical activity. The German study, with older adults aged between 72-93 years (mean age of 77 years), reported the results of telephone interviews. The most frequently reported barriers were poor health (58%), lack of company (43%) and lack of interest (37%). The study concluded that future interventions should consider barriers that effectively reduce older adults' limitations to participating in physical activity. Mathews et al. (2010) conducted 42 focus groups in the US to determine enablers and barriers to physical activity within an ethnically, racially and geographically diverse group of older adults. Common barriers reported were health problems, fear of falling and inconvenience. Both of these studies reported that poor health and lack of company or social support can be an issue with older people, suggesting that improvements in health and support from others may effectively enable older people to participate in physical activity. There is a need for physical

activity programs for older adults that cater for individual needs, provide support and therefore reduce barriers to physical activity.

Other studies have reported on environmental factors that influence physical activity. For example, people living in lower SES areas reported safety concerns or poor neighbourhood aesthetics influenced their ability to walk, resulting in lower levels of physical activity compared to people residing in higher SES areas (Kamphuis et al., 2007; Owen et al., 2007). The lack of environment maintenance can affect the amount of physical activity people participate in, both for recreation and transport (Pikora et al., 2006) within their local areas. These findings indicate that if a physical environment is not maintained, or is considered to be unsafe, it can have detrimental effects on participation in physical activity. Therefore programs that take part within the home may be a more suitable alternative for older adults, as they increase the ability to manage or maintain their home space and reduce concerns regarding lack of safety or maintenance of the environment outside of their home.

Enablers

Older adults require guidance to encourage and support them throughout their participation in physical activity intervention programs (Dorgo et al., 2011; Jancey et al., 2007; Schutzer & Graves, 2004). Individual attention is required for older adults who are inexperienced or unfit whereas community-based programs do not always provide social support or professional assistance (Dorgo et al., 2011). Previous research has reported that older adults who are overweight and insufficiently active are more likely to drop out of a program (Jancey et al., 2007).

Older, inactive adults aged between 65-74 years reported certain actions that enabled them to take part in physical activity. (Price et al., 2011) noted older adults found it easier to participate when they received support from others, including encouraging words from a friend or partner and even playing with grandchildren Price et al. (2011). Receiving professional exercise instruction to enable them to perform specific physical activities was useful, as it improved their ability and willingness to take part. Exercise buddies were another factor that enabled them to keep motivated.

A printed table or chart comparing types of physical activity and equivalent activities, such as energy burned riding a bicycle versus time taken to jump rope has encouraged choice in types of physical activity performed. Messages should not be too prescriptive, but encourage people to do as much physical activity as they can, to allow for individual differences in ability. They also suggested that a list of activities be provided that were appropriate or modified for people who had some sort of physical impairment or injury.

Withall, Jago and Fox (2011) reported on a survey of physical activity participants (n=152), non-participants (n=33) and exercise leaders (n=14) in low-income areas. The results demonstrated similar enablers for physical activity (Withall et al., 2011). Participants reported that they enjoyed participating in activities in groups as they were fun and sociable. Some also preferred to attend with a friend, to help boost their confidence.

Motivators

Common motivators for physical activity include access to physical activity programs, social support and positive outcome expectations (Mathews et al., 2010; Price et al., 2011). Motivation to take part in physical activity can be related to individual or community benefit. Pan et al. (2009) found that older people were more motivated than younger people to take part in physical activity because of perceived health benefits and due to improved self-efficacy to engage in and complete behaviours.

Price et al. (2011) conducted ten focus groups in South Carolina, US, with older adults (n=55) aged between 65-74 years, who were considered ‘irregularly active’, to gain their perceptions on physical activity and cognitive health. Feedback from the focus groups suggested motivators to increase participation in physical activity included self-motivation and having a routine or schedule. Participants confirmed that group run activities were motivational, as they provided the opportunity for social interaction where they could chat and listen to others, as well as contribute to the conversations and activities themselves. They also reported that they went to

exercise classes to keep their community healthy and safe. Socialisation activities within an intervention have the potential to increase motivation to take part in physical activity, providing participants who wish to meet up with others the opportunity to do so.

Program design

Physical activity programs targeting older adults should be designed specifically for older adults, to enable them to participate more readily. Design factors need to address falls, inconvenience and health problems (Mathews et al., 2010). Program design is important to keep older people interested and engaged in physical activity (Jancey et al., 2011).

King et al. (2007) conducted a study specifically investigating how program design affects participation in regular physical activity. In-active men and women aged 55 years and older (n=218) were recruited and randomly assigned to human advice or automated advice via telephone-linked computer, or a health education control group who attended weekly health education classes. At six months, participants in both intervention groups showed significant improvements in weekly physical activity (moderate to vigorous activity >150 minutes/week on average) compared with the control group, with most of these differences maintained at 12 months. The study demonstrated that an individual motivation/counseling session, followed by booster telephone call, delivered either by phone or computer, could significantly increase levels of physical activity of intervention participants in comparison to the control group (King et al., 2007). Therefore, the inclusion of phone calls that provide support and advice may be a useful aspect of program design, to increase participation in physical activity behaviours.

Tailoring of programs is increasingly recognised as a useful criterion of program design. For example, results from the 2002 nation-wide survey of the Physical Activity Monitor in Canada confirmed that physical activity programs needed to be tailored to enhance peoples' confidence to take part in physical activity (Pan et al., 2009) and subsequently increase participation rates. Tailored programs have been

shown to be effective in reducing attrition of participants (Burke et al., 2008; Jancey et al., 2008; Morey et al., 2009). Interventions that have provided booklets with information on diet and physical activity and which encouraged older adults to set their own goals showed improvements in older adults' dietary and physical activity behaviours (Burke et al., 2008; Morey et al., 2009). Programs that offered flexibility, so participants could participate in physical activity at a level that suited their ability and progressed at their own pace, have also been successful (Jancey et al., 2008).

2.5 Nutrition

Eating adequate amounts of fruit and vegetables provides essential nutrients for healthy tissue growth, bolsters the immune system and is protective against chronic diseases (Department of Health and Ageing, 2006; Doerksen & Estabrooks, 2007), such as:

- Cardiovascular disease (World Health Organization, 2012);
- Some cancers (Schatzkin et al., 2008; World Cancer Research Fund / American Institute for Cancer Research, 2007; World Health Organization, 2012);
- Stroke (He et al., 2006; World Health Organization, 2012);
- Type 2 diabetes (Carter et al., 2010; World Health Organization, 2012) and
- Obesity (Howard et al., 2006; World Health Organization, 2012).

Reducing dietary fat can be beneficial to weight management (Foster et al., 2010; Howard et al., 2006; Ley et al., 2004; Vincent-Baudry et al., 2005). Consumption of calcium can help in the prevention or management of osteoporosis (Francis, 2008; Rizzoli et al., 2008) and therefore help to reduce fracture risk. The WHO (2004) recommends a varied diet to achieve energy balance and healthy weight, with limited amounts of sugar and fat, an increased consumption of fruit, vegetables, legumes, whole grains and nuts and to limit salt consumption from all sources (World Health Organization, 2004). As poor nutrition can lead to higher susceptibility to non-communicable diseases (NCDs) including cardiovascular disease, type 2 diabetes,

stroke and some cancers (World Health Organization, 2012). In many developing countries there is a rise in over-nutrition, leading to an increase in diet-related chronic disease (Kearney, 2010).

2.5.1 Australian Dietary Guidelines

The National Health and Medical Research Council Australian Dietary Guidelines for all Australians encourage people to improve their nutritional health, based on the best available scientific evidence. It explains how to make dietary decisions and select foods that improve health and well-being, while reducing the risk of developing chronic diseases. With the rising incidence of death and disability due to diet-related chronic disease in the Australian population, it is important that guidelines are available to help allow people to make better food choices (NHMRC, 2011). The Australian Guidelines have recently been updated (NHMRC, 2013) to ensure diet, nutrition and health information reflected latest knowledge and to ensure information was clear and practical, so that Australians could make healthier food choices to reduce the risk of diet-related conditions (NHMRC, 2011).

2.5.2 Dietary guidelines for adults over 60 years

Older adults need to consume foods that are more ‘nutrient dense’, compatible with age-related changes to nutritional and energy requirements. It is also recommended that for improved health older adults should follow a diet that is high in fibre and low in saturated fats (NHMRC, 1999). In the past few decades energy and fat intake have both increased in the US population (Chanmugam et al., 2003). Worldwide trends are shifting towards an increased consumption of energy-dense foods high in saturated fats and sugars (World Health Organization, 2012).

2.5.3 Dietary intake of older Australians

While figures on Australians’ dietary behaviours are limited, the mean energy consumption of older Australians has increased (Bennett et al., 2004; Flood et al., 2010). In 2007-08 the National Health Survey and an evaluation of the 1995 National

Nutrition Survey (most recently conducted in Australia), both reported that older age groups had the highest proportion of people meeting the recommended intakes of fruit and vegetables (ABS, 2009). Yet, in older adults (51-64 years) only 35% met the recommended serves for fruit and vegetables (Magarey et al., 2006); as few as 10% met the recommended daily serves of two fruit and five vegetables (ABS, 2009).

2.5.4 Barriers to improving diet

In order to improve consumption of fruit and vegetables interventions need to address relevant barriers (Pollard et al., 2008). Changing dietary patterns may be difficult due to barriers such as cost (Kamphuis et al., 2007), availability (Glasson et al., 2011), preparation time (Glasson et al., 2011) and knowledge on how to prepare food for consumption (Leone et al., 2012).

Glasson et al. (2011) reported the findings of a computer-assisted telephone interview survey addressing fruit and vegetable consumption. They interviewed 1403 parents and carers (aged 25-44 years) of primary-school-aged children from the Hunter and New England regions of New South Wales, Australia. Barriers for the consumption of fruit included quality, availability, cost and wastage. For vegetables the main barriers were lack of time to prepare, food preferences, taste and cost. Kamphuis et al. 2007 reported that people from lower SES areas confirmed cost played a big part in choice of fruit and vegetables consumed, when compared to people living in higher SES areas (Kamphuis et al., 2007). Similar findings were reported in Western Australia where it was found that interventions for implementing public health strategies, specifically fruit and vegetable consumption and supply, would need to address the following barriers: high costs, family and personal eating habits that are difficult to change, a false sense that consumption of fruit and vegetables was already ample, limited skills for preparation of fruit and vegetable dishes, and perceptions of long time frames to prepare vegetables (Pollard et al., 2008).

A study conducted in North Carolina, US, provided insight on barriers to fruit and vegetable consumption in people of low-income and receiving government assistance. Participants (n=341) were recruited from waiting rooms of the Division of Social Services (DSS) offices. Eligible individuals who completed a written self-completion survey reported the main barriers to eating fruit and vegetables were cost and not having time or knowledge to quickly and easily prepare fruit and vegetables (Leone et al., 2012).

Common barriers to consumption of fruit and vegetables were reported in a study in Northern Ireland (Appleton et al., 2009). Participants (n=426) recruited from a data sampling company, aged 65 years and over, were interviewed over the phone. The major barriers included disliking particular fruits and vegetables, lack of awareness of current recommendations for consumption, an unwillingness to change habits, difficulties in achieving consumption and problems with ease of consumption. Lesser barriers reported were cost and access to fruit and vegetables.

The review demonstrates that it is important to target barriers and accommodate for flexibility of dietary behaviours in order to improve food consumption and dietary patterns.

2.6 Theoretical basis for study

When developing the theoretical basis for the Physical Activity and Nutrition for Seniors (PANS) intervention, behaviour change theories and models were reviewed to select those that would best ‘fit’ the target group, older adults, and study aims.

2.6.1 Behaviour change theory

Behaviour change theories aim to explain reasons for a person’s change in actions or patterns of behaviour. Behaviour change theories or models that focus on different factors to explain these changes (Glanz et al., 2008), include the Health Belief Model, Social Cognitive Theory and Transtheoretical Model. These theories also have specific variables or components including self-efficacy, perceived barriers,

benefits and cues to action (Bandura, 1997). Behaviour change strategies have been used to help improve health behaviours in many age groups, but there is limited evidence on the effectiveness of these with older adults (Witham & Avenell, 2010).

2.6.2 Health Belief Model

The Health Belief Model (HBM) is one of the most popular models used to explain health behaviour. It is based on the concept of a health-related act being reliant upon the existence of three factors: health concern, perceived threat and a belief that the perceived benefits outweigh the perceived costs (Harrison et al., 1992) The increased possibility of poor health in older people makes the HBM model more relevant to this age group (Sahyoun et al., 2004). A number of interventions focusing on physical activity and nutrition in older adults have effectively utilised the HBM framework (Fitzpatrick et al., 2008; Jancey et al., 2008; Manios et al., 2007).

2.6.3 Social Cognitive Theory

The cognitive-behavioural approach is an essential element of behaviour change interventions (Artinian et al., 2010). The HBM is closely related to Bandura's Social Cognitive Theory (SCT). The SCT is built around the assumption that behaviour is determined by extrinsic (external) incentives (the value of an outcome or object) and expectations (behaviour and the environment) and self-efficacy (Artinian et al., 2010; Rosenstock et al., 1988). The theory incorporates personal and cognitive factors, human behaviour and environmental events, which all interact reciprocally to shape how a person behaves (Bandura, 1986).

Self-efficacy can be useful in promoting behaviour change. Self-efficacy relates to an individual's belief in their ability to perform a behaviour required successfully; for example, increasing their level of physical fitness, in order to generate the required outcomes (Artinian et al., 2010; Rosenstock et al., 1988). It is assumed that people will perform a health-related action if they have a positive expectation that a negative health condition can be avoided and they believe they can successfully take the recommended health action (Bandura, 1986).

Goal setting has been shown to be a successful strategy that can result in changing health behaviours and helps to increase self-efficacy (Bandura, 1997; Dishman et al., 2010). Goal setting allows individuals to proactively engage in their own development and make things happen as a result of their own actions (Bandura, 1986, 1997). In their systematic assessment of reviews, Greaves et al. (2011) found positive changes in terms of dietary outcomes, physical activity and weight loss, due to the use of theoretical-based intervention techniques including goal setting, prompted self-monitoring, the provision of feedback on performance and goal revision.

2.6.4 Transtheoretical model

The Transtheoretical model (TTM) suggests that people move through six stages of change in order to change health behaviour. The six stages are: pre-contemplation, contemplation, preparation, action, maintenance, and termination. Research on recruitment, retention and progress using stage-matched interventions that have applied this model have been successful (Prochaska & Velicer, 1997).

Intervention programs for older adults have used a variety of theories to elicit behaviour change. Some interventions with older adults have used the TTM of behaviour change (Kolt, 2010; Kolt et al., 2009); others have used the SCT (Stewart et al., 2001) or a combination of the two (Morey et al., 2009), although these studies have targeted adults older than 70 years, or those with pre-existing conditions.

2.7 Single risk factor interventions

Interventions are designed to change knowledge, attitudes or behaviour in some way. Single risk factor interventions focus on one factor only. Focusing on one factor at a time can be very effective. Single risk factor interventions for older adults, targeting either diet (Keller et al., 2006; Thomson et al., 2005) or physical activity (Jancey et al., 2008; Kolt et al., 2009) alone, have increased levels of physical activity (Dishman et al., 2010; Dorgo et al., 2011; Kolt, 2010; Norton et al., 2011; Schneider et al., 2011) or improved nutrition (Bernstein et al., 2002; Keller et al., 2006; Wright

et al., 2011). Interventions have taken place in a variety of community settings, within a range of time frames (de Jong et al., 2007; Stewart et al., 2001). The following section discusses single risk factor interventions.

2.7.1 Physical activity interventions

Physical activity interventions aim to improve the physical activity of participants. Interventions may focus on one or many components of physical activity including fitness, strength and flexibility. They may be delivered by one, or a number of methods including phone calls, written and mailed information, small group meetings and one-to-one discussions. Physical activity interventions can take place in a variety of settings such as fitness centres, hospitals, and local parks or in the home.

Physical activity interventions with older adults have had positive results (Baker et al., 2008; de Jong et al., 2007; Dishman et al., 2010; Dorgo et al., 2011; Jancey et al., 2008; King et al., 2007; Kolt, 2010; Norton et al., 2011; Schneider et al., 2011; Stewart et al., 2001; Tudor-Locke et al., 2004).

A number of studies have only focused on walking (Baker et al., 2008; Jancey et al., 2008; Tudor-Locke et al., 2004) and few have encouraged strength and flexibility (Schneider et al., 2011). Other studies have recruited participants from specific populations including worksites (Dishman et al., 2010), tertiary hospital and government departments (Norton et al., 2011), adults who attended outreach education (Schneider et al., 2011), clients from medical health maintenance organisations (Stewart et al., 2001) and diabetes education centres (Tudor-Locke et al., 2004). Interventions have taken place over short time frames (Baker et al., 2008; Dishman et al., 2010; Kolt, 2010; Norton et al., 2011; Schneider et al., 2011; Tudor-Locke et al., 2004) or had small sample sizes (Baker et al., 2008; de Jong et al., 2007; Dorgo et al., 2011; King et al., 2007; Stewart et al., 2001).

Physical activity interventions for adults have used a mixture of young and middle-aged to older target groups aged between 26-58 years (Baker et al., 2008; Dishman et al., 2010; Norton et al., 2011; Tudor-Locke et al., 2004). Others have targeted adults

in older age groups, from 65-90 years (Dorgo et al., 2011; Jancey et al., 2008; Kolt, 2010; Stewart et al., 2001), with none targeting older adults aged 60-70 years. These interventions are discussed in the following section.

Walking interventions

Walking, a simple, accessible form of exercise to increase physical fitness can be performed anywhere by individuals or in groups. Olgilvie et al. (2007) undertook a systematic review of 48 studies to assess the effects of interventions promoting walking in individuals and populations (schools, workplaces). It was reported that interventions to promote walking could contribute substantially towards increasing the activity levels of the most sedentary individuals, although sustainability and generalisability remained uncertain. The results suggest that interventions tailored to people's needs, targeted to the most sedentary, at individual, household or at group levels, can encourage people to walk more.

Jancey et al. (2008) reported on a randomised controlled trial (RCT) in Australia that also encouraged walking. It was designed to motivate older adults to improve their levels of physical activity over a six-month period. The participants, in Western Australia, were recruited through the Federal Electoral Roll; participants' names were randomly generated and potential participants were sent a postcard explaining the study, forewarning them of phone calls to establish suitability and recruitment to the study. The study recruitment procedure demonstrated the importance of recruiting participants randomly, to acquire a broad sample of the population to make study results more generalisable, as opposed to being recruited through advertising. Participants were aged 65-74 years and allocated to either intervention (n=177) or control groups (n=236). The intervention was a neighbourhood-based program that encouraged older adults to walk to improve their level of physical activity gradually over six months. It was successful in increasing the physical activity levels of the intervention group by way of the tailored/progressive program. The program demonstrated the appropriateness of walking as a form of physical activity for the age group (Goodrich et al., 2007; Kahn et al., 2002; Ogilvie et al., 2007). It also demonstrated the usefulness of small groups for socialisation, learning, sharing of

new skills and for social support (Kahn et al., 2002). The program used limited written resources to motivate the participants that were not developed with any input from the target group. The study by Jancey et al. (2008) demonstrated the appropriateness of small groups for social support and demonstration of new skills, the use of tertiary students in a support role for intervention programs, walking as an appropriate method for older adults to improve their physical activity, and the effective method of recruiting participants through the Federal Electoral Roll to ensure suitable randomisation.

Pedometer interventions

Pedometers have been used with a number of interventions aimed at increasing physical activity (Baker et al., 2008; Bravata et al., 2007; Kolt, 2010). Tudor-Locke et al. (2004) reported on the First Step program conducted in Ontario, Canada, which aimed to increase the number of daily steps participants took when using pedometers. The program, a 16-week intervention (24-week follow-up) for adults with type 2 diabetes, utilised group meetings and goal setting. Participants, recruited through a diabetes' education centre (n=60), were aged between 47-58 years and randomly assigned to intervention (n=30) and control (n=30) groups. Results taken at 16 weeks confirmed that a pedometer-based intervention can help increase the number of steps taken in a day, although results were not maintained at 24 weeks follow-up. The generalisability of this program may be limited due to the small numbers and homogeneity of the group, all being adults with type 2 diabetes, and as all were recruited from a diabetes' education centre they were likely to be more motivated. It also took place over a short period of time, which may not have been long enough to encourage long-term behaviour change.

Kolt et al. (2009) described the Healthy Steps RCT intervention that compared the efficacy of a pedometer-based Green Prescription (Elley et al., 2003; Kerse et al., 2005) to the time-based Green Prescription, to determine if the pedometer-based intervention could improve and maintain physical activity levels in sedentary older adults. Of 330 participants aged from 68-80 years recruited at baseline, numbers dropped at three months post-intervention (n=278) and slightly at 12 months follow-

up (n=270). Results confirmed that pedometer use helped to increase physical activity levels.

Baker et al. (2008) aimed to increase walking in low SES individuals in Scotland using a pedometer-based intervention. Participants (n=79) aged 16-65 years were recruited via mail drops, advertisements in the local newspaper, posters displayed in local shops, physician surgeries and community stalls. Participants were randomly assigned to control (n=40) and intervention (n=39) groups. Step counts were collected at baseline and at the end of the intervention. The 12-week combined pedometer walking and physical activity consultation program was found to be effective in increasing walking and decreasing sedentary behaviour of participants in the intervention group. Although results were positive, the small sample size, short time frame and recruitment method may affect generalisability of the program results. There was no long term follow-up to confirm if participants' increased levels of physical activity were maintained.

Norton et al. (2011) compared the methodological strategies of two short-term, intense, physical activity interventions. The participants were aged between 18 and 60 years, from a variety of backgrounds: students, health professionals, public servants, academics and cleaners, recruited from the top 40% of the most advantaged metropolitan areas of South Australia. The 40 day randomised controlled trial consisted of three arms: 1) an active control group (n=135); 2) a home-based pedometer group (n=251); and 3) a group-based intensive group (n=148). The results were positive for both intervention groups, with better results from the group-based intensive group compared to the home-based pedometer group. These results show that a combination of the two interventions may also result in improved levels of physical activity. The age range of participants was broad and included young adults, but was restricted to people aged up to 60 years old. A large percentage of participants were from higher SES, which may make it harder to replicate the study with people of lower SES.

To date, walking interventions for older adults have not specifically targeted the 60-70 year age group (Baker et al., 2008; Jancey et al., 2008; Kolt, 2010; Tudor-Locke et al., 2004), although this is an important age to target, as it is the transition period into retirement. Studies of walking interventions do not reflect the community population because they have used small sample sizes (Baker et al., 2008; Tudor-Locke et al., 2004), or short time-frames (Baker et al., 2008; Tudor-Locke et al., 2004) and many have restricted recruitment of participants (Baker et al., 2008; Kolt et al., 2009; Tudor-Locke et al., 2004).

Community-based interventions

Another study that aimed to improve older adults' levels of physical activity was the Groningen Active Living Model (GALM). It was a 12-month study in the Netherlands for sedentary and underactive older adults (n=181), aged 55-65 years (de Jong et al., 2007). The intervention aimed to increase energy expenditure in participants, using a randomised (cluster) design. The intervention consisted of a control (n=102) and intervention group (n=79). The generalisability of this intervention is possible, as the study was set in a community setting and participants were considered to be a representative cross-section of the Dutch population because they came from municipalities with differing degrees of urbanisation. De Jong et al. (2007) reported that the results were positive with improvements in energy expenditure in recreational sports activities, other leisure time activities (only at six months) and total physical activity. The positive results demonstrate the usefulness of a number of strategies in the intervention program that promoted physical activity. These included individualised goal setting, regular self-monitoring and reinforcement for reaching goals (Dishman et al., 2010), all aimed at increasing self-efficacy. The study was one of the few to provide information of a community-based strategy targeting older sedentary/underactive adults, a group that can benefit from increased physical activity. There was however, a low retention/completion of data rate, which may have been due to the high subject burden in regards to testing. In order to reduce attrition and obtain more complete data subject burden needs to be taken into consideration when developing an evaluation process in interventions for older adults.

Community-based programs have become a priority for older adults, in an attempt to bring programs to the participants. The Community Healthy Active Model was a one-year RCT to promote increased physical activity in underactive sedentary older adults (Stewart et al., 2001). Participants (n=164) had a mean age of 74 years and were randomised into control, or intervention groups. The intervention encouraged older adults to develop their own physical activity regime to suit their abilities, preferences and health; this could include the joining of community-based classes or programs. Participants were provided with guidance, support, skill-building opportunities and information from study staff in the form of monthly workshops, telephone counselling and newsletters. There was a significant increase in the intervention groups' levels of physical activity, in comparison to the control group. The intervention group increased caloric expenditure by 687 calories per week in physical activities (Stewart et al., 2001). Despite the positive results, the recruitment procedure may affect generalisability to other settings, as the participants were members of two medical health maintenance organisations, recruited through a large multi-specialty group practice and were fairly well educated. Future research should take place in communities in more diverse settings, particularly with minority groups and people of low SES.

Flexibility and strength interventions

Flexibility and strength programs have become more prevalent, due to the recognised benefits and appropriateness for older adults (Green, Campbell, et al., 2009; Shubert, 2011). Schneider, Cook and Luke (2011) explain the unexpected results arising from an intervention that compared cognitive-behavioural therapy to self-reported exercise behaviour and functional outcomes in adults. Participants aged between 71-77 years, were randomised into three groups: 1) control (n=109); 2) therapy intervention (n=113); and 3) education intervention (n=110). The participants were recruited through newspaper articles, mailings and those who attended outreach education, which may affect generalisability of the program. Data on self-reported exercise behaviour and physical function outcomes was measured at three month intervals, over a one-year time frame. The intervention components encouraged participants to exercise independently. They were advised to incorporate a warm-up, upper and

lower body flexibility and strength exercises using resistance bands and a cool down at the end of their exercise session. Participants were also encouraged to walk for cardio-fitness. Both exercise groups demonstrated higher results in relation to the control group in strength exercises and improved walking speed. The program took place at community exercise facilities, but results suggest that a home-based exercise program encouraging walking and incorporating the use of resistance bands to improve strength and flexibility in older adults could be effective. Participants were over 70 years of age, which may have allowed them to attend an intervention based at a local community facility more readily, as opposed to participants aged 60-70 years who may still be in the workforce, or newly retired.

Cost effectiveness of physical activity interventions

Muller-Riemenschneider et al. (2008) examined the literature to evaluate the cost-effectiveness of physical activity interventions targeted at healthy adults to identify cost-effective components. Results suggested that the delivery of print messages were not only more effective in the long term, but also lower in costs. The delivery of print messages was considered to be highly cost-effective, in comparison to using telephone contact as the primary mode of delivery to promote physical activity intervention messages (Muller-Riemenschnieder et al., 2008). Tailored-print interventions have also been shown to be a promising approach for promoting physical activity in adult populations (Short et al., 2011).

There is a need to develop and implement physical activity interventions that have larger sample sizes, target 60-70 year olds and include the general population. Interventions for older adults need to allow participants to take part in physical activity that is tailored to suit their individual needs. Physical activity interventions for older adults need to be low-cost, targeted to people of low SES and home-based. Interventions need to be more accessible to the general population, so people do not have to make large changes to their work or family routines, or have to rely on transport, or weather conditions, to enable them to take part.

2.7.2 Nutrition interventions

Nutrition interventions aim to improve the dietary habits of participants by focusing on either specific goals or food groups. The settings of nutrition interventions also vary between local community centres, universities, schools, or in the home. They may also be delivered in a number of ways such as mailed information, one-to-one meetings, group meetings and telephone calls.

Interventions have been aimed at improving nutritional habits of older adults (Bernstein et al., 2002; Howard et al., 2006; Johnson et al., 2004; Keller et al., 2006; Thomson et al., 2005; Wright et al., 2011). Not all have been based on behavioural theory (Keller et al., 2006; Thomson et al., 2005). Interventions:

- Have had a restricted time frame (3 months) (Johnson et al., 2004; Wright et al., 2011);
- Have used small sample sizes (70-150) (Bernstein et al., 2002; Johnson et al., 2004; Thomson et al., 2005; Wright et al., 2011);
- Have targeted fruit and vegetable consumption only (Johnson et al., 2004; Keller et al., 2006; Thomson et al., 2005);
- Or in the case of a few have focused on other foods (dairy, saturated fats or grains) (Bernstein et al., 2002; Howard et al., 2006; Wright et al., 2011).

Nutrition-based interventions for adults have included middle-aged adults aged from 40 years (Thomson et al., 2005; Wright et al., 2011), or older participants aged older than 69 years (Bernstein et al., 2002), with very few targeting adults from the age of 60 years (Johnson et al., 2004). Interventions have also targeted specific groups within the general population such as postmenopausal women (Howard et al., 2006) or homebound seniors (Johnson et al., 2004).

A review of 25 interventions by Sayoun et al. (2004) reported that 70% targeted people who were generally healthy and mobile and the other 30% targeted people who had, or were at risk of, developing chronic disease. The research indicated that it was still possible and important to impart knowledge to older adults (reinforcing

messages, limiting educational messages, using appropriate theories of behaviour change), as certain dietary modifications are needed in later life, to address the metabolic and physical changes that occur (Sahyoun et al., 2004).

Johnson et al. (2004) aimed to increase fruit and vegetable intake of homebound elders in the Seattle Senior Farmers' Market Nutrition pilot program. The intervention was designed to increase fruit and vegetable intake by delivering baskets of fruit and vegetables to low-income, homebound, older adults. Participants (n=100) were recruited to complete a pre- and post-questionnaire from those who received baskets (n=480). Data was compared to a control group (n=52), who lived outside the project service area. Consumption of fruit and vegetables in the intervention group significantly increased over the five month period by 1.04 servings, in comparison to the control group (95% CI, 0.68-1.95, $P<0.001$). The authors concluded that the delivery of fruit and vegetables to homebound older adults is a successful way to increase consumption of fruit and vegetables. This type of intervention would be costly and require community and policy support, or business/corporate partnerships in order to be effective and sustainable.

Another home-based study that targeted nutrition in older adults was based in Boston, US (Bernstein et al., 2002). A 6-month nutrition intervention, it was aimed at improving fruit and vegetable consumption and increasing calcium intake in functionally impaired, community dwelling elders. The study was a randomised controlled trial (RCT) with small numbers of participants (intervention (n=38); control (n=32), aged 69 years and older. The intervention incorporated a number of methods including education (booklet, newsletters), home visits and telephone contact. Bernstein et al. (2002) reported that participants demonstrated positive improvements in all objectives, with participants increasing their daily servings of fruit, vegetables and calcium by one serve each. Although results were significant, the small sample size and recruitment method of participants, via local newspaper and presentations, limits the generalisability of this intervention. The sample population was also further restricted as participants needed to have reported at least

two concerns in physical function, as determined by the Medical Outcomes Survey (Stewart et al., 1988), in order to participate in the study.

Evergreen Action Nutrition (EAN) was a community planned and run program, that took place in a seniors' recreation centre in Guelph, Ontario, Canada (Keller et al., 2006). The program was developed to prevent chronic disease and maintain health by providing nutrition education to older adults. It consisted of food demonstrations, dietetic counselling, food workshops that included nutrition information and food tasting, men's cooking groups, monthly displays and newsletters. Older adults were free to choose which activities they took part in over the three-year period of the intervention. Almost 65% of members were exposed to components with 50% of the participants confirming that they were frequent users of the program. Follow-up survey data from randomly selected members (n=251), confirmed that fruit and vegetable intake improved from baseline. At baseline 57.4% ate few fruit and vegetables, 6.6% ate less than three times a day compared to 42.7% and 3.3% respectively at follow-up. At post-intervention, however, 37.3% of participants reported a low consumption of fruit and vegetables compared to 53.7% of non-participants. Greater changes in food practices originated from the food demonstrations, which encouraged increases in fruit and vegetable intake by changing cooking methods. The program demonstrated the positive results of involving the target group in an intervention from the planning stages, through to implementation and evaluation. It confirmed that a variety of activities and methods of delivery are required to ensure that program objectives are accessible to all participants. Generalisability of this program is limited, as the intervention took place with seniors who attended a recreation centre, and only interested and motivated members took part.

A four-year study by Thomson et al. (2005) was aimed at improving the nutrition of women who had been treated for breast cancer and identify changes in body composition, via anthropometric measures. Participants (n=52) aged between 18-70 years from the Arizona site of the Women's Healthy Eating and Living Study, were randomly allocated into intervention and control groups. The intervention group was

prescribed a diet high in fibre, fruit and vegetables, and low in fat. Participants received regular dietary counselling over the telephone, via newsletters and in monthly cooking classes. Control group participants were given materials and general instructions consistent with current cancer prevention guidelines and were offered less regular cooking classes and newsletters, but received no dietary counselling. Results from the study showed no major changes in body composition, or anthropometric measures, but change did occur in the intervention group's diet, with a decrease in dietary fats and increased consumption of plant foods (fibre). Despite the major changes in diet observed in this study, generalisability is limited as the participants were previously treated for cancer, which may have made them more motivated to improve their dietary habits, due to perceived susceptibility to breast cancer. The participants had been recruited from a previous study and the small sample size may also have a negative effect on transferring this intervention to the general population.

The Stages to Healthy Eating Patterns study (STEPs) conducted by Wright et al. (2011) was designed to improve short-term dietary behaviour by way of printed, tailored iterative dietary feedback or nutrition education sessions. The three month RCT study was aimed at middle-aged adults (40-65 years) who were diagnosed with one or more risk factors of cardiovascular disease, or who had reported a previous cardiac event (heart attack, angina). Participants (n=178) were randomly assigned to one of three groups: dietitian-led small group nutrition education sessions (n=58); tailored iterative printed dietary feedback posted via mail (n=58); or wait listed (n=62) to receive one of the interventions in four months' time (post-intervention). Evaluation was completed both before and after the 3-month intervention. All groups were successful at reducing intake of saturated fats. Intake of fruit only increased in the printed dietary feedback group, intake of vegetables only increased in the nutrition education group and there was little improvement in cereal and grains intake for any of the groups. As the recruitment was voluntary, via advertisements (newspaper, radio and television), as opposed to random mail-outs or phone-calls, participants may have had an increased interest in dietary change. Also, the participants could have been more willing to improve their dietary habits due to their

perceived susceptibility to cardiovascular disease and previous cardiac events. The study took place over a short time period with no long term follow-up to see if dietary habits were maintained. A longer time-frame may be required to properly assess dietary behaviour patterns.

It is important that further investigation target improvements in the nutrition of older adults for single risk factor interventions. Interventions should have large sample sizes, time frames of at least six months and aim to improve diet following recommended guidelines (NHMRC, 1999; World Health Organization, 2004), such as reducing consumption of saturated fats, as well as increasing fruit and vegetable consumption. Interventions need to be developed for the 60-70 year age group who are becoming a larger proportion of the Australian population (ABS, 2008b), in order to encourage them to improve their eating habits and help to reduce their obesity levels.

2.8 Multiple/combined risk factor interventions

Multiple/combined risk factor interventions have increased as the benefits of working on more than one risk factor at a time has been demonstrated (Villareal et al., 2011). It has been suggested that the synergistic effects of working on two or more health-related behaviours at a time may reduce costs and increase efficiency of interventions (Clark et al., 2011). There continues to be an urgent need for interventions that can effectively modify more than one risk factor concurrently, as there are still gaps in our knowledge on the best ways to design, implement and evaluate these programs (Goldstein et al., 2004; Hyman et al., 2007; Orleans, 2000; Prochaska et al., 2010; Villareal et al., 2011).

Physical activity and nutrition interventions that include the 60-70 year age group have also targeted younger adults (van Keulen & Keulen, 2011), older adults (Burke et al., 2008; Clark et al., 2002; Clark et al., 2005; Frimel et al., 2008; Greaney et al., 2008; Greene et al., 2008; Jancey et al., 2011; Lee et al., 2011; Villareal et al., 2011). A few even included both young and old age groups (Bourke et al., 2011; Ross et al., 2012). A limited amount of interventions have been home-based (Burke et al., 2008;

Burke et al., 2012; Clark et al., 2005; Goodpaster et al., 2010; Greaney et al., 2008; Lee et al., 2011; Morey et al., 2009; van Keulen & Keulen, 2011). A number of the interventions have only had a small sample size (Bourke et al., 2011; Burke et al., 2008; Frimel et al., 2008; Goodpaster et al., 2010; Villareal et al., 2011), or recruited participants from restricted population groups within the general population (Bourke et al., 2011; Frimel et al., 2008; Goodpaster et al., 2010; Lindström et al., 2006; Lindström et al., 2003; Morey et al., 2009; Ross et al., 2012; Simkin-Silverman et al., 2003; van Keulen & Keulen, 2011; Villareal et al., 2011). Few have targeted low to middle SES older adults who are sedentary (Burke et al., 2008; Lee et al., 2011; Morey et al., 2009), or considered otherwise healthy (Burke et al., 2008; Clark et al., 2005; Greaney et al., 2008; Greene et al., 2008; Lee et al., 2011). In the following paragraphs interventions that target both physical activity and nutrition behaviours are discussed.

2.8.1 Physical activity and nutrition interventions

A few risk factor interventions focusing on increasing the physical activity levels of older adults and improving their diet have had positive results (Clark et al., 2005; Greaney et al., 2008; Morey et al., 2009; Villareal et al., 2011; Withrow & Alter, 2010). A number of these interventions, however, have recruited a specific population that did not reflect the general population (Bourke et al., 2011; Frimel et al., 2008; Goodpaster et al., 2010; Lindström et al., 2006; Morey et al., 2009; Ross et al., 2012; Simkin-Silverman et al., 2003; van Keulen & Keulen, 2011; Villareal et al., 2011), or they targeted a broad age range (Bourke et al., 2011; Ross et al., 2012; van Keulen & Keulen, 2011). As only a small number of interventions has reported on costing (van Keulen, 2010), other researchers intending to replicate their intervention are unable to determine if the intervention was high or low cost. Interventions have even provided food replacements to participants (Goodpaster et al., 2010), which is in conflict with nutritional guidelines (World Health Organization, 2004). Walls et al. (2011) in their critique of public health campaigns and obesity, confirm that the most likely strategies to decrease the incidence of obesity population-wide, are increased levels of physical activity, together with the adoption of healthier eating habits.

Researchers agree that there is a need for population-based studies targeted at older adults, to encourage improvements in dietary behaviours and physical activity levels, to enhance quality of life (Blair et al., 1996; Clark et al., 2011; Drewnowksi & Evans, 2001).

Multiple/combined risk factor interventions have taken place in a number of settings, including the home (Jancey et al., 2008; Lee et al., 2011; Morey et al., 2009), medical practices (Ross et al., 2012) and community (de Jong et al., 2007). They have utilised a variety of different strategies for older adults including goal setting (Burke et al., 2008; Jancey et al., 2008), mailed written materials (Lee et al., 2011) and telephone calls (Eakin et al., 2009; Morey et al., 2009). A few home-based diet and physical activity interventions have demonstrated positive effects on health outcomes (Greene et al., 2008; Jancey et al., 2011; Morey et al., 2009), including improved levels of physical activity (such as increased minutes of walking per week) (Jancey et al., 2011; Lee et al., 2011) and better nutrition habits (increased fruit and vegetable intake) (Bernstein et al., 2002; Greene et al., 2008).

Reach out to Enhance Wellness (RENEW) was a home-based diet and exercise program for older, overweight cancer survivors, that took place in the United Kingdom, US and Canada (Morey et al., 2009). The program aimed to determine if telephone and mailed print materials based on diet and exercise, could help reduce functional decline in older, overweight cancer survivors. Participants aged between 65-91 years (n=641) were recruited and randomly placed into control (n=322) and intervention (n=319) groups. The program took place over 12 months, with the controls receiving a delayed intervention. Participants reported a decreased rate of physical activity decline in comparison to the control group. Morey et al. (2009) reported that there were significant increases in physical activity (2.4-4.9 minutes/week), dietary behaviours (increased consumption of fruit and vegetables, reduced consumption of saturated fat) and overall quality of life in the intervention group, compared to the control group. Similar interventions may be beneficial to overweight older adults with other conditions, especially in relation to weight loss, taking into account the concerns about whether it is beneficial or detrimental for

overweight older adults (Bales & Buhr, 2008). As participants were all long-term cancer survivors who were overweight and many had self-referred to the program, they may have been highly motivated to lose weight; this may affect the generalisability of the program to the general population.

Another home-based intervention was the Study of Exercise and Nutrition in Older Rhode Islanders (SENIOR) project (Clark et al., 2002; Clark et al., 2005; Greaney et al., 2008; Greene et al., 2008). It focused on increasing exercise and fruit and vegetable consumption in community-dwelling older adults. The aim of the intervention was to compare the effectiveness of a multiple behaviour intervention to single behaviour interventions (Clark et al., 2002). The secondary aims were to analyse the effects of the intervention on general health outcomes, functional ability and investigate the movement of older adults along a continuum of health changing behaviours. Intervention materials were stage-tailored and consisted of newsletters, manuals, assessments, reports and coaching calls. The participants (n=966) were recruited through advertisements, direct mailing, fliers and presentations at senior housing sites. Participants were randomly assigned to one of four interventions: 1) increase fruit and vegetable consumption; 2) increase physical activity; 3) increase fruit and vegetable consumption and exercise; and 4) contact-comparison group. Fruit and vegetable consumption increased in the intervention group who received the fruit and vegetable intervention only by 0.5-1.0 serving per day, in comparison to those not receiving the intervention, yet there was no significant effect on weight over the 24 month intervention (Greene et al., 2008). Results from the changes in exercise intentions and behaviour over the long term (24 months), confirm that a community-based intervention can promote progression of the participants through stages of contemplation for physical activity (Greaney et al., 2008). This implies that sedentary adults could benefit from a low-cost, predominantly print-based intervention. Although effective, this study used an active recruitment method which may have had confounding influences on results and a majority of the community could have been exposed to the intervention, whether involved, or not.

Bourke et al. (2011) described a RCT lifestyle intervention in patients recovering from colon cancer. The prospective pilot study set out to test the efficacy of a home-based, supervised exercise and dietary program that compared combined exercise and diet, to standard treatment. Eighteen people (52-80 years) were recruited at 6-12 months post-operative, to either intervention arm. Meetings took place at a university rehabilitation facility. The findings of the impacts on dietary behaviour, aerobic exercise tolerance and waist-to-hip ratio (WHR) showed significant changes in fibre consumption ($p=0.044$) and a reduction in WHR ($p=0.002$). The results imply that lifestyle interventions with supervised exercise training and dietary advice are viable and have potential to make improvements. The study, however, had a very small sample size and recruitment was limited, as participants were all colon cancer survivors identified at follow-up nurse appointments, or from meeting lists in hospital clinics.

The Vitalum study was a home-based, computer tailored, motivational interviewing intervention that promoted increased physical activity and improved nutrition (van Keulen & Keulen, 2011). Participants (n=1629), aged between 45-70 years, were recruited through 23 Dutch general practices. Approximately 50% had been classified as 'hypertensive' by their general practitioner (systolic blood pressure >180 mmHg), according to the International Classification of Primary Care (Dutch College of General Practitioners, 2006). Participants were randomised into one of four groups: 1) tailored print communication (n=405); 2) telephone motivational interviewing (n=407); 3) combined print and telephone motivational interviewing (n= 408) and; 4) control group (n=409). The intervention was conducted over 43 weeks, with self-reported measurements taken at three time points. Results demonstrate that the intervention group participants all improved in physical activity and nutrition behaviours, in contrast to the control group. The ability to transfer the intervention to the general population is weak because 50% of participants were all classified as 'hypertensive', and the remaining participants were recruited if, on the baseline questionnaire, they failed to meet at least two of the three Dutch public health guidelines for fruit and vegetable consumption or participation in physical activity.

Goodpaster et al. (2010) conducted a single-blind randomised trial with severely obese adults (n=130), to determine the efficacy of a combined physical activity and weight loss intervention on the adverse health risks of severe obesity. Participants aged between 30-55 years were recruited from the community via television and newspaper advertisements, and mass mailings. Participants were randomised into a 12-month diet and physical activity intervention (n=67), or diet only (n=63), with a delayed physical activity component at six months. The results confirmed that the lifestyle intervention was effective, resulting in weight loss and favourable changes in cardio-metabolic risk factors, including reductions in abdominal adipose tissue, blood pressure and waist circumference. The results implied that a combined physical activity and nutrition intervention could make positive changes to severely obese participants. Generalisability may be an issue as the study had no control group, the sample size was small and participants were volunteers recruited through the media. The cost of replicating the study would be high, to cover the provision of meal replacements, financial incentives for participation and extra incentives for adherence to behavioural goals. A study of this type would not be suitable for a population-based intervention as it does not follow dietary guidelines and principles.

Current evidence-based data to guide the treatment of obese adults is limited and previous studies have been short term or limited to participants with specific health conditions (Villareal et al., 2011). Hence, Villareal et al. (2011) conducted a one-year RCT to evaluate the independent and combined effects of weight loss (diet) and exercise. Participants aged between 65-74 years were recruited through advertisements and underwent a comprehensive medical screening procedure, to ensure they were healthy. Participants (n=107) were randomly placed into one of four groups: 1) control (n=27); 2) diet (n=26); 3) exercise (n=26) and 4) diet and exercise (n=28). Results confirmed that a combination of weight loss (diet) and exercise was more effective than either single risk factor intervention. The diet and exercise group participants increased more on the physical performance test, peak oxygen and functional status, than either of the exercise or diet groups alone. They also improved consistently in strength, balance and gait outcomes, in comparison to the other groups. The study supports multiple risk factor interventions and suggests

that health promotion aimed at older adults could positively contribute to healthy ageing. Before transferal to the general population an intervention of this type would need to be replicated with a much larger sample to confirm effectiveness.

The longitudinal Survey in Europe on Nutrition and the Elderly: a Concerted Action (SENECA) study aimed to identify dietary and lifestyle factors that may contribute to healthy ageing (Haveman Nies et al., 2003). Baseline measurements, taken in 1988/89, were repeated in 1993 and 1999. The 2586 participants aged 70-75 years were recruited from a random age and sex stratified sample of inhabitants from 19 small European towns in Belgium, Denmark, France, Italy, Poland, Portugal, Spain, Switzerland and the Netherlands. Participants were rated on three health aspects at the three time points of the study: vital status, self-rated health and functional status. The results found that being physically inactive, having a low-quality diet and smoking were related to increased mortality risk (hazard ratios ranged from 1.2-2.1) and a decline in health status was correlated to inactivity and smoking. A healthy lifestyle at older age was positively related to decreased mortality risk and to a delay in decline in health status (Haveman Nies et al., 2003).

The Prevention and Reduction of Obesity through Active Living (PROACTIVE) study reported on the long-term (24 months) effects of a program encouraging behavioural intention changes in physical activity and nutrition within a primary health-care setting (Ross et al., 2012). The participants (n=490) were abdominally obese men and women aged between 25-75 years, recruited through their physicians and randomly assigned to usual care (n=241) or a behavioural intervention group (n=249). Results confirmed that those who took part in the intervention had a significantly decreased waist circumference at 24 months, compared to those who were in the usual care group, although these results were more significant in males than females at 24 months. These results suggest that a combined risk factor intervention promoting improvements to both physical activity and nutrition can produce positive outcomes, although in this case it was only restricted to the male intervention group at 24 months. Generalisability of this program may be restricted due to the recruitment procedure, as participants may have been more motivated to

lose weight due to their pre-existing conditions, visits to physicians and as it took place in a primary care setting. There may be a problem in replicating the intervention in a general older adult population, as although the sample size was fairly large, the age range of the sample was broad.

There is a need for more research into combined physical activity and nutrition interventions for older adults in the general population, as they are an increasing proportion of the Australian population (ABS, 2008b) and are a high burden to health care costs (AIHW, 2010). Interventions need to take place over longer time frames with larger sample sizes that are recruited from the general population. They need to be home-based and low-cost and should include mailed print materials and telephone contact for advice and feedback.

2.9 Effective components of behaviour change interventions

Physical activity and nutrition behaviour change interventions are comprised of the following components designed to achieve a desired outcome:

- Goal setting (Burke et al., 2008; Dishman et al., 2010; Lee et al., 2011),
- Self-monitoring of progress (Artinian et al., 2010; Jancey et al., 2011; Lemmens et al., 2008),
- The provision of written information (Doerksen & Estabrooks, 2007; Lee et al., 2011) and
- Support provided through sustained contact from guides or walk leaders (Jancey et al., 2008; Martinson et al., 2010), including telephone calls (Eakin et al., 2009; Eakin et al., 2007)).

A 12-week group-randomised intervention that used goal setting to improve levels of physical activity, was implemented in eight work sites along with eight ‘control’ worksites (Dishman et al., 2010). Participants (n=664) were aged from 19-64 years. Results showed a positive relationship between changes in goal setting, satisfaction, intention, commitment and self-efficacy with increased physical activity. The results

suggest that goal setting is a worthwhile technique to help improve behaviour change and self-efficacy in physical activity.

Telephone calls can be an effective component of behavioural change interventions (Eakin et al., 2007). Telephone interventions (n=26) targeting physical activity and dietary behaviour change were reviewed. Eakin et al. (2007) reported that 20 of the interventions demonstrated significant behavioural improvements, with 75% of those addressing both outcomes yielding positive results, 69% of physical activity studies and 83% of dietary behaviour studies reported positive results. Positive outcomes were consistent with interventions that included 12 or more phone calls and lasted between 6-12 months.

Greaves et al. (2011) conducted a systematic review to identify intervention components that increased effectiveness of physical activity and dietary interventions aimed at individuals at risk of type 2 diabetes and identified the following components:

- Aim to promote changes in both physical activity and diet.
- Use well defined, established behaviour change techniques (including goal setting, self-monitoring of progress).
- Encourage social support.
- Use a wide range of trained people in program delivery.
- Take place in a range of settings, including home, workplace, community.
- Use a variety of modes (group, individual, mixed).
- Maximise frequency of number of contact with participants.
- Be based on a systematic analysis of factors following the PRECEDE-PROCEED model or similar intervention design (Greaves et al., 2011).

Effective interventions to improve diet and increase physical activity behaviours have been attributed to the integration of these components (Burke et al., 2008; Jancey et al., 2011; Lee et al., 2011; Martinson et al., 2010), which could also be useful in interventions aimed at decreasing overweight and obesity, as type 2

diabetes is closely linked to excess body weight and a lack of physical activity (World Health Organization, 2012).

To better understand the translational process and provide recommendations for process evaluations of community-based research conducted in the future, Griffin et al. (2010) reviewed the process evaluation of two programs that aimed to increase physical activity in mid-life older adults. Participants (n=8159) aged from 62-79 years took part in the Active Living Every Day (ALED) (n=4689) and Active Choices (AC) (n=3470) programs, over the four years they were offered. The programs had different time frames ranging from 12 weeks-6 months. As a result of process evaluation the programs were modified in order to suit a variety of diverse adult populations. The interventions were flexible enough to be tailored to suit the given target group, which allowed for greater dissemination and reduced attrition (Griffin et al., 2010). This implies study results indicate that programs designed to allow for tailoring or flexibility can be beneficial to better suit the heterogeneous nature of participants. Generalisability is limited, however, as there was no control group for either of the programs and all data was self-reported, possibly resulting in some inherent risk of inaccuracy.

2.10 Conclusions

The proportion of people aged 60-70 years is increasing worldwide and people in this age group have a higher risk of developing chronic disease. Internationally, the rates of overweight and obesity levels are increasing amongst adults, and are reflected in older Australian adults. In the last two decades fat and energy intake of Australians has increased (Bennett et al., 2004), resulting in detrimental effects to body weight, with over 79% of Australians aged between 65-74 years now classified as obese or overweight (ABS, 2009). As people age, their levels of physical activity reduces and their nutritional needs change. Statistics confirm that almost 50% of older adults do not meet the national physical activity guidelines (Sims et al., 2006) and over 33% of these are completely sedentary. Of concern is the high association between excess body weight, chronic health problems and health care costs (OECD, 2010; Popkin, 2006b). A large amount of evidence confirms that increased physical activity and a healthy diet can slow down physiological changes associated with ageing, decrease the likelihood of developing chronic disease and, in turn, reduce health care costs.

Developing interventions to increase the levels of physical activity and improve the diet of people aged 60-70 years is important to decrease the number of older adults who develop chronic disease and in turn reduce health care costs. Interventions for the older population need to be flexible and low-cost.

A vast amount of literature on physical activity and nutrition aims to understand, describe and predict physical activity and nutrition behaviours, confirming the complexities of these health behaviours. The literature describes a variety of barriers, motivators and enablers with inconclusive evidence in regards to the effectiveness of physical activity and nutrition interventions.

Program components identified as being effective in improving older adults' physical activity and nutrition behaviours include program design, setting, modes of delivery, provision of support and program flexibility.

Intervention programs that only focus on one single risk factor in isolation, such as diet or physical activity, are reducing their potential effectiveness. When designing interventions aimed at improving health it is important that both diet and physical activity are combined, as these both interact to positively affect health. Multiple or combined risk factor interventions have improved physical activity and dietary habits in older adults.

There is strong evidence that robust and lasting changes to such health related behaviours as safe driving, smoking, alcohol consumption, physical activity and diet, are more likely under a comprehensive approach to health promotion (Howat et al., 2004). Such behaviours are not only shaped by individual choices and motivation, but are strongly associated with organisational, economic, environmental, and social factors (Department of Health, 2010; Sleet et al., 2007). Therefore, approaches that combine educational with other behavioural, environmental, policy and organisational changes are more likely to be the most effective (Howat et al., 2004). Nevertheless, there remains a role for well designed and implemented behaviourally based interventions that aim to modify specific behaviours, like physical activity and diet. In many of our communities today there are ongoing environmental, policy and organisational supports for such behaviours that complement the behaviourally based programs.

CHAPTER 3: Methodology

This chapter outlines the study design, suburb and participant selection process, measuring instruments used, data collection and analysis. It also provides details of the intervention program. Additional information on the methodology is provided in subsequent chapters, and appendix A contains a published paper which explains the project protocol. Details on evaluation and analysis are explained in Chapters 4-6.

3.1 Study Design

The study was a 6-month randomised controlled trial (RCT) that comprised the development, implementation and evaluation of a physical activity and nutrition intervention. The study aimed to increase levels of physical activity and enhance nutritional intake of insufficiently active 60-70 year olds, residing in low and medium socio-economic-status (SES) suburbs or neighbourhoods in the Perth metropolitan area. The intervention's implementation and data collection process is summarised in Table 3.1.

Table 3.1 Intervention process

Time frame	0 months Baseline	Intervention	6 months Post-test
Intervention Group	O_1	X_1	O_2
Control Group	O_1		O_2

O = observation X = intervention

3.2 Suburb selection

Following a stratified quasi-random sampling frame, 68 suburbs were selected from the Perth metropolitan area. Selection criteria for suburbs were: a) comprised of at least 14% of 60-year olds and above, reflecting Western Australia's state average (Department of Health WA, 2006); b) contained at least 120 people aged 60-70-year olds, to ensure a sample size sufficient for matching telephone numbers to the

electronic white pages. This left 189 suburbs of 93990 people aged 60-79 years. Suburbs more than 30 kilometres from the Perth Central Business District were excluded, as the program could not be properly administered by Group Guides (costs and time constraints). The suburbs were then divided into approximate thirds to determine lower, middle and upper SES.

Suburbs were arbitrarily matched for low and medium levels of SES using the Socio-Economic Index for Area (SEIFA) (ABS, 2008a), a value derived from income, educational attainment, employment status and skill level. The suburbs were then assigned to either the intervention group or the control group, using a table of random numbers (see Table 3.2). This strategy is based on a previous RCT conducted by the research group to recruit a similar study sample (Jancey et al., 2006).

Table 3.2 Assignment of study suburbs to intervention or control group

Intervention group suburbs	Control group suburbs
Lower SES (n=17)	*Lower SES (n=18)*
Balcatta	Armadale
Belmont	Balga
Carlisle	Beaconsfield
Coolbellup	Beckenham
Girrawheen	Bentley
Glendalough	Cannington
Gosnells	Cloverdale
Hazelmere	Hamilton Hill
Hilton	Kelmscott
Kewdale	Maddington
Lynwood	Marangaroo
Midland	Midvale
Osborne Park	Nollamara
Redcliffe	Queens Park
Rivervale	Spearwood
White Gum Valley	Swan View
Willagee	Tuart Hill
	Westminster
Middle SES (n=18)	*Middle SES (n=15)*
Dianella	Bibra Lake
Doubleview	Craigie
Edgewater	Fremantle
Ferndale	Greenwood
Forrestfield	Guildford
Hamersley	Innaloo
Lathlain	Joondanna
Maida Vale	Kalamunda
Munster	Kardinya
North Beach	Manning
North Perth	Menora
Palmyra	Mount Richon
Riverton	Warwick
Scarborough	West Perth
Stirling	Wilson
Thornlie	
Wanneroo	
Yokine	

3.3 Participant selection

Using the Federal Electoral Roll (FER), a sample of 7200 potential participants was randomly generated from the 68 Perth suburbs. Approximately 120 participants per suburb, was calculated as the required number to recruit 15 participants per suburb. This recruitment procedure was used in the research teams' previous research and found to be methodologically robust, cost-effective and highly successful (Jancey et al., 2006). Participants were required to be a) "insufficiently active", not achieving 30 minutes of moderate physical activity on at least 5 days/wk); b) aged 60-70 years old; c) healthy to the extent that participation in a low-stress physical activity program would not place them at risk; d) free from taking part in any research studies involving exercise or nutrition in the last five years; and e) following a diet that was considered 'normal' (unrestricted by any special circumstances).

3.4 Procedure

The Survey Research Centre at Curtin University was contracted to match telephone numbers (of the 7200 names from the FER) using the Perth Electronic White Pages and make the initial contact with participants. A matching yield with an 80% success rate was anticipated, based on previous research (Jancey et al., 2006). During the initial contact, the purpose of the call was explained and the caller determined if the participant met the selection criteria. A covering letter (Appendix C, Cover letter), consent form (Appendix D, Consent form) and self-completion questionnaire (Appendix E, Questionnaires), were then sent to the willing participants.

Of the 629 participants who agreed to enter the study (intervention n=326, control n=303) 478 participants (intervention n=248, control n=230) completed the baseline questionnaire and thereby officially entered the program.

Participants were advised to furnish a medical clearance and to complete a Readiness for Physical Activity Questionnaire (PARQ) (Shephard, 1988) (Appendix E, Questionnaires), before commencing the program. Included in the first 'mail out' to intervention group participants was a program booklet, calendar, exercise chart,

pedometer (and instructions) and a resistance band. The control group did not receive the program materials. Over the 6-month intervention the control group was required to complete two self-completion questionnaires. A draw with prizes, as an incentive, was held at the conclusion of each data collection period for both the intervention and control groups.

3.5 Measuring instruments

Participants filled out a self-completion questionnaire at baseline and at six months. The questionnaire included the following measuring instruments: The International Physical Activity Questionnaire (IPAQ) (Craig, 2003); a modified version of the Fat and Fibre Barometer (FFB) (Wright & Scott, 2000) which included some additional dietary questions; and the Medical Outcomes Study Short-Form Health Survey (SF8) (QualityMetric Incorporated, 2010). Anthropometric and related measures included: height, weight, body mass index (BMI), waist and hip circumference and waist and hip ratio (WHR).

The reliability and validity of all the instruments is reported in the literature (Craig, 2003) and all have been used by the research team in previous research involving older people (Jancey et al., 2006; Jancey et al., 2007).

3.5.1 Focus groups

The evaluation instrument was reviewed before the intervention in two focus groups (n=17) comprised of members of the target group. Focus group participants were not eligible to participate further in the intervention. The following feedback from the focus group participants was used to refine the instrument:

- The majority of focus group participants preferred the categorical style of questions.
- They confirmed that their time was limited and they did not want to be burdened with a long questionnaire that required a lot of work on their behalf.

- The detailed recording of dietary behaviours was considered to be a too hard task.
- A “three day food diary” was considered too intrusive.

3.5.2 Test-retest

A test-retest (n=100) of the evaluation instrument was conducted two weeks apart, via computer-assisted telephone interviewing (CATI Technical Reference Group: National Public Health Partnership, 2003) to ensure reliability. Test-retest results confirmed the questions in the measuring instrument had a moderate to high intra-class correlation (0.62-0.95).

3.6 Components of the survey instrument

3.6.1 Physical activity

The International Physical Activity Questionnaire (IPAQ) (Craig, 2003) has undergone extensive reliability and validity testing in 12 countries. This instrument has acceptable measurement properties for use in many settings and was specifically designed for population-based prevalence studies of participation in physical activity. A strength exercise question based on recommendations from the American Health Association (Haskell, 2007) was included, to ensure all components of the home-based exercise program were measured.

3.6.2 Nutrition

The Fat and Fibre Barometer (FFB) (Wright & Scott, 2000) was chosen as it can be self-administered and takes a short time to complete. Reliability of the questionnaire was considered acceptable, as a test-retest reliability of (r=0.92) was obtained by the designers of the FFB. Results obtained from the FFB are easy to interpret and provide information on the intake of fibre and fats, thus covering the main nutritional objectives of the present research.

3.6.3 Health status

The Medical Outcomes Study Short-Form Health Survey (SF8) (QualityMetric Incorporated, 2010), a shorter version of the Medical Outcomes Study Short-Form Health Survey SF-36 (QualityMetric Incorporated, 2010) was used. It is a standard international instrument that gives a generic measure of health status and is comprised of two summary scales: the physical component summary (PCS) score and the mental component summary (MCS) score. However, results are not presented, as the scope of the present thesis did not cover the evaluation of this data.

3.6.4 Anthropometric measures

Participants were provided with a tape measure and instructions on how to accurately measure themselves at both time points. The instructions detailed how to measure waist circumference "halfway between the lowest rib and top of hipbone, roughly in line with the belly button" and hip circumference "at the point where the buttocks protrude the most". Participants were requested to "breathe out normally", then "measure directly against their skin and make sure the tape was snug and not twisted, without compressing the skin", before recording to the nearest 0.5 inch or cm (Commonwealth of Australia, 2009). Waist hip ratio was calculated as waist circumference divided by hip circumference.

Participants were also requested to measure their height and weight and record this information on the self-report questionnaire. Participants were reminded not to wear shoes when measuring height and weight.

BMI was calculated by dividing weight in kilograms (kg), by height in metres squared (m^2). Participants with a BMI of 18.5–24.9 kg/m2 were classified as normal weight; 25.0–29.9 kg/m2 were classified as overweight and those over 30.0 kg/m2 were classified as obese. BMI is promulgated as the most useful epidemiological measure of obesity along with waist circumference, while WHR has been suggested as a better predictor of cardiovascular disease (CVD) and coronary heart disease (CHD) mortality (Welborn & Dhaliwal, 2007).

3.6.5 Participant demographics

Demographics included gender, age, educational level, work status, perceived financial struggle, relationship status, co-morbidities, alcohol consumption and smoking status.

3.7 Statistical analysis

Statistical analyses were undertaken using SPSS and STATA packages. Univariate statistics were first applied to compare the intervention and control groups. The main objective was to assess program effectiveness while accounting for demographic and confounding factors. Outcomes such as total physical activity times were measured at baseline and post-intervention. Mixed regression modelling was considered appropriate because the two observations collected from the same individual are correlated. The approach accounts for the inherent correlation of the panel data and provides appropriate estimates for the regression coefficients. Differences between participants as a source of extra variation are accommodated within the random component of the model. Intervention effects, as well as pertinent factors affecting the outcomes, were quantified.

3.8 Ethics

Consent was obtained from participants after informing them: about the purpose of the research, of who was conducting the research, on the type of involvement required by them, that their participation was entirely voluntary, that confidentiality would be respected, and that participants had the right to withdraw at any stage. This study and access to the FER data base were approved by the Curtin University Human Research Ethics Committee, ethics number HR 186/2008 (Appendix F, Ethics approval).

3.8.1 Confidentiality and data storage

Codes only and master lists of codes were used to identify data. Names of participants were kept in a locked cabinet accessible to the candidate and her

supervisors. Data on the computer was protected by a password accessible only to the researchers. Participants were not identified by name in any publication or report. The raw data was stored in the candidate's office while in use and then transferred to the School of Public Health archive at the completion of the study.

3.9 Qualitative Data

Interviews were developed to obtain information on perceptions of the program. Participants were asked how future programs on improving older adults' physical activity and nutritional intake could be made more appealing. They were also questioned on how participant involvement could be encouraged.

3.9.1 Participants

Participants (n=20) were purposely selected from the randomly selected neighbourhoods within the intervention (completers n=10, non-completers n=10), to participate in exit interviews.

3.9.2 Procedure

After obtaining informed consent, telephone interviews taking approximately 20 minutes took place. Participants were contacted by a single interviewer, who manually recorded responses to questions. A movie voucher was provided to participants in appreciation of their participation.

3.9.3 Interview schedule

The interview schedule was developed after reviewing the literature and consulting experts in physical activity and nutrition. It provided some structure to the interviews, but was not meant to be followed strictly, especially if participants wanted to provide less or more information. The interviews were based on the participants' perceptions of the program including the resources and Group Guides,

people assigned to support and encourage the participants through the study (Appendix E Questionnaires).

3.9.4 Data analysis

The analysis process involved breaking down transcribed data into smaller units. The data were coded according to similarities in the content and then the material was categorised in relation to these and any discrepancies that were present.

3.10 Theoretical planning framework

Interventions need to have a sound theoretical basis to ensure that elements impacting on behaviours are considered. The SCT (Bandura, 1986) is an effective theory when considering appropriate physical activity and nutrition interventions, as it focuses on behaviour change, incorporating the complexities of the individual's personal, cognitive, behavioural and environmental factors. The SCT was used to promote behaviour change in a tailored fashion or manner allowing for individual, personal, behavioural, environmental and cognitive factors. Elements of the HBM were incorporated into resources in order to increase the awareness and need for behaviour change in this age group. The PRECEDE-PROCEED Model (Green & Kreuter, 2005) was used to plan, develop and implement the PANS intervention as it considers the target group's behaviours, environment, social and situational circumstances.

This research was guided by the Social Cognitive Theory (SCT) framework, using relevant components of the Health Belief Model (HBM) and the construct of self-efficacy (Bandura, 1997; Glanz et al., 2008; Lee et al., 2008). It was designed specifically for the 60-70 year age group. Predisposing, enabling and reinforcing factors were considered to increase participation. The research promoted self-efficacy with information resources designed to assist participants to carry out suggested recommended behaviours, complemented by support and encouragement provided by Group Guides, trained university students who worked with the older adults throughout the program. The program applied the SCT's four information

sources: performance accomplishments, vicarious experience, verbal encouragement and perception of physiological and affective responses (Bandura, 1997; Glanz et al., 2008; Lee et al., 2008), which lead to improvements in participants' physical activity and nutrition behaviours.

The study was based on the Social Cognitive Theory (SCT) (Glanz et al., 2008) and PRECEDE-PROCEED Model (Green & Kreuter, 2005), incorporating voluntary cooperation and self-efficacy (Glanz et al., 2008). The PRECEDE-PROCEED Model was selected to plan, develop and implement the program, as it ensures that there is thorough consultation with the target group and comprehensive planning (Green & Kreuter, 2005). The PRECEDE-PROCEED Model guides how the intervention should be implemented and evaluated, both during and post-intervention, to ensure the intervention is carried out and evaluated as planned.

The framework is systematic and methodologically considers the needs and social circumstances of the target group and relevant behavioural (lifestyle) and environmental factors that predispose, enable and reinforce behaviours and the settings in which they occur (Howat et al., 1997). Predisposing factors can be motivators for improved nutrition and physical activity and may be addressed through suitable education comprising of knowledge, attitudes and beliefs. Enabling factors relate to the environment and include program costs, accessibility and skills required to complete activities. Reinforcing factors consist of rewards for the health behaviour, including support from guides, family or peers and intrinsic rewards one has set for achieving personal goals.

The SCT's central construct of self-efficacy was included to increase the likelihood of improving participants' confidence in carrying out suggested health behaviours. The four information sources (Bandura, 1997; Glanz et al., 2008; Lee et al., 2008) applied to help increase self-efficacy were: 1) performance accomplishments; 2) vicarious experience; 3) verbal encouragement and 4) perceived physiological and affective responses. Performance accomplishments refers to goal setting; vicarious experience addresses seeing, being a part of, or experiencing the examples and

capability of others; verbal encouragement provided face-to-face, through phone calls or the internet (for example emails).Perceived physiological and affective responses include prompts and information provided through written materials, Group Guides and activities.

Using the SCT, HBM and PRECEDE-PROCEED Model strengthened the intervention and increased the likelihood of older adults participating and improving their physical activity and nutritional behaviours. Elements of the theoretical frameworks encouraged participants to participate due to health concerns or the perceived threat of health issues and provided autonomy to tailor the intervention to suit their own, individual needs.

3.11 Intervention program

The intervention drew on the research literature and from the research team's previous work in the area (Jancey et al., 2006; Jancey et al., 2007) including a recently completed pilot project (Burke et al., 2008; Lee et al., 2010; Lee et al., 2011). Where appropriate, materials developed for the project team's previous projects (Jancey et al., 2008) and pilot study (Burke et al., 2008; Lee et al., 2011), were used, along with information gained through focus groups conducted for the present intervention. All written materials were pre-tested with the present target group and were deemed appropriate. The intervention was designed to encourage the establishment of relevant personal goals, along with social support through supportive phone calls and feedback and through the provision of optional suburb-based group meetings. The gradual and tailored nature of the program aimed to increase the likelihood of sustaining increased levels of physical activity and positive dietary changes.

3.11.1 Personal support

Group Guides

A key component of the program was the trained Group Guides. University Health Science students in their 3rd or 4th year of study, with expertise in physical activity, nutrition and health promotion were recruited as “Guides”. Potential Guides underwent screening for suitability and intensive training; were provided with a specifically developed handbook of dietary and physical activity guidelines and information on the program; were given regular support via email and phone contact from the project coordinator. Each Group Guide supervised and supported participants in one or two suburbs (group n=10-15). The Guides encouraged participants to set goals and explained written materials and activities. They provided support to the participants via phone calls and/or emails, for information sharing and answering questions, and coordinated optional suburban-based group meetings. Non-compulsory group meetings were held in locations convenient for a majority of group members to attend provided the opportunity for Group Guides to facilitate one-to-one and small group discussion and to encourage socialisation and peer support. Guides maintained a detailed log book of these contacts with their participants (Burke et al., 2008) (Appendix A, Protocol article).

3.11.2 Material support

Participants received mailed information: a program booklet, newsletters, calendar and an exercise chart. In addition pedometers and resistance bands were distributed.

Program Booklet

The booklet, the main educational resource for the intervention, promoted healthy eating and physical activity. All other intervention activities were based on its contents and reinforced its messages. The booklet, developed and trialled in a pilot project (Burke et al., 2008; Lee et al., 2011) was modified to make it relevant for the 60-70-year olds with more information on physical activity, nutrition and health

issues. It encouraged the establishment of nutrition and physical activity goals, in line with national recommendations, to suit each individual's needs. It explained the management of relevant health issues, through the adoption of good nutrition and regular physical activity, along with guidelines. The booklet consisted of three sections.

Section one introduced the program and focused on physical activity participation, based on the National Physical Activity guidelines (Brown et al., 2008) and included a home-based physical activity program. It explained strategies to improve physical activity and discussed benefits of regular participation as well as how to plan for physical activity. The booklet provided guidelines on how participants could set their own short and long term physical activity goals for the duration of the program.

Section two outlined the Dietary Guidelines for Older Australians (Department of Health and Ageing, 1998; NHMRC, 1999) and explained how to establish both short and long term nutritional goals, based on personal eating habits. It included information on nutrition, recipes, healthy diet patterns, sample meal plans and healthy eating tips. Information was also provided on shopping tips, how to read food labels and suggested foods to avoid.

Section three was based on the Health Belief Model; it raised questions about health concerns and issues. It provided information on specific health issues in relation to the benefits of physical activity and nutrition, to help participants set goals more suited to their individual needs.

Newsletter

A newsletter, sent every 2 months, reinforced the key project messages contained in the project booklet. Previous research demonstrated that a 1-2 page newsletter containing information on physical activity and nutrition was positively received (Jancey et al., 2007). A nutritionist and exercise gerontologist supervised the content.

Calendar

A calendar was provided to assist and prompt participants to keep track of scheduled activities, meetings and important dates and as a diary to record physical activity and dietary intake. The calendar included motivational comments, motivational questions, and a variety of activity and nutrition tips and provided spaces for participants to record their goals. The names and phone numbers for age-relevant health promotion agencies and resources were listed on the calendar.

Exercise chart

An exercise chart showing photographs of stretch, strength, flexibility and balance exercises was provided as a visual resource to prompt participants to practise the home-based physical activity program provided in the booklet. The front of the chart also included information on warming up, cooling down, exercise intensity, exercise frequency, hydration and safety. The back of the chart contained brief written instructions. Participants were encouraged to display the exercise chart, for easy reference, in a prominent position in their home.

Pedometers

Pedometers were provided to participants to motivate and increase levels of physical activity through the self-monitoring of their daily steps (Jancey et al., 2011; Lee et al., 2010). Group Guides liaised with their group members to assist with the use of pedometers.

Resistance bands

Resistance bands and written instructions were provided. The flexible latex resistance exercise bands allowed positive and negative force to be applied to muscles to improve strength, range of motion and coordination.

CHAPTER 4: Process Evaluation

Burke, L, Jancey, J M, Howat, P, Lee, A H. & Shilton, T. Physical Activity and Nutrition Program for Seniors (PANS): Process Evaluation. *Health Promotion Practice*, online (2012).

Physical activity and nutrition program for seniors (PANS): Process evaluation

Abstract

Issue addressed: The Physical Activity and Nutrition Program for Seniors (PANS) program aimed to increase levels of physical activity and improve the diet of insufficiently active community based seniors aged 60-70 using a range of strategies. Comprehensive process evaluation was used to determine the suitability and appropriateness of the resources and effectiveness of the strategies.

Method: Process evaluation data (qualitative and quantitative) were collected on the program strategies and resources throughout, and at the conclusion of the intervention period.

Results: The program strategies/ resources were found to be relevant to the population, assisting participants to increase their level of physical activity and improve their diet. Participants reported that the program resources were suitable for their age group (84%); encouraged them to think about physical activity (78%); and nutrition (70%). Participants reported that they used the pedometer (91%) and recorded daily steps (78%). Moreover, the provision of group Guides facilitated individuals to set and achieve personal goals.

Conclusion: The PANS strategies and resources were appropriate, which supported the seniors in identifying, establishing, and achieving their physical activity and nutrition goals. Minor refinements of the program were recommended based on the findings.

INTRODUCTION

Physical activity declines as people age (Thogersen-Ntoumani, Loughren, Duda, Fox, & Kinnafick, 2010). In the USA, only 39% of the population aged 65 and above achieved recommended physical activity levels in 2007 (Centers for Disease Control and Prevention, 2007). In Australia, 51% of older adults aged 60 to 75 years do not meet the national physical activity guidelines while 33% are completely sedentary (Australian Bureau of Statistics, 2009). Physical inactivity is now recognised as the fourth largest preventable cause of diseases behind hypertension, overweight/obesity and smoking (Danaei et al., 2009).

Along with reduced levels of physical activity (Australian Bureau of Statistics, 2009; United States Department of Health and Human Services, 2008), there has been an increase in the consumption of energy dense foods high in saturated fat and sugar worldwide (World Health Organization, 2012). Indeed, energy and fat intake have increased in both USA (Chanmugam et al., 2003) and Australia (Flood et al., 2010) within the past few decades. Such changes in dietary patterns have detrimental effects on body weight; 79% of older Australians are now classified as overweight or obese (Australian Bureau of Statistics, 2009). This is of great concern in view of the strong association between excess body weight, chronic health problems and health care costs (Popkin, 2006; Sassi, Cecchini, & Devaux, 2010). In developed countries, obesity contributes 0.7 to 2.8% of total yearly health expenditure (Withrow & Alter, 2010), emphasising the need for interventions that can improve both physical activity and nutrition, especially for people aged 60 to 70 years (Prochaska, Nigg, Spring, Velicer, & Prochaska, 2008).

Process evaluation of physical activity and nutrition programs is necessary to confirm if the prescribed intervention is appropriate for the priority population (Green & Kreuter, 2005) and implemented according to plan (Burke et al., 2008; Griffin et al., 2010; Jancey et al., 2008). It provides insight into the internal operations of the program. Without process evaluation, the fit of the program, its delivery and context cannot be determined (Nutbeam & Bauman, 2006). Process

evaluation is essential to determine the reach and acceptability of the varied strategies implemented in an intervention, which includes mailed information, emails, phone calls and group meetings (Oakley et al., 2006).

Process evaluations of RCTs aimed at older adults are required to address the increasing demand to develop more public health interventions for the target group (Clark et al., 2011). Many RCT's reported in the literature do not explicitly describe their process evaluation (Oakley, et al., 2006). This intervention research program provides comprehensive information on the intervention components by collecting both qualitative and quantitative data via a range of instruments, such as brief questionnaires and exit interviews (Oakley, et al., 2006). This paper discusses the process evaluation of the Physical Activity and Nutrition Program for Seniors (PANS). It presents information on the acceptability and effectiveness of strategies, the appropriateness of PANS resources and factors that may have affected usage of program materials.

METHODS

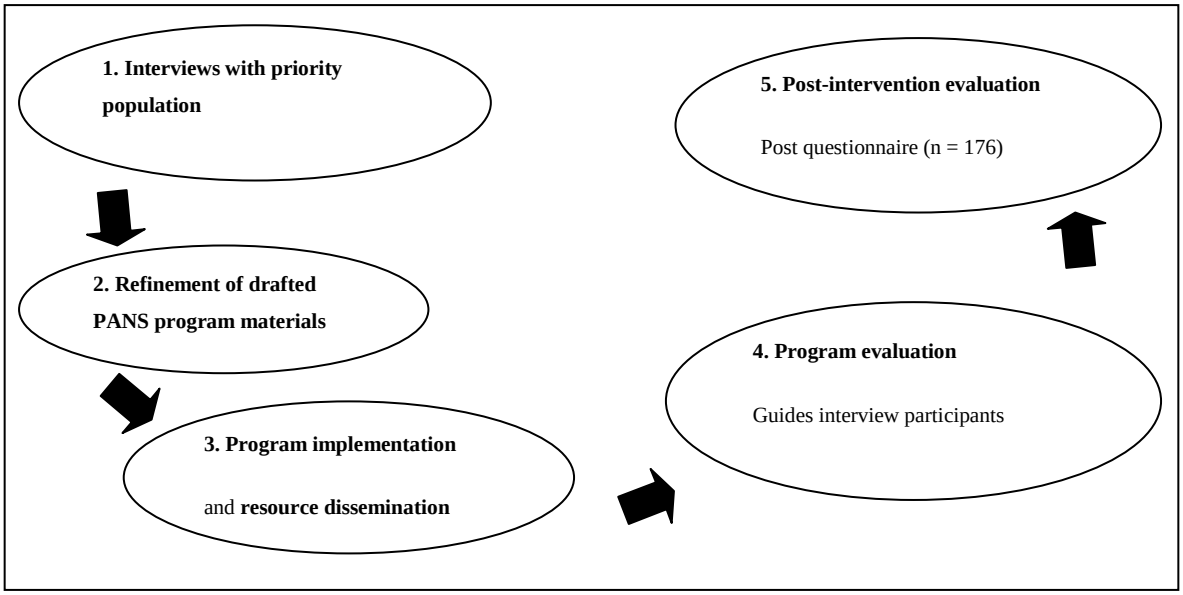
The intervention

PANS was a 6-month physical activity and dietary intervention conducted in metropolitan Perth, Western Australia. It aimed to improve physical activity and nutrition behaviours using a home-based program, with materials specifically developed for insufficiently active older adults aged 60 to 70 years. The intervention and evaluation design were based on a pilot study that produced encouraging results with respect to adherence and behaviour change (Burke, et al., 2008). The project protocol was approved by Curtin University Human Research Ethics Committee (approval number HR 186/2008).

The process undertaken to develop, implement and evaluate PANS is summarised in Figure 1. Step 1 consisted of interviews with people from the priority population to determine their views on the appropriateness of pilot program materials (Burke, et

al., 2008). Step 2 involved the refinement of drafted materials based on the feedback, review of pertinent literature on physical activity and nutrition programs (Morey et al., 2009; Sherwood et al., 2008), along with input from the experienced research team. Step 3 represented program implementation, whereby seniors who met the inclusion criteria and agreed to take part were provided with the PANS resources. Steps 4 and 5 outlined the different aspects of evaluation via feedback provided by Group Guides, questionnaires and exit interviews with the participants.

Figure 1. Development and process evaluation of the PANS program



This study was based on the Social Cognitive Theory (SCT) (Bandura, 1986; Glanz, Rimer, & Viswanath, 2008), The Health Belief Model (HBM) (Glanz, et al., 2008), and the Precede-Proceed Model (Green & Kreuter, 2005), incorporating voluntary cooperation and self-efficacy (Bandura, 1997) in planning the intervention. The SCT's central construct of self-efficacy was included to increase the likelihood of improving participants' confidence in carrying out suggested health behaviours. The program content was developed using the four information sources (Bandura, 1997; Glanz, et al., 2008): a) performance accomplishments – participants were encouraged to set short and long term goals; b) vicarious experience - examples and capability of

others were demonstrated in the written materials and this was also provided through discussions and activities at non-compulsory group meetings; c) verbal encouragement - from the Guides, face-to-face conversations, phone calls and emails; and d) perceived physiological and affective responses - provided through written materials, the Guides and activities that included prompts and information.

The PANS intervention contained a range of strategies and resources. The main component was a program booklet designed to motivate and encourage participants to increase their level of physical activity and improve their diet through individual goal setting. It provided physical activity and dietary advice in line with the Australian physical activity guidelines (Brown, Moorhead, & Marshall, 2008) and the Australian dietary guidelines for older adults (Department of Health and Ageing, 1998; National Health and Medical Research Council, 1999). Additional written materials included an exercise chart, a calendar that reinforced key messages in the PANS booklet. The participants were also supplied with a resistance band to perform the strength exercises described in the home-based program, together with a pedometer to encourage walking and recording of daily steps.

The provision of trained Guides (Jancey, et al., 2008; Lee et al., 2011) was another feature of PANS. These Guides were third year university Health Science students with interest and experience in physical activity, nutrition and health promotion. They were initially screened for suitability, before undertaking training and received a comprehensive Guide's manual. Their role was to provide support to participants, which included coordinating regular group meetings and maintaining telephone/email contact. The Guides were accessible for information sharing and answering questions. They arranged meeting times and venues to suit the majority of group members, and maintained a project diary to record interactions with participants and document feedback on the PANS program. Further details of the PANS program were described elsewhere (Burke et al., 2010).

Participants

The intervention group consisted of 248 participants aged between 60 and 70 years. Table 1 presents the sample demographic characteristics. Participants were recruited from Perth metropolitan suburbs with low or medium socioeconomic status, based on the Socio-Economic Index for Area (Australian Bureau of Statistics, 2008), a value derived from income, education level, employment status and skill level. They were insufficiently active, defined as "taking part in less than a minimum of 30 minutes of moderate physical activity on at least 5 days a week" (Brown, et al., 2008).

Table 1. Demographic characteristics of participants

Variable		
Age: mean (SD) years		65.96 (3.11)
Body Mass Index: mean (SD) kg/m^2		28.02 (4.63)
Gender: male		126 (50.8%)
Relationship status:	with partner	179 (72.2%)
Work status:	working	112 (45%)
Education level:	primary school	14 (5.6%)
	secondary school	119 (48%)
	trade certificate/diploma	69 (27.8%)
	university	46 (18.5%)

(n=248)

PROCESS EVALUATION METHODS

Group Guides

Guides recorded implementation of the program activities and distribution of resources in their project diaries, they documented information that they provided to their participants via the phone or email due to non-attendance at meetings, or when additional information was requested.

Brief questionnaire

Following program implementation and resource dissemination, participants were mailed brief self-administered questionnaires to evaluate the booklet, calendar, exercise chart and supplementary program resources (resistance band and pedometer). These questionnaires were modified from those used in the pilot (Burke, et al., 2008) and other studies (Jancey, et al., 2008; Lee, et al., 2011). The printed copies were non-identifiable to encourage honest responses. Participants were invited to rate specific features and suggest possible improvements by commenting on what they particularly liked or disliked about the resources (United States Department of Health and Human Services, 1992). A 5-point likert scale was used for specific feedback on the resources. Respondents were required to circle the number closest to statement they agreed with (e.g. *useful* to *not useful*, *relevant* to *not relevant*, *suitable* to *not suitable*, *strongly agree* to *strongly disagree*). These scales were then collapsed into a dichotomous variable e.g. '*agree*' and *disagree*' as presented in Table 2. Respondents were required to respond 'yes' or 'no' to the resources questions (e.g. pedometer / resistance band).

Post-intervention evaluation

Additional process evaluation was conducted after the completion of PANS. Using a mailed questionnaire, participants were solicited about their intention to continue using the program resources, their overall perception of the program, and what improvements could be made. A five-point likert scale ranging from '*strongly agree'* to *strongly disagree'*, was used for feedback on the program. These scales were then collapsed into a 'agree' (combining strongly agree and agree) versus 'disagree' (combining strongly disagree and agree).

Exit interviews

Twenty exit interviews (10 completers, 10 non-completers) were conducted via telephone by a trained researcher (first author). Names of participants were randomly selected from the lists of program completers and non-completers until 10 participants had been interviewed from each group. When a selected participant did not answer the telephone after three attempts, or failed to reply to messages left, the next person on the list was contacted. Each interview took approximately 20 minutes to complete. The exit interviews contained questions that were open ended. Questions included what participants thought about: the program and materials provided; their perceptions of the PANS Guides; whether the program encouraged them to make changes to their levels or types of physical activity; and if they had made any changes to their diet in relation to program information. The exit interview intended to identify the preferred design aspects that encouraged participation and involvement, as well as feedback on resources and Guides.

RESULTS

Group guides

The Guides reported that the group preference for regular phone contact or face-to-face meetings varied, with some participants requesting only phone contact or information via email. The total number of meetings across groups ranged from three to seven, with one to 10 participants attending each meeting. The Guides claimed that most participants wanted to continue holding such meetings. Locations of meetings were convenient to the majority of participants who attended, as this was negotiated between Guides and group participants. Participants reported the meetings as "*very interesting, useful, supportive, and motivational.*" One senior commented that he "*felt informed by others in the group and appreciated their contributions on how to deal with and manage similar problems.*" Other comments included: "*the meetings make you commit to your physical activity goals, as you have someone to ask you what you have done.*" Feedback from Guides confirmed that topics included in the program seemed to be relevant; some topics were dealt with briefly, as

participants appeared more knowledgeable, while others were discussed at great length. Again, this varied considerably between groups. Participants also indicated that ongoing telephone calls or reminder emails were motivating and encouraging. The Guides reported that participants worked well together and motivated each other, as there were "*lots of chatting and laughing,*" and "*they seemed to get along well on a personal level.*" The Guides also stated that some participants had regular contact with each other outside the meetings and arranged to walk together. Participants reported that they left the program due to health issues, injuries, the need to care for family and/or friends, vacation and work commitments.

Booklet and written materials

Participants enjoyed the home-based exercise component of the booklet and found the exercises clearly described. A typical positive comment was: "*the stretches in the booklet are actually taught by my physiotherapist and I found them similar to my daughter's yoga stretches.*" The participants were more likely to use the resources if "*the professional said so, and young people do so.*" A number of participants reported completing the exercises whilst watching television or sitting. Some suggested the provision of a recording table, similar to the pedometer table already provided, would be useful to count the number of exercises performed. When it came to dietary advice, participants found shopping hints and advice on portion sizes helpful. They also enjoyed goal setting, commenting: "*It's a good idea, as I often write down tasks and tick them off when I complete them. It gives me a sense of achievement.*" When asked about improvements to written materials, a request was made for more healthy recipes that were easy to prepare and suitable for one or two people, rather than a family of four. Other requests included more backstretches, hints on healthy alternative ingredients to substitute in recipes and extra links to relevant websites.

Pedometer and resistance bands

Participants confirmed the pedometer was a motivating and useful tool that helped them reach their physical activity goals. One Guide commented, "*some participants*

religiously kept track of the amount of steps they took daily," and "*appreciated such an easy/quantifiable method of tracking activity.*" With respect to incidental physical activity, participants expressed their appreciation with positive comments such as: "*I never thought to walk to the shops*" and "*before this program I would have driven.*" They also confirmed the resistance band was useful: *"I could feel it working as I performed the strengthening exercises." "I was surprised how sore my arms felt the next day,*" and "*I really enjoyed using it.*" Several participants favoured more practise and supervision in how to use the resistance band.

Brief questionnaires

Brief questionnaires on the booklet (n = 177: 71% response rate (RR)) and supplementary program resources (n =167: 67% response rate (RR)) were returned by the majority of participants. As shown in Table 2, the majority of participants reported that the booklet 'provided useful advice' (88%); 'was suitable for their age group' (84%); 'encouraged them to think about physical activity' (78%); 'encouraged them to think about nutrition' (70%); and they found the messages were relevant' (71%). Suggestions to improve the booklet included offering alternatives for lactose intolerant individuals; more healthy recipes for two, particularly using legumes; a section on staying mentally active; and to reduce the booklet size to fit into a handbag.

The majority of participants reported that they 'used the exercise chart' (74%) and claimed it 'encouraged them to practise recommended exercises' (62%). They reported the exercise chart was '*easy to follow, had clear instructions, and provided a range of helpful exercise options.'* Sixty-six per cent of the participants thought the calendar 'encouraged them to think about physical activity'; 'encouraged them to think about nutrition' (55%); and contained 'contained useful information' (57%). Suggested improvements for the calendar included providing more information about physical activity and nutrition and a recipe of the month.

A majority of the participants reported that they 'used the pedometer' (91%) and 78% 'recorded their daily steps'. The majority of participants reported using the resistance band to complete strength exercises (63%).

Table 2. Participant responses to statements relating to supplementary program resources

	Agree/Strongly agree with statement
Booklet (n = 177) RR = 71%	
Useful advice in booklet	88%
Easy to understand	85%
Suitability for age group	84%
Interesting information in booklet	80%
Attractive booklet	80%
Encouraged me to think about physical activity	78%
Relevance of messages to me	71%
Encouraged me to think about nutrition	70%
Exercise chart (n = 167) RR = 67%	
Suitability for age group	74%
I used the exercise chart	74%
Found exercise chart useful	70%
Encouraged me to practise PANS exercises	62%
Calendar (n = 167) RR = 67%	
Encouraged me to think about physical activity	66%
Suitability for age group	64%
Attractive calendar	61%
Useful information on calendar	57%
Encouraged me to think about nutrition	56%
PANS resources (n = 167) RR = 67%	
I used the PANS pedometer	91%
Encouraged me to take more steps	78%
Recorded number of steps I took	77%
I used the PANS resistance band	63%

Post-intervention evaluation

Feedback from post-program evaluation (n = 176; 71% response rate (RR)) verified that the PANS program and resources were relevant and appropriate for this population. Eighty-four per cent of respondents reported that they 'became more aware of their health and wellbeing'; 'their nutrition and eating habits improved' (55%); most 'felt fitter' (53%); and most reported that they 'will continue to stay active when the program concludes' (71%). The majority agreed the Guides provided 'helpful guidance' (73%); 'motivated them to be active' (68%); and 'improve their diet' (63%). The results are presented in Table 3.

Table 3. Participants' perceived benefits of the PANS program

	Agree/Strongly agree
Since starting the PANS program …	
I have become more aware of my health and wellbeing	84%
I feel fitter	53%
My Group Guide …	
Encouraged me to do well	77%
Gave me helpful guidance	73%
Motivated me to be more active	68%
Motivated me to improve my diet	63%
I believe I will continue to use the PANS materials to help me …	
Stay active when the program concludes	71%
Stay active in 6 months time	67%
Stay active in 12 months time	60%
My physical activity has changed since starting PANS	
I am generally more active	59%
I walk more often	57%
I have become more involved in new activities	31%
My nutrition/eating habits have improved since starting PANS	55%

(n = 176):RR = 71%

When asked how the program could be improved participants suggested *'getting more people involved', 'finding a method to maintain meeting attendance', 'providing a few hands-on cooking sessions' and 'making it an ongoing, government funded program for senior-card holders'.*

Exit interviews

Program completers (n = 10) reported that PANS was appropriate and informative, particularly the layout of materials. They found the physical activity aids (resistance band and pedometer) useful and motivating. They enjoyed meeting people their own age and preferred meetings to be regular. Participants indicated that the program "*reminded me about good eating habits and made me more conscious of my nutrition.*" Some participants were trying to improve their diet: "*I am now checking food labels and trying to eat more fruit, nuts, and vegetables.*" "*I am eating less bread*" and "*increasing my consumption of peas and nuts.*" "*I even tried stuffed potatoes, which I have never eaten before.*" However, PANS could be more appealing if it has "a longer time frame," "some hints on how to lose weight," "more exercises" and "larger font size on the exercise chart."

According to non-completers (n = 10), the main reasons for dropping out were that they 'did not want to fill out questionnaires,' 'previous experience with exercise programs had proved difficult,' 'lack of self-motivation,' 'transport issues,' 'recent illness' and 'time constraints due to work and other commitments.'

DISCUSSION

Reaching, recruiting and retaining older adults in community-based interventions can be challenging. To encourage involvement of participants in this 6-month home-based physical activity and nutrition program, a number of strategies and initiatives were trialled, including Group Guides, written materials (booklet, calendar and exercise chart) and activity aids (pedometer and resistance band). Comprehensive process evaluation was conducted to determine whether these strategies had been implemented as planned, and appropriately for the priority population. Feedback and opinions were solicited using a variety of approaches. The response rate for the questionnaires were reasonable, ranging from 61% to 71%.

The provision of Guides was a valuable component of the intervention, as demonstrated by the positive feedback from participants, who considered them encouraging and motivating. Previous research conducted in the USA and Australia have shown Group guides, filling the role of walk leaders, facilitators, health educators or phone counsellors, to be beneficial to the outcomes of intervention programs (Griffin, et al., 2010; J Jancey, et al., 2008).

Post-intervention evaluation confirmed that the regular telephone or email contact by Guides could increase participant's motivation, adoption and adherence to the program. Furthermore, exit interviews suggested that ongoing reminder emails and telephone calls were encouraging, while feedback from Guides verified that participants were receptive to the information provided. The seniors preferred the flexibility of telephone or email contact, as it suited their busy lifestyle. However, the optimal type and amount of contacts appeared to vary between individuals. Studies with older adults in Canada, USA, UK and Australia have reported that the provision of telephone contact can stimulate a positive change and/or increase adherence to physical activity (Griffin, et al., 2010; Morey, et al., 2009), however, limited research has been conducted with email delivered interventions with this age group (Dinger, Heesch, Cipriani, & Qualls, 2007).

The intervention group meetings were also beneficial for supporting participants to establish and reach personal goals, physical activity maintenance, as well as facilitating social support amongst participants. Some participants reported that they had commenced regular walking together, potentially revealing the long-term positive elements of the optional group meetings. This finding was consistent with the literature concerning benefits of group meetings (Cox, Burke, Gorely, Beilin, & Puddey, 2003).

The process evaluation indicated the written materials were relevant and motivated participants to improve their physical activity and dietary behaviours. Previous intervention trials have also successfully incorporated information booklets on physical activity (balance, strength, endurance) and dietary advice within programs (Burke, et al., 2008; Greene et al., 2008; Morey, et al., 2009). In addition, the PANS booklet encouraged participants to set personal goals, while the calendar assisted

with recording of progress, and the exercise chart acted as a visual cue for action. A previous study similarly reported positive behavioural change when participants were encouraged to set their own short-term goals (Greene, et al., 2008).

The process evaluation results demonstrated the value of adopting a variety of strategies to cater for participants' preferences (Griffin, et al., 2010; Jancey, et al., 2008). The PANS program offered flexibility through the provision of written resources and additional materials, motivational telephone calls and/or emails, as well as the opportunity to attend optional group meetings in the local area. Consequently, participants could adapt the program to suit their individual needs. For example, some seniors preferred working through the program independently, whereas others enjoyed the group support. This semi-tailoring of the intervention allowed participants autonomy to work through the program at their own pace, leading to a positive outcome (Burke, et al., 2008). As with other programs (Burke, et al., 2008; Jancey et al., 2007), the main reported reasons for attrition were health issues, injuries, caring for family and friends, time constraint, work and other commitments, and not the program design.

Limitations

Although additional process evaluation could have be conducted for this project; it was considered more important to concentrate on program development and delivery to ensure the PANS intervention was implemented efficiently and appropriately for the target group. Evaluation based on self-report data was deemed realistic and sufficient within the allowed timeframe. The PANS intervention was limited to six months because of budgetary and resource constraints.

CONCLUSION

Process evaluation is integral to program evaluation, providing detailed information on the implementation of the program components. Such information is an essential part of the evaluation cycle, which helps inform the improvements of future health promotion programs. The PANS process evaluation provided an opportunity to obtain feedback and advice from the participants on how the program and resources could be improved. The triangulation of process evaluation data had the advantage of

validating results from different sources that the PANS program and associated resources were appropriate and effective; and enabled the seniors to identify, establish, and achieve their physical activity and nutrition goals.

The process evaluation data indicated that PANS engaged a significant proportion of the participants. The seniors were generally positive about the program in terms of improving their physical activity and eating behaviours, thereby indicating that the program had been implemented and delivered as intended. The information and suggestions for refinements will be useful to make future interventions more relevant to the priority population.

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CHAPTER 5: Physical Activity and Nutrition Results

Burke L, Lee AH, Jancey J, Xiang L, Kerr DA, Howat P, Hills A, Anderson AS, Physical activity and nutrition behavioural outcomes of home-based intervention program for seniors: A randomized controlled trial. *International Journal of Behavioral Nutrition and Physical Activity*, 10:14, 2013.

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INTERNATIONAL JOURNAL OF BEHAVIORAL NUTRITION AND PHYSICAL ACTIVITY

RESEARCH **Open Access**

Physical activity and nutrition behavioural outcomes of a home-based intervention program for seniors: a randomized controlled trial

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Abstract

Background: This intervention aimed to ascertain whether a low-cost, accessible, physical activity and nutrition program could improve physical activity and nutrition behaviours of insufficiently active 60–70 year olds residing in Perth, Australia.

Methods: A 6-month home-based randomised controlled trial was conducted on 478 older adults (intervention, n = 248; control, n = 230) of low to medium socioeconomic status. Both intervention and control groups completed postal questionnaires at baseline and post-program, but only the intervention participants received project materials. A modified fat and fibre questionnaire measured nutritional behaviours, whereas physical activity was measured using the International Physical Activity Questionnaire. Generalised estimating equation models were used to assess the repeated outcomes over both time points.

Results: The final sample consisted of 176 intervention participants and 199 controls (response rate 78.5%) with complete data. After controlling for demographic and other confounding factors, the intervention group demonstrated increased participation in strength exercise ($p < 0.001$), walking ($p = 0.029$) and vigorous activity ($p = 0.015$), together with significant reduction in mean sitting time ($p < 0.001$) relative to controls. Improvements in nutritional behaviours for the intervention group were also evident in terms of fat avoidance ($p < 0.001$), fat intake ($p = 0.021$) and prevalence of frequent fruit intake ($p = 0.008$).

Conclusions: A minimal contact, low-cost and home-based physical activity program can positively influence seniors' physical activity and nutrition behaviours.

Trial registration: anzctr.org.au Identifier: ACTRN12609000735257

Keywords: Fat avoidance, Fibre intake, Fruit intake, Goal setting, Sitting, Strength exercise, Vegetable intake, Walking

Background

Physical activity is known to decline with age [1]. In Australia, 51% of the older population aged 60 to 75 years are insufficiently active, with the highest prevalence of inactive behaviour being reported in adults over 75 years of age [2]. Similarly, rates of physical activity among American adults aged 65 years and older are low, with only 20% of women and 25% of men meeting the national recommended physical activity guidelines [3], while 26% of those in the 65–74 age group are inactive [4]. Research has demonstrated that sedentary behaviours may be linked to obesity, cardiovascular diseases and type 2 diabetes [5-11]. Moreover, as people age, their nutritional requirements change and energy requirements decrease. Older adults should consume nutritious foods that are high in fibre and low in saturated fats to help maintain a healthy weight [12]. However, worldwide trends are shifting towards an increased consumption of energy-dense foods rich in saturated fats and sugars [13], leading to energy imbalance and rise in diet related diseases [14].

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In the literature, intervention programs designed to improve physical activity levels or dietary habits have used a variety of strategies including workbooks, calendars, telephone counselling, goal setting and pedometers [15-19]. Although interventions combining physical activity and nutrition appear to result in better outcomes than those focusing on either aspect alone [17,19], there is limited evidence on home-based interventions in terms of improving both physical activity and nutritional behaviours among people aged 60–70 years [20-22]. Moreover, research involving seniors has generally been undertaken with a small sample size [18,19,23], or targeting those with a specific chronic disease [15,19,23]. Another limitation is that the participants recruited were generally self-referrals and volunteers [17,18,24] as opposed to being randomly selected samples. Therefore, there is an urgent need to develop well-designed interventions that overcome such shortcomings [25].

The Physical Activity and Nutrition for Seniors (PANS) program attempted to improve both physical activity and nutritional behaviours. It was a low-cost and accessible home-based intervention targeting insufficiently active low to middle income older adults aged 60–70 years who could semi-tailor the program to suit their own pace and needs [26]. We targeted these "baby boomers" (60–70 year olds) because they contribute to the fast growing segment of the population who are retired or near retirement. The aim of the present study was to determine whether the PANS intervention was effective with respect to the main outcome measures of self-reported physical activity and nutritional behaviours. The findings have important implications for the control and prevention of overweight and obesity in the older population.

Methods

Study design

PANS was a 6-month two-arm randomised controlled trial collecting data at two time points (baseline; post intervention). The project protocol was approved by the Human Research Ethics Committee of Curtin University (approval number HR 186/2008) and written consent was obtained from all participants.

Procedure

A random sample of 478 participants was recruited from 60 suburbs/neighbourhoods (30 intervention; 30 controls) within the metropolitan area of Perth, the capital of Western Australia. Participants were randomly selected from the Australian Federal Electoral Roll in 2010, which provided a representative sampling frame. Suburbs were required to comprise at least 14% of adults aged 60 years and older; contain at least 120 potential participants; and be classified as low or medium socio-economic status [27]. Participant selection criteria called for "insufficiently active" recruits who participated in less than 30 minutes of moderate-intensity physical activity on at least 5 days per week [28]; aged 60 to 70 years; considered "healthy" to the extent that participation in a low-stress physical activity program would not place them at risk; and not on any special diet [26]. Participant flow and corresponding sample sizes are presented in Figure 1. Of the 248 program participants and 230 controls that completed the baseline questionnaire, 176 and 199 seniors respectively with complete data were available for analysis, giving a final response rate of 78.5%.

Intervention

The intervention was developed using Social Cognitive Theory [29,30] and the Precede-Proceed Model [31] incorporating voluntary cooperation and self-efficacy [29,32], and based on a pilot project [33] that produced encouraging results with respect to adherence and behaviour change [33,34]. Further revisions were made after extensive formative research [26]. Such formative data from representatives of the target group confirmed the preference for a flexible, home-based program, whereby participants would be able to set their own goals and semi-tailor the intervention to better suit their own needs [26].

The main resource of the home-based program was a booklet specially designed for seniors that provided physical activity and nutrition recommendations and encouraged goal setting. The booklet was supported by an exercise chart, calendar, bi-monthly newsletters, resistance band and pedometer, along with telephone and email contact by program guides. Frequency of telephone contact varied, as some participants requested only phone contact or information via email. Participants generally received between six to 10 phone calls and/or two to five emails over the 6-month period. The protocol of the intervention has been described in detail elsewhere [26]. The control group received baseline and post-intervention questionnaires at the same time as the PANS participants, and both groups were given a small token of appreciation upon completion and return of the postal questionnaires.

The intervention was funded for A$400,000 over a three-year period. The estimated costs to replicate the intervention include salary for a part-time coordinator (A$180,000) and a research assistant (A$150,000), intervention materials (A$23,500) and incentives (A$7,000), postage (A$1,500), telephone calls (A$3,500), program guide reimbursement (A$6,500), guide manuals (A$500), administration costs (A$5,000) and printing of questionnaires (A$2,500).

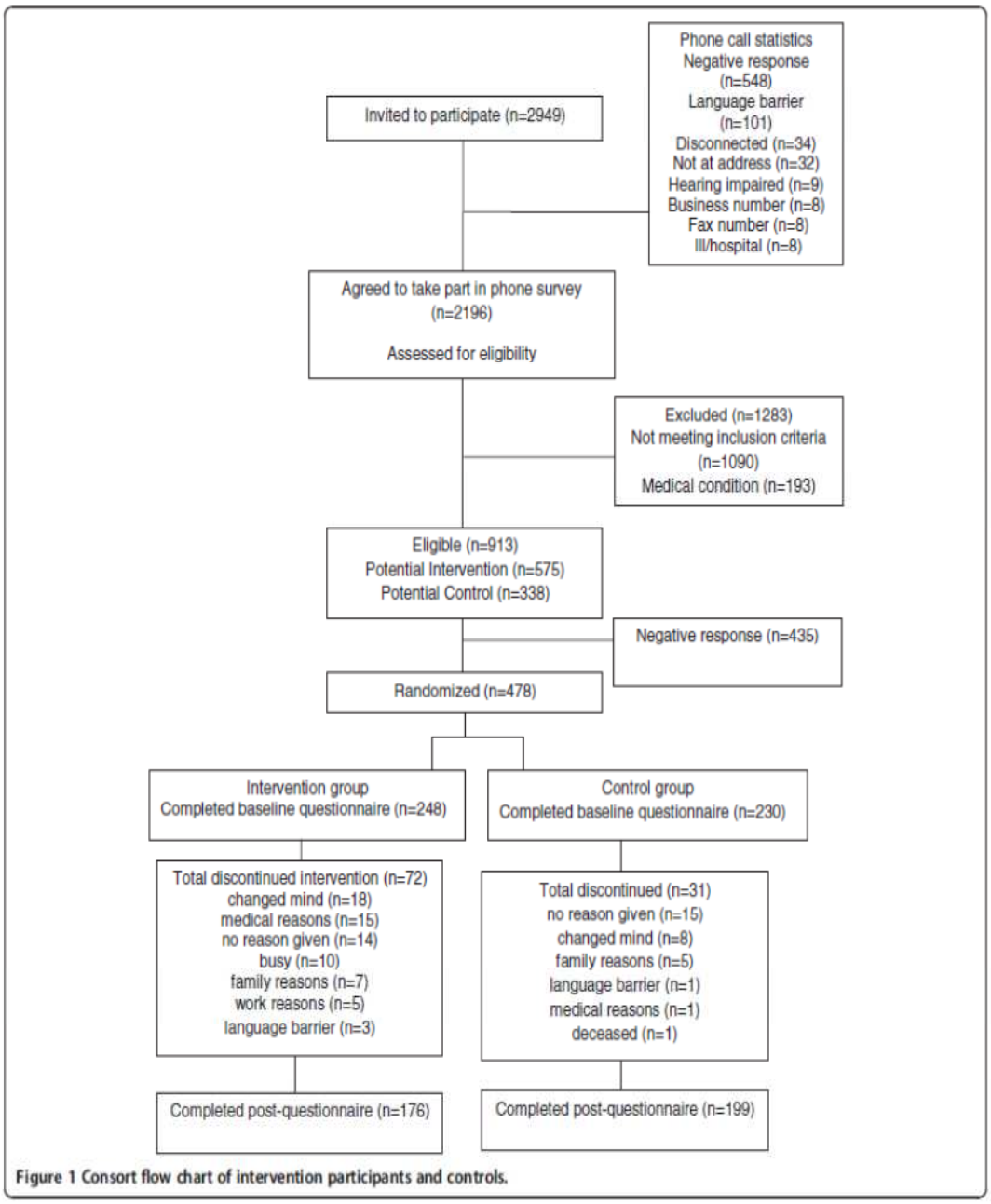

Figure 1 Consort flow chart of intervention participants and controls.

Instrument

The self-completion questionnaire consisted of previously validated instruments on physical activity and sitting behaviour [35] and nutrition behaviours [36], along with demographic and personal characteristics including gender, age, education level, marital status, tobacco smoking and alcohol consumption. The instrument was reviewed by experts in the field, underwent test re-test, and found to possess moderate to high intra-class correlation (0.62-0.95). The International Physical Activity Questionnaire short-form [35] was used to measure self-reported walking, moderate-intensity physical activity, vigorous-intensity physical activity and sitting time for older adults [37,38]. It specifically asked whether a person participated (yes or no) in various types of physical activity and their duration (minimum of 10 minutes). A strength exercise question "During your usual week, on how many days did you do strength activities? How much time did you usually spend doing strength activities on each of these days?" was also appended [39].

Dietary intake behaviours were assessed via a modified version of the Fat and Fibre Barometer [36] to gather specific information on fat intake (e.g. butter, cheese, milk) and fibre-related intake (e.g. cereals, fruit and

vegetables). Extra questions were added to assess frequency of fruit and vegetable intake, which enabled quantification of the number of days participants consumed at least two servings of fruit or vegetables per week. The content of the intervention emphasised increasing consumption of fruits, vegetables and fibre but reducing the intake of saturated fat.

Statistical analysis

Descriptive statistics were first applied to summarize the baseline demographic profile and lifestyle characteristics of the sample. Comparisons between intervention and control groups were made across the two time points using independent samples and paired t-tests for continuous outcomes, and chi-square test for categorical outcome variables.

The main outcomes of interest were strength exercise, walking, moderate- and vigorous-intensity physical activity levels, sitting time, fibre intake, fat intake, fat avoidance, frequency of fruit intake and frequency of vegetables intake. In the presence of many zeros (lack of participation by seniors, i.e. < 10 minutes duration), all physical activity variables were recoded into binary form indicating participation status (yes; no), while sitting time remained as a continuous variable (recorded in minutes per week). For food eating habits, the fibre intake (range 0–28), fat intake (range 0–21) and fat avoidance (range 6–30) composite scores were computed based on the corresponding consumption behavioural questions from the Fat and Fibre Barometer, whereas consumption of at least two servings of fruit per week was considered as either infrequent (0 to 2 days) or frequent (3 to 7 days), and analogously for vegetables consumption.

To accommodate the inherent correlation of observations taken from the same individual, generalized estimating equation (GEE) models with exchangeable correlation structure were fitted to assess the repeated measures over time, while accounting for the effects of potential confounding factors. All binary outcomes were modelled using logistic GEE. Normal GEE with identity link was applied to fibre intake and fat intake scores, whereas gamma GEE with log link was considered appropriate for modelling the highly skewed sitting time variable and fat avoidance score. All statistical analyses were undertaken in the SPSS package, version 18.

Table 1 Baseline characteristics of intervention participants and controls

Variable	Intervention group (n = 176)	Control group (n = 199)	*p* value [1]
Age: mean (SD) years	65.80 (2.95)	65.75 (3.19)	0.884
Gender: male	93 (52.8%)	101 (50.8%)	0.686
Relationship status: with partner	128 (72.7%)	159 (79.9%)	0.102
Work status: working	77 (43.8%)	80 (40.2%)	0.487
Co-morbidity [2]: yes	129 (73.3%)	139 (69.8%)	0.461
Education level: primary school	8 (4.5%)	16 (8.0%)	0.483
secondary school	83 (47.2%)	91 (45.7%)	
trade certificate/diploma	48 (27.3%)	57 (28.6%)	
university	37 (21.0%)	35 (17.6%)	
Financial struggle: never	24 (13.6%)	25 (12.6%)	0.951
sometimes	115 (65.3%)	131 (65.8%)	
always	37 (21.0%)	43 (21.6%)	
Alcohol drinking: yes	116 (65.9%)	137 (68.8%)	0.545
Smoking status: never	97 (55.1%)	94 (47.2%)	0.283
former	69 (39.2%)	94 (47.2%)	
current	10 (5.7%)	11 (5.5%)	

[1] chi-square or t test between intervention and control groups.
[2] presence of at least one of nine common health conditions.

Results

Characteristics of the sample are summarized in Table 1 which shows the intervention and control groups were similar in terms of demographics and lifestyle at baseline. Overall, the mean age was 66 years, about half were male, the majority of them had a partner and experienced common health conditions. Less than half the seniors completed secondary school but over 40% were still in the workforce. No differences in reported alcohol drinking and smoking status were found between the intervention and control participants. No adverse events were reported in relation to the intervention.

Process evaluation based on a brief questionnaire indicated good adherence to the program. Participants reported that the booklet encouraged them to think about physical activity (78%) and nutrition (70%), with the majority using the exercise chart (74%) to practise the recommended exercises (62%). Moreover, the calendar reminded them to consider physical activity (66%) and nutrition (55%). About 90% of the intervention participants reported using the pedometer while 63% utilised the resistance band to perform strength exercises.

Table 2 compares the physical activity outcomes between the intervention and control groups across the two time points. Both groups were similar in terms of physical activity participation at baseline, except in sitting time. However, significant improvements in these outcomes from baseline to post-program were evident among the intervention participants but not the controls. In particular, the intervention group exhibited significantly higher prevalence of participation in strength exercise and walking than the control group at six months.

Comparison of nutritional behaviours are summarised in Table 3. All nutritional outcomes were similar between the two groups at baseline. At six months, the intervention participants demonstrated significant increases in fibre intake and fat avoidance, with significantly higher mean scores than the controls. Improvements in prevalence of frequent fruit intake and prevalence of frequent vegetable intake were also observed in the intervention group, though the latter increase appeared marginal. As expected, there was little change in dietary habits among the controls over the six-month period.

Results of the GEE analyses are given in Table 4. After controlling for demographic and other confounding factors, the regression results confirmed significant increases in engagement in strength exercise ($p < 0.001$), walking ($p = 0.029$) and vigorous-intensity physical activity ($p = 0.015$) but not moderate-intensity physical activity ($p = 0.144$) for the intervention participants relative to the controls. The PANS intervention was also successful in significantly reducing the sitting time of participants through the group×time interaction term ($p < 0.001$). Moreover, positive behavioural changes towards reducing dietary fats were evident in the intervention group in terms of fat avoidance ($p < 0.001$) and fat intake ($p = 0.021$) when compared with the controls. The likelihood of frequent fruit intake significantly increased among the PANS participants post-intervention ($p = 0.008$), but fibre intake and prevalence of frequent vegetable intake did not change significantly after the six-month period. The estimated correlations between the repeated observations were substantial which justified the fitting of GEE models.

Discussion

Appropriate home-based interventions can improve physical activity and nutrition behaviours in insufficiently active 60–70 year olds [33,34,40], and are especially useful when they allow for flexibility, with self-tailoring to suit individual pace and needs [15,33,38]. The PANS intervention was developed based on a large pilot study [33,34] and offered a practical community-based program for older people. The relatively low cost trial was designed to evaluate the effect of combining physical activity and nutrition on behavioural changes of seniors with low to middle socioeconomic status. The moderate sample sizes provided sufficient statistical power for evaluation of the repeated measures [26]. The overall response rate of 78.5% was comparable with other randomized controlled trials on seniors [24,41]. The main reasons of attrition such as work and family commitments, illness and injuries, were consistent with other studies in the literature [15,24]. The International Physical Activity Questionnaire short-form appears to be useful to assess physical activity behavioural change for older adults. However, objective assessment of physical activity should be considered in future research.

The results from this 6-month home-based intervention for seniors indicated improvements in physical activity and nutritional behaviours among program participants in comparison to the controls. The intervention was shown to be effective and consistent with previous studies in terms of levels of change in physical activity and nutrition behaviours [15], specifically, increases in walking [34,38], participation in strength exercises [15], increases in vigorous-intensity physical activity [42], improvements in fruit intake [15,43] and a reduced consumption of fat [15]. However, fibre intake behaviour and the frequency of vegetable intake showed no significant change. The seniors may already maintain a varied and healthy diet with a low consumption of take-away foods at baseline. This could have imposed limitations on further dietary gains, producing a so called "ceiling effect" [34,44].

Table 2 Comparison of physical activity outcomes between intervention participants and controls

Outcome	Intervention group (n = 176)		Control group (n = 199)		chi-square or t test
	Baseline	Post	Baseline	Post	
Strength exercise [1]	34 (19.3%)	70 (39.8%)	55 (27.6%)	55 (27.6%)	$p_2 = 0.060$ $p_3 = 0.013$
	$p_1 < 0.001$		$p_1 = 1$		
Walking [1]	152 (86.4%)	166 (94.3%)	171 (85.9%)	173 (86.9%)	$p_2 = 0.903$ $p_3 = 0.015$
	$p_1 = 0.012$		$p_1 = 0.770$		
Moderate activity [1]	124 (70.5%)	145 (82.4%)	143 (71.9%)	154 (77.4%)	$p_2 = 0.764$ $p_3 = 0.229$
	$p_1 = 0.008$		$p_1 = 0.205$		
Vigorous activity [1]	33 (18.8%)	49 (27.8%)	55 (27.6%)	51 (25.6%)	$p_2 = 0.050$ $p_3 = 0.629$
	$p_1 = 0.044$		$p_1 = 0.650$		
Sitting time: mean (SD) min per week	2063 (1050)	1708 (952)	1691 (925)	1734 (986)	$p_2 < 0.001$ $p_3 = 0.794$
	$p_1 < 0.001$		$p_1 = 0.441$		

[1] participation of at least 10 minutes.
p_1 : baseline versus post p value.
p_2 : baseline intervention versus baseline control p value.
p_3 : post intervention versus post control p value.

Table 3 Comparison of nutritional outcomes between intervention participants and controls

Outcome	Intervention group (n = 176)		Control group (n = 199)		chi-square or t test
	Baseline	Post	Baseline	Post	
Frequent fruit intake [1]	153 (86.9%)	164 (93.2%)	167 (83.9%)	163 (81.9%)	$p_2 = 0.250$ $p_3 = 0.001$
	$p_1 = 0.037$		$p_1 = 0.345$		
Frequent vegetable intake [1]	155 (88.1%)	165 (93.8%)	170 (85.4%)	177 (88.9%)	$p_2 = 0.275$ $p_3 = 0.072$
	$p_1 = 0.047$		$p_1 = 0.184$		
Fibre intake score: range 0–28, mean (SD)	16.77 (5.60)	18.07 (5.30)	16.14 (6.05)	16.74 (6.05)	$p_2 = 0.300$ $p_3 = 0.025$
	$p_1 < 0.001$		$p_1 = 0.035$		
Fat avoidance score: range 6–30, mean (SD)	21.53 (4.83)	22.81 (4.34)	21.36 (4.78)	21.49 (4.77)	$p_2 = 0.757$ $p_3 = 0.009$
	$p_1 < 0.001$		$p_1 = 0.953$		
Fat intake score: range 0–21, mean (SD)	1.84 (1.99)	1.63 (1.60)	1.47 (1.56)	1.60 (1.86)	$p_2 = 0.280$ $p_3 = 0.350$
	$p_1 = 0.049$		$p_1 = 0.230$		

[1] consumption of at least two servings on 3 to 7 days per week.
p_1 : baseline versus post p value.
p_2 : baseline intervention versus baseline control p value.
p_3 : post intervention versus post control p value.

The health benefits of physical activity and its role in preventing many chronic diseases are well established [6,10,45]. On the other hand, recent research has suggested that sitting for long periods of time can have a detrimental effect on the body's physiology, with excessive sitting being recognised as a serious health hazard [5]. The PANS intervention was effective in reducing the sitting time of seniors. There is clearly a need for incorporating sitting time within physical activity guidelines [3,46,47], and positive change in sedentary behaviour should be a key component of future intervention programs.

Limitations

In this study, the data collected from the postal questionnaires were based on self-report, although similar inaccuracies would be expected between the intervention and control groups. Large scale community trials have used self-reported data as valid proxies to reduce cost and attrition rates, and such data have been considered sufficiently reliable for monitoring changes over time [15,48-51] which formed the basis of our evaluation. Self-selection bias was minimized through randomisation, but participation in the home-based intervention was entirely voluntary. Therefore, reporting bias might still be a problem. Furthermore, residual confounding could not be ruled out even though demographic and other factors were controlled for in the GEE regression analyses.

Conclusions

The PANS participants improved their physical activity and dietary habits in comparison to the controls, confirming that a low-cost, home-based physical activity and nutrition

Table 4 Regression analysis of outcomes before and after intervention (n = 375)

Outcome	Coefficient [1]	95% Confidence interval	*p* value	Correlation [2]
Strength exercise [3]	1.075	(0.559, 1.591)	< 0.001	0.417
Walking [3]	0.909	(0.094, 1.724)	0.029	0.314
Moderate activity [3]	0.416	(−0.142, 0.974)	0.144	0.387
Vigorous activity [3]	0.664	(0.128, 1.199)	0.015	0.405
Sitting time [4]	−0.215	(−0.312, -0.117)	< 0.001	0.583
Frequent fruit intake [3]	0.921	(0.236, 1.607)	0.008	0.400
Frequent vegetable intake [3]	0.424	(−0.403, 1.251)	0.314	0.275
Fibre intake [5]	0.716	(−0.115, 1.546)	0.091	0.742
Fat avoidance [4]	0.057	(0.028, 0.085)	< 0.001	0.843
Fat intake [5]	−0.345	(−0.639, -0.051)	0.021	0.637

[1] effect of group by time interaction, adjusted for age, gender, relationship status, work status, co-morbidity, education level, financial struggle, alcohol drinking, smoking status, group (intervention/control) and time (baseline/post).
[2] exchangeable correlation estimate.
[3] logistic generalized estimating equation model.
[4] gamma generalized estimating equation model with log link.
[5] normal generalized estimating equation model with identity link.

program tailored for insufficiently active, low to middle income seniors can produce effective behavioural changes. A follow-up study is recommended to confirm the adherence of the positive behavioural changes beyond six months. It would also be useful to replicate the program both in the community and in other settings where seniors reside such as retirement villages.

Abbreviations

GEE: generalized estimating equation; PANS: physical activity and nutrition for seniors.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

LB conducted the trial and drafted the manuscript. PAH coordinated the study. PAH, AHL, JJ, DAK, APH and ASA contributed to conception and study design and revised the manuscript. LX and AHL performed statistical analysis and interpreted the data. All authors read and approved the final manuscript.

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CHAPTER 6: Effects on Body Mass and Waist-to-hip Ratio

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Effects of a physical activity and nutrition program for seniors on body mass index and waist-to-hip ratio: A randomised controlled trial

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ABSTRACT

Objective. To investigate whether a home-based program, physical activity and nutrition for seniors (PANS), made positive changes to central obesity, measured by body mass index (BMI) and waist-to-hip ratio (WHR).

Methods. A 6-month randomised controlled trial was conducted targeting overweight and sedentary older adults aged 60 to 70 years residing in low to medium socio-economic suburbs within metropolitan Perth. Intervention participants (n = 248) received mailed materials and telephone/email support to improve nutrition and physical activity levels. Controls (n = 230) received small incentives to complete baseline and post-intervention questionnaires. Both groups reported anthropometric measures following specific written instructions. Generalised estimating equation models were used to assess repeated outcomes of BMI and WHR over both time points.

Results. 176 intervention and 199 controls (response rate 78.5%) with complete data were available for analysis. After controlling for demographic and other confounding factors, the intervention group demonstrated a small (0.02) but significant reduction in WHR (p = 0.03) compared to controls, no apparent change in BMI was evident for both groups. The 0.02 reduction in mean WHR corresponded to a 2.11 cm decrease in waist circumference for a typical hip circumference.

Conclusion. PANS appears to improve the WHR of participants. Changes in BMI might require a longer term intervention to take effect, and/or a follow-up study to confirm its sustainability.

Introduction

Obesity has reached epidemic proportions globally, with more than one billion adults overweight and at least 300 million of them clinically obese (World Health Organization, 2011). In Australia, the ageing population is heavier than they were a generation ago, with more than 79% of older Australians (aged 65–74 years) now considered as obese or overweight (Australian Bureau of Statistics, 2009). Obesity is a major contributor to the global burden of chronic disease and disability (World Health Organization, 2011). It is also a costly public health problem. The nationwide annual cost of obesity in Australia is estimated to be $21 billion (Physical Activity Taskforce, 2007). Due to the ageing population, sound interventions capable of making a positive change to the health status of older adults are needed to curb the obesity epidemic. However, to date there is evidence that community-based interventions have had limited success in gaining substantial or lasting benefits (Walls et al., 2011).

Although the main causes of obesity are increased consumption of energy-dense foods high in saturated fats and sugars, and reduced physical activity (World Health Organization, 2011), many intervention programs for seniors have focused either solely on physical activity (Cox et al., 2008; Greaney et al., 2008; Jancey et al., 2008; Wilcox et al., 2008) or diet alone (Greene et al., 2008; Johnson et al., 2004). Recently, a few programs have considered both aspects with some promising results (Morey et al., 2009; Villareal et al., 2011). Among them, the physical activity and nutrition for seniors (PANS) program attempted to control overweight and obesity by improving both physical activity and dietary behaviour (reduce fat, increase fibre, fruit and vegetable intake). It was a low cost and accessible home-based intervention developed specifically for insufficiently active older adults aged 60 to 70 years (Burke et al., 2010). At the conclusion of the program, participants were found to increase their walking time and strength activities while reducing their sitting time and fat intake.

Anthropometric measurements are typically used to assess the effectiveness of weight management and obesity control trials (Goodpaster et al., 2010). Apart from body mass index (BMI), waist-

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to-hip ratio (WHR) has been shown to be a good indicator of cardiovascular disease (Esmaillzadeh et al., 2004; Welborn and Dhaliwal, 2007), trunk fat mass (Taylor et al., 2000) and all-cause mortality (Welborn and Dhaliwal, 2007). In the absence of accurate clinical measurements which are preferable, self-reported data are often taken as the proxy, especially in large community-based trials to reduce cost and attrition rates (Dhaliwal et al., 2010). Recent research has confirmed the effectiveness of such self-reported anthropometric measures (Burton et al., 2010; Dhaliwal et al., 2010; Fillenbaum et al., 2010; Stommel and Schoenborn, 2009).

This study aims to determine whether the PANS intervention has made a positive impact on the outcome measures of self-reported BMI and WHR. The findings have important implications on the control and prevention of central obesity for older adults.

Methods

Study design and procedure

PANS was a six-month two-arm randomised controlled trial delivered by mailed materials and telephone calls. It was developed as a home-based intervention with the intention to accommodate insufficiently active seniors who could semi-tailor the program to suit their own pace and needs (Burke et al., 2010). The project protocol was approved by the Human Research Ethics Committee of the researchers' institution and written consent was obtained from all participants.

In 2010 a total of 478 participants residing in low to medium socio-economic suburbs within metropolitan Perth were recruited from the Australian Federal Electoral Roll and randomly assigned to the intervention (n = 248) and control (n = 230) groups using a table of random numbers. More participants were allocated to the intervention group due to its expected higher attrition rate. Older adults aged between 60 and 70 years satisfied the selection criteria if they (a) were not on any special diet and (b) were "insufficiently active", i.e. participated in less than 30 min of moderate activity on at least 5 days per week (Brown et al., 2008), but (c) were considered "healthy" to the extent that participation in a low-stress physical activity program would not place them at risk. Fig. 1 shows the flow chart of the recruitment procedure and corresponding sample sizes; details of which had been reported previously (Burke et al., 2010).

Intervention

The PANS intervention consisted of a specially designed booklet containing information on dietary guidelines, recommended physical activity levels and encouraged goal setting. The booklet was supplemented by additional written materials including an exercise chart, calendar and bi-monthly newsletters. The

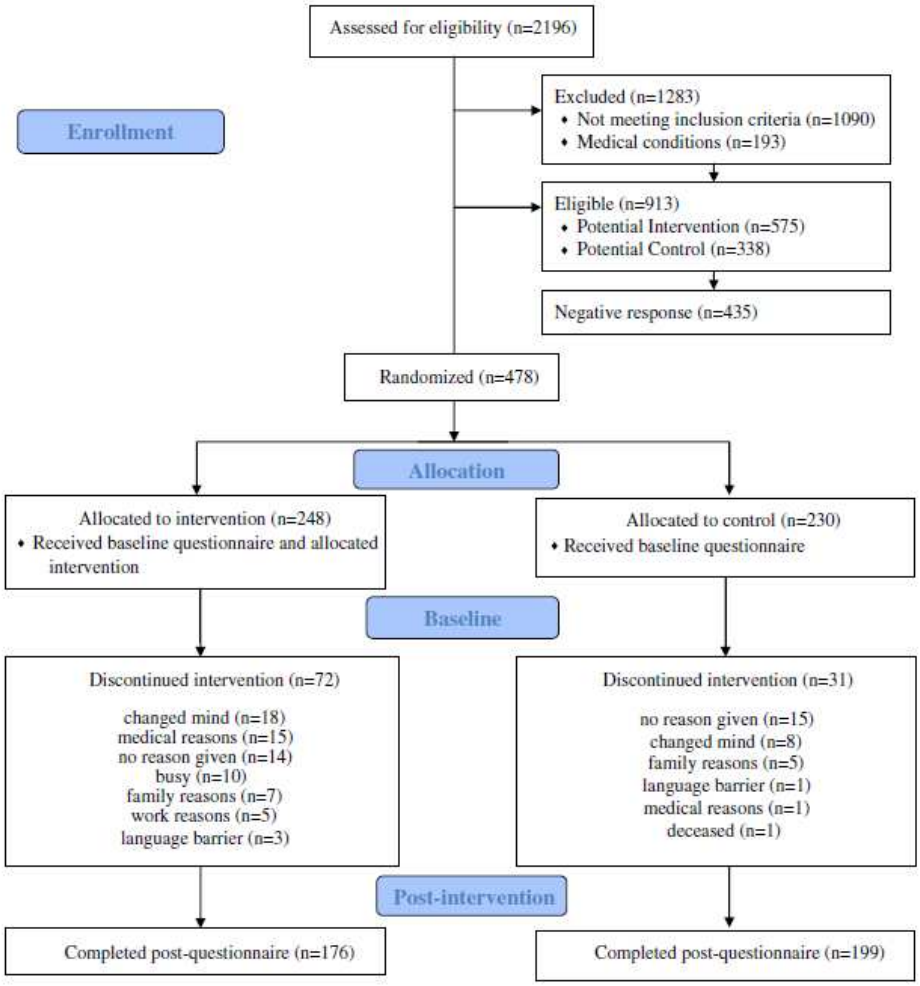

Fig. 1. Consort flow chart of participants and controls (2010, Perth, Australia).

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participants were also given a pedometer to keep track of their daily steps and a resistance band to perform strength exercises suggested in the booklet. Strength exercises were intended to reduce fat mass and help increase muscle mass (Banz et al., 2003; DeNysschen et al., 2009). Moreover, group guides provided telephone and email support, as well as the coordination of non-compulsory group meetings. The PANS participants could semi-tailor the program to suit their own pace and need, and participated as much or as little as they wanted without restriction over the six-month period. Further information on the intervention can be found elsewhere (Burke et al., 2010). The program resources were subsequently evaluated using a feedback sheet. Controls received baseline and post-intervention questionnaires at the same time as the PANS participants and were given a small incentive upon completion and return of the postal questionnaires.

Anthropometric measures

In addition to demographic and lifestyle characteristics, physical activity and dietary behaviours, the self-completion questionnaires solicited information on height, weight, waist and hip girth measurements at baseline and at six months post intervention. All subjects were provided with a tape measure and clearly written instructions on how to accurately measure themselves at both time points. They were reminded not to wear shoes when measuring height and weight. The instructions explained how to measure waist circumference "halfway between the lowest rib and top of hipbone, roughly in line with the belly button", and hip circumference "at the point where the buttocks protrude the most". Subjects were requested to "breathe out normally", then "measure directly against their skin and make sure the tape was snug and not twisted, without compressing the skin", before recording to the nearest 0.5 inch or cm (Commonwealth of Australia, 2009).

Statistical analysis

Descriptive statistics were first applied to summarise the baseline demographic profile and lifestyle characteristics of the sample. The continuous outcomes of BMI and WHR were then compared between intervention and control groups across the two time points using independent samples and paired t-tests. To accommodate the inherent correlation of observations taken from the same individual, generalised estimating equation (GEE) models with exchangeable correlation structure were fitted to assess the two repeated measures over time, while accounting for the effects of potential confounding factors. An intention-to-treat analysis was also performed to assess the sensitivity of the analysis. All statistical analyses were undertaken in the SPSS package version 18.

Results

Of the total 478 recruited seniors who completed the baseline questionnaire, 176 intervention participants and 199 controls with complete data were available for analysis, giving a final response rate of 78.5%. Table 1 presents the characteristics of the completers at baseline. The intervention and control groups were similar in terms of demographic and lifestyle variables. Overall, the mean age was 66 years, about half were male, the great majority of them had a partner and experienced common health conditions prevalent among older adults. Just less than half the seniors received tertiary education while over 40% continued working. No differences in alcohol drinking and smoking status were found between the intervention participants and controls.

Table 2 compares the BMI and WHR outcomes between the intervention and control groups across the two time points. The mean BMI measures at six months were similar to those at baseline for both groups. However, a significant improvement in mean WHR from baseline to post-program was evident among the intervention participants but not the controls, even though the reduction of 0.02 appeared small in magnitude. This 0.02 reduction in mean WHR corresponded to a 2.11 cm decrease in waist circumference for a typical hip circumference among the intervention participants.

Results of the GEE analyses are given in Table 3. After controlling for demographic and other confounding factors, the intervention group demonstrated a significant reduction in WHR ($p = 0.03$) relative to the controls, but no change in BMI was apparent for both groups through the group × time interaction term. In addition, WHR was positively associated with the male gender, whereas the presence of co-morbidity had more significant impact on the seniors' BMI than their WHR. The estimated correlations between the repeated observations were substantial which justified the fitting of GEE models.

An intention-to-treat analysis was next performed. For both intervention and control groups, no significant differences in baseline variables were found between completers and non-completers, so that the post-program BMI and WHR outcomes of the latter could be considered as missing at random (results omitted for brevity). With the inclusion of the non-completers' baseline data, the corresponding GEE fits are shown in Table 4. The results were generally comparable with those in Table 3, though the effect of the group × time interaction term became marginal ($p = 0.06$) for WHR.

Process evaluation of the program resources provided the following feedback. The great majority (80%) of PANS participants reported information given in the booklet was useful, easy to understand and suitable for their age group, which encouraged them to think about physical activity and nutrition behaviours. They believed the exercise chart was appropriate (74%) and used the resistance band provided to practise the suggested stretch and strength exercises (63%). Over 90% of participants said they used the pedometer. Moreover, many participants (64%) perceived that the provision of additional support through

Table 1
Baseline characteristics of intervention participants and controls (2010, Perth, Australia).

Variable	Intervention group (n = 176)	Control group (n = 199)	p [a]
Age: mean (SD) years	65.80 (2.95)	65.75 (3.19)	0.88
Gender: male (%)	93 (52.8)	101 (50.8)	0.69
Relationship status: with partner (%)	128 (72.7)	159 (79.9)	0.10
Work status: working (%)	77 (43.8)	80 (40.2)	0.49
Co-morbidity [b]: yes (%)	129 (73.3)	139 (69.8)	0.46
Education level: primary school (%)	8 (4.5)	16 (8.0)	0.48
secondary school (%)	83 (47.2)	91 (45.7)	
trade certificate/diploma (%)	48 (27.3)	57 (28.6)	
University (%)	37 (21.0)	35 (17.6)	
Financial struggle: never (%)	24 (13.6)	25 (12.6)	0.95
Sometimes (%)	115 (65.3)	131 (65.8)	
Always (%)	37 (21.0%)	43 (21.6)	
Alcohol drinking: yes (%)	116 (65.9)	137 (68.8)	0.54
Smoking status: never (%)	97 (55.1)	94 (47.2)	0.28
Former (%)	69 (39.2)	94 (47.2)	
Current (%)	10 (5.7)	11 (5.5)	

SD: standard deviation.
[a] Chi-square or t test between intervention and control groups.
[b] Presence of at least one of nine common health conditions.

Table 2
Comparison of anthropometric outcomes between intervention participants and controls (2010, Perth, Australia).

Outcome	Intervention group (n = 176)		Control group (n = 199)		t test
	Baseline	Post	Baseline	Post	
Body mass index: mean (SD) kg/m²	27.71 (4.36) $p_1 = 0.13$	27.61 (4.34)	27.27 (4.56) $p_1 = 0.15$	27.13 (4.40)	$p_2 = 0.34$ $p_3 = 0.28$
Waist-to-hip ratio: mean (SD)	0.94 (0.09) $p_1 = 0.001$	0.92 (0.08)	0.93 (0.09) $p_1 = 0.58$	0.92 (0.09)	$p_2 = 0.31$ $p_3 = 0.81$

p_1 : baseline versus post p value.
p_2 : baseline intervention versus baseline control p value.
p_3 : post intervention versus post control p value.
SD: standard deviation.

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Table 3
Generalised estimating equations analysis of body mass index and waist-to-hip ratio before and after intervention (2010, Perth, Australia).

	Body mass index			Waist-to-hip ratio		
Parameter	coefficient	(SE)	p	coefficient	(SE)	p
Intercept	29.74	(5.31)	<0.001	91.70	(6.68)	<0.001
Age	−0.08	(0.08)	0.28	−0.12	(0.10)	0.24
Gender: male	0.55	(0.47)	0.25	12.04	(0.71)	<0.001
Relationship: with partner	1.05	(0.55)	0.06	0.48	(0.84)	0.57
Work status: working	−0.22	(0.52)	0.67	−0.68	(0.68)	0.32
Co-morbidity: yes	1.61	(0.50)	0.001	1.27	(0.64)	0.04
Alcohol drinking: yes	−0.01	(0.18)	0.94	0.89	(0.66)	0.18
Smoking status: current			0.25			0.81
Never	0.84	(0.60)		−0.75	(1.18)	
Former	0.77	(0.48)		−0.68	(1.14)	
Financial struggle: always			0.62			0.99
Never	−0.55	(0.87)		−0.02	(1.17)	
Sometimes	−0.54	(0.56)		−0.04	(0.76)	
Education level: university			0.34			0.06
primary school	2.15	(1.35)		0.49	(1.46)	
secondary school	0.33	(0.61)		1.80	(0.79)	
trade certificate/diploma	0.74	(0.66)		2.11	(0.88)	
Group: intervention	0.55	(0.44)	0.22	0.77	(0.65)	0.24
Time: post	−0.15	(0.10)	0.13	−0.20	(0.36)	0.57
Group × Time	0.05	(0.12)	0.69	−1.16	(0.55)	0.03
Exchangeable correlation	0.99			0.66		

SE: standard error.

group guides could facilitate individuals to set and achieve personal physical activity and nutrition goals.

Discussion

This study investigated the effectiveness of the PANS intervention in terms of anthropometric end points. The moderate sample sizes provided sufficient statistical power for evaluation of the repeated measures (Burke et al., 2010). As expected, the attrition was higher among the intervention participants (29%) than the control group (13.5%), but the rates were comparable with similar physical activity trials in the literature (Cox et al., 2008; Jancey et al., 2008). Future studies should take account of barriers when designing programs for older adults, and may consider using computer-assisted telephone interviewing (Wilson et al., 2001) instead of self-completion postal questionnaire to improve the response rate. Moreover, process evaluation of PANS revealed that the program strategies and resources were relevant to the target group, assisting participants to increase their level of physical activity and improve dietary intake.

According to Dhaliwal and Welborn (2009), the difference between two successive measurements in a subject will be considered significant in clinical practice if the value is greater than the measurement error, which is 0.02 for WHR for both males and females. Therefore, the mean WHR reduction of 0.02 observed in the intervention group would be regarded as clinically relevant. Despite being home-based, the PANS intervention was successful in motivating participants to engage in walking and strength exercises while reducing their sitting time and fat intake (Lee et al., 2011). It is likely that these positive behavioural changes contributed to their significant decrease in WHR over the six-month period. As changes in central obesity can be

Table 4
Intention-to-treat Generalised estimating equations analysis of body mass index and waist-to-hip ratio before and after intervention (2010, Perth, Australia).

	Body mass index			Waist-to-hip ratio		
Parameter	coefficient	(SE)	p	coefficient	(SE)	p
Intercept	31.39	(5.27)	< 0.001	82.10	(7.27)	<0.001
Age	−0.11	(0.08)	0.17	0.04	(0.10)	0.70
Gender: male	1.07	(0.45)	0.02	7.47	(0.71)	< 0.001
Relationship: with partner	0.49	(0.51)	0.33	3.41	(0.81)	<0.001
Work status: working	−0.17	(0.49)	0.73	1.14	(0.71)	0.11
Co-morbidity: yes	1.53	(0.46)	0.001	1.06	(0.68)	0.12
Alcohol drinking: yes	0.02	(0.22)	0.92	1.39	(0.66)	0.04
Smoking status: current			0.19			0.10
Never	1.34	(0.77)		−2.69	(1.38)	
Former	1.19	(0.07)		−1.76	(1.34)	
Financial struggle: always			0.36			0.84
Never	−0.85	(0.81)		0.66	(1.27)	
Sometimes	−0.72	(0.52)		0.46	(0.86)	
Education level: university			0.21			0.19
primary school	2.47	(1.21)		0.09	(1.48)	
secondary school	0.69	(0.57)		1.04	(0.85)	
trade certificate/diploma	0.50	(0.59)		1.96	(0.96)	
Group: intervention	0.49	(0.43)	0.26	0.66	(0.69)	0.34
Time: post	−0.18	(0.10)	0.07	−0.25	(0.37)	0.49
Group × Time	0.05	(0.12)	0.65	−1.01	(0.55)	0.06
Exchangeable correlation	0.93			0.62		

SE: standard error.

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effectively measured via WHR (Welborn and Dhaliwal, 2007), the observed improvement in WHR among the PANS participants have important consequences for implementing obesity control and management for older adults in the clinical setting.

Although the recommended strength exercises using the resistance band might increase the build-up of muscle mass (Banz et al., 2003; DeNysschen et al., 2009), the reduction in BMI among the intervention participants was not statistically significant. A longer time frame for the intervention program is probably required to demonstrate substantial changes in BMI. A follow-up study to collect anthropometric measurements is also recommended to confirm the sustainability of the PANS intervention beyond six months.

Two pertinent factors were found to be associated with BMI and WHR. In this sample, males had significantly higher WHR than their female counterparts, whereas the presence of some common health conditions (heart disease, stroke, diabetes, cancer, osteoporosis, arthritis, high blood pressure, high cholesterol and constipation) impacted positively on the anthropometric outcomes, especially BMI. These effects were expected and consistent with the literature; WHR tends to be higher in men than women (Ferrara et al., 2008; Lee et al., 2005; Wu et al., 2007), and the existence of chronic health conditions have been associated with elevated BMI (Must et al., 1999).

A potential limitation of the study concerned the self-reporting of anthropometric measures, though the inherent inaccuracies were expected to be similar between the intervention and control groups. All subjects were provided with a tape measure and clearly written instructions on how to take measurements at both time points. Self-reported data have been considered as valid proxies to reduce cost and attrition rates in large scale community trials, and should be sufficiently reliable for monitoring changes over time (Burton et al., 2010; Dhaliwal et al., 2010; Fillenbaum et al., 2010; Stommel and Schoenborn, 2009), which formed the basis of our evaluation. Self-selection bias was minimised through randomisation, but participation was voluntary due to the home-based nature of the intervention. Therefore, reporting bias might still pose a threat to the validity of the findings. Moreover, residual confounding could not be eliminated even though demographic and other factors were adjusted for in the GEE regression analyses. As alluded above, the duration of the PANS intervention might not be of sufficient length to reflect significant changes in BMI. A longer, sustainable program should be considered in the future, but it might increase the likelihood of further attrition among older adults.

Conflict of interest statement

Nothing declared for all authors.

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CHAPTER 7: Conclusions and Recommendations

7.1 Introduction

Improving the levels of physical activity and nutritional intake of older adults in the 60-70 year age group has become increasingly relevant in Australia due to their high proportion in the population and the association with ageing and chronic disease. By improving the health of this age group, not only will the quality of life of the ageing population improve, but the increased burden on the health care system may be reduced. Research on physical activity and nutrition intervention programs for older adults has provided insight into how physical activity and nutrition behaviours can be improved; however interventions to improve these behaviours as combined outcomes are relatively new.

This present research examined a home-based program to improve levels of physical activity and nutritional intake of older adults from areas of low and medium socio-economic-status, incorporating both qualitative and quantitative research methods. Factors explored included changes to levels of physical activity and nutritional intake behaviours, shifts in body mass index (BMI) and waist-to-hip ratio (WHR). The research has demonstrated the value of process evaluation to ensure effective program delivery, implementation and reach. The intervention has shown that a home-based program can improve physical activity and nutrition behaviours, and significantly reduce WHR, although there were no significant improvements in BMI.

7.2 Conclusions

1. Process evaluation of the intervention program

Process evaluation is an essential practice when implementing intervention programs as it ensures that a program is implemented as planned and reaches the target group. The information contained in Chapter 5 (Burke et al. 2012b) confirmed that the process evaluation performed was valuable, as it obtained extra feedback and information from participants about the program and resources.

Participants suggested improvements to the written resources and voluntary meetings. The resources were evaluated as appropriate and effective, and that they supported the participants to identify, establish and achieve their nutrition and physical activity goals. Requests from participants included encouraging more people to become involved in the program, provision of interactive cooking sessions and that the program be made on-going and government funded for senior-card holders.

The process evaluation established that the program was implemented and delivered as intended. Participants showed positive feedback in terms of the program assisting them to improve their physical activity and nutritional intake behaviours.

Feedback from the participants confirmed that the Guides were a positive element of the intervention, providing them with encouragement and motivation.

2. Changes in physical activity and nutrition behaviours

Participation in regular physical activity and consumption of a healthy diet can improve health and reduce the risk of lifestyle disease (World Health Organization, 2012). Chapter 6 (Burke et al. 2012 c), reports on the physical activity and nutrition outcomes of the home-based intervention. The results show that by the end of the 6-month program, in comparison to the control group, the intervention group had significantly improved in most of their physical activity and nutrition behaviours.

At baseline the control and intervention groups were similar in terms of participation in physical activity, but not in sitting time, affirming the need for interventions to promote physical activity to reduce sedentary behaviour. In comparison to the controls, the intervention participants demonstrated significant improvements from baseline to post-program. The intervention group had significant increases in engagement in strength exercise ($p<0.001$), walking ($p=0.029$) and vigorous activity ($p=0.015$) and significantly reduced their sitting time.

The nutritional outcomes between the two groups (control and intervention) were similar at baseline. At the conclusion of the intervention, the intervention group demonstrated positive behavioural changes in reducing dietary fats, in terms of fat avoidance ($p<0.001$) and fat intake ($p=0.021$), in comparison to the controls. Frequency of fruit intake significantly increased amongst the intervention group ($p=0.008$) as opposed to the controls, but fibre intake and prevalence of frequent vegetable intake did not change significantly at the end of the 6-month intervention.

The significant improvements in physical activity and dietary behaviours are comparable to other community-based physical activity and nutrition interventions (Burke et al., 2008; Greene et al., 2008; Lee et al., 2011; Morey et al., 2009). The present study demonstrates that it is possible to achieve a range of improvement in physical activity and nutrition behaviours among adults aged 60-70 years, over a period of 6 months.

3. Changes in body mass index and waist-to-hip ratio

It is well recognised that increased physical activity and improved nutrition can have an impact on BMI and WHR of individuals. Chapter 7 (Burke et al. 2012d) reported on the changes made to BMI and WHR as a result of participation in the home-based intervention. At baseline, the mean BMI and WHR measures were similar for both intervention and control groups. There was no real change in BMI, although WHR was significantly improved for both males and females. These results may indicate an improvement in muscle tone and decrease in body fat. At the conclusion of the 6-month program, the intervention group demonstrated a significant reduction in WHR ($p=0.03$) relative to the controls, but no change in BMI was apparent for either group. The improvement in WHR converts to a 0.02 reduction in mean WHR, which corresponds to a 2.11cm mean decrease in waist circumference for each participant. This improvement in WHR is large enough to be considered clinically significant, highlighting the effectiveness of the home-based intervention. The improvements in WHR amongst participants may have important significance for implementing obesity management and control for older adults in clinical settings (Burke et al., 2012).

7.3 Recommendations

7.3.1 Recommendations for practice

Results from this study confirm that the design of interventions needs to be rigorous, with large sample populations and longer time frames. Sedentary older adults need guidance and encouragement about how to improve their physical activity and nutrition to suit their specific needs.

1. Physical activity and nutrition programs

This program provides guidelines for others planning to implement combined physical activity and nutrition programs in a community-based setting. The practical, community-based program had a number of design factors that led to successful outcomes. These include:

- Allowing for flexibility and self-tailoring to suit individual pace and needs;
- The use of university students as Group Guides to provide support;
- Mailed written materials that had been developed in consultation with the target group and health professionals;
- Supplementary materials to encourage positive behaviour change;
- The provision of voluntary meeting groups to encourage social support.

However, some minor improvements to resources and voluntary meetings could be considered. The suggested improvements to resources should be acknowledged, as well as the request to encourage more people to attend meetings and the feasibility of making the program ongoing and government funded.

2. Process evaluation

It is recommended that process evaluation is carried out on any future programs to better inform program development and implementation. Process evaluation should be part of the initial evaluation plan for programs such as this. It should be rigorous, extensive and systematically performed to validate intervention appropriateness and effectiveness and to inform future interventions.

3. BMI and WHR

Changes in WHR and BMI should not be viewed as the most important focus in behaviour change programs. These programs are about getting people to *change their behaviours* to improve their health, as was effectively demonstrated by this program for both physical activity and nutritional behaviour.

The use of behaviour change theories and models to plan, develop and implement this study ensured its success, as it helped people to make positive changes to target behaviours. Following the framework of the PRECEDE-PROCEED Model assured the intervention was acceptable to the participants, as it is systematic and considers the requirements of the target group. Use of self-efficacy from the SCT increased the participants' confidence to improve their own health behaviours through goal setting, experience and encouragement.

4. Objective measures

The self-report measures used in this research have been shown to be appropriate for this type of study (Dhaliwal et al., 2010; Jancey et al., 2008) and reliability of the instruments was supported by the test-retest results. It is useful to consider incorporating objective measures such as an accelerometer, in future interventions of this type but only if the balance between subject burden and extensive data collection is not disturbed.

7.3.2 Recommendations for future research

This qualitative and quantitative research highlights areas that require additional examination.

It is recommended that future studies replicate the program, both in community and other settings where older adults reside, such as retirement villages. However, longer, sustainable programs should be considered in future trials. The duration of interventions need to be of sufficient length to reflect significant changes in physical

activity and dietary behaviour outcomes. It is recommended that researchers use a variety of dissemination strategies to improve health outcomes in the population, incorporating tailored resources, communication channels that best suit the target group (taking into account the updates in technology) to provide regular feedback and motivation.

Future research needs to focus on interventions that encourage older adults to reduce sedentary behaviour such as sitting for longer periods of time, which is increasing due to the impact of changes in technology, communication and transport (Hamilton et al., 2008; Hamilton et al., 2007). Positive changes in sedentary behaviour should be a key component of future intervention programs that target increased physical activity as an outcome.

Continuing research into strategies that promote behaviour change is essential to encourage increased physical activity and improved dietary behaviour in insufficiently active older adults from low to middle socio-economic status (SES), to aid in the prevention and management of ill health and chronic disease linked with ageing. A range of strategies and dissemination techniques are necessary to mobilise this diverse group. There needs to be further investigation into program resources and content to make interventions more appealing to older adults.

The above recommendations will, if implemented, lead to improved physical activity and nutrition behaviours in older adults and in turn, lower health care costs associated with chronic disease, overweight and obesity in older adults.

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Burke L, Jancey J, Howat P, Lee A, Kerr D, Shilton T, Hills A, Anderson A. Physical activity and nutrition program for seniors (PANS): protocol of a randomized controlled trial, *BMC Public Health*, 10:751, 2010.

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Other Publications

Burke L, Jancey J, Howat P, Kerr D, Lee A, Shilton T, Kent C, Booth M, Maitland C, Freeman S, Radici S, Sheppard A. *(2010). Physical activity and nutrition for seniors – taking charge of your life (Booklet)* Perth, Western Australian Centre for Health Promotion Research, the Centre for Behavioural Research in Cancer Control, Curtin University, and the National Heart Foundation of Australia (WA Division) funded by NHMRC. ISBN 978-0-9807998-1-1

Appendix A

Project Protocol

Burke L, Jancey J, Howat P, Lee A, Kerr D, Shilton T, Hills A, Anderson A. Physical activity and nutrition program for seniors (PANS): protocol of a randomized controlled trial, BMC Public Health, 10:751, 2010.

Burke et al. BMC Public Health 2010, 10:751
http://www.biomedcentral.com/1471-2458/10/751

BMC Public Health

STUDY PROTOCOL Open Access

Physical activity and nutrition program for seniors (PANS): protocol of a randomized controlled trial

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Abstract

Background: Along with reduced levels of physical activity, older Australian's mean energy consumption has increased. Now over 60% of older Australians are considered overweight or obese. This study aims to confirm if a low-cost, accessible physical activity and nutrition program can improve levels of physical activity and diet of insufficiently active 60-70 year-olds.

Methods/Design: This 12-month home-based randomised controlled trial (RCT) will consist of a nutrition and physical activity intervention for insufficiently active people aged 60 to 70 years from low to medium socio-economic areas. Six-hundred participants will be recruited from the Australian Federal Electoral Role and randomly assigned to the intervention (n = 300) and control (n = 300) groups. The study is based on the Social Cognitive Theory and Precede-Proceed Model, incorporating voluntary cooperation and self-efficacy. The intervention includes a specially designed booklet that provides participants with information and encourages dietary and physical activity goal setting. The booklet will be supported by an exercise chart, calendar, bi-monthly newsletters, resistance bands and pedometers, along with phone and email contact. Data will be collected over three time points: pre-intervention, immediately post-intervention and 6-months post-study.

Discussion: This trial will provide valuable information for community-based strategies to improve older adults' physical activity and dietary intake. The project will provide guidelines for appropriate sample recruitment, and the development, implementation and evaluation of a minimal intervention program, as well as information on minimising barriers to participation in similar programs.

Trial Registration: Australian and New Zealand Clinical Trials Registry ACTRN12609000735257

Background

Australia has experienced a steady increase in the proportion of older adults, with projections that 22% of the population will be aged over 60 by 2025 [1,2]. This ageing population is heavier than a generation ago, with in excess of 60% of older adults now classified as overweight or obese [3]. Overweight and obesity levels are increasing at a rapid rate worldwide while other non-communicable diseases (NCDs) such as heart disease, type 2 diabetes and cancer are also on the rise [4,5]. It has been estimated that in developed countries, the cost of obesity equates with 0.7 to 2.8% of the total yearly health expenditure [6]. For example, the annual cost of obesity is estimated to be $21 billion in Australia and $2.1 billion in the state of Western Australia [7]. The increase in the prevalence of overweight and obesity is of particular concern, in view of the strong association between excess body weight and chronic health problems. It is known that as age increases physical activity declines [8], with 46% of Australians aged 60 to 75 years being insufficiently active and 33% being completely sedentary [1,9]. Over the years, the physical activity levels of older Australians have reduced [9,10] while their food consumption has increased [11]. This follows the worldwide trend in diet which is shifting towards an increased consumption of saturated fats, with the level of fat consumed exceeding the recommended proportion of daily energy intake [12-14].

The benefits of regular physical activity are well recognised [5,15,16,18-21], regardless of body mass index

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(BMI) [22]. The greatest health improvements appear to occur when a person moves from being sedentary (<100 mins/week) or involved in light (1-2.9 METS) to moderate-intensity activity (>3 METS) [23]. Low-intensity aerobic exercise is typically recommended for older adults as it can be sustained for longer, results in less tiredness and injury, and therefore may result in greater energy expenditure than high-intensity exercise [24]. The Australian Government has recently developed physical activity guidelines for older Australians to help improve their health and well being. The guidelines recommend that moderate-intensity physical activity be performed for a minimum of 30 minutes on most, preferably all, days of the week [25,26]. In addition, eating adequate amounts of fruit and vegetables can provide essential nutrients for healthy tissue bolster the immune system and protect against chronic diseases [5,27-29]. The Australian Guide to Healthy Eating [30] recommends between four to seven 75 gram serves of vegetables and two to three 150 gram serves of fruit for adults aged over 60 years. In addition, both dietary fat and refined carbohydrate should be reduced to achieve appropriate balance in macronutrient intake necessary for an acceptable body weight [31].

Maintaining adequate levels of physical activity [32] and sustaining an appropriate diet [33] are important public health goals to address obesity and to minimise the adverse physiological changes [34] associated with ageing. However, there remains a need for systematic assessment of dissemination strategies to improve health outcomes [35,36], recognising that older people are a heterogeneous group that would benefit from interventions to suit their personal needs and circumstances [37]. The design of interventions needs to be rigorous [38] with large samples and longer time frames [39,40]. Additionally, home-based nutrition and physical activity programs for older adults may reduce future costs to health care [37]. This paper describes the protocol of a randomised controlled trial that aims to improve the physical activity and nutrition behaviours of insufficiently active people aged 60 to 70 years.

Methods/Design

Study design

This project will consist of the development, implementation and evaluation of a physical activity and nutrition intervention. The program is designed to increase physical activity levels, enhance nutritional intake and assist in the management of body weight of insufficiently active 60-70 year-olds. It will be conducted in metropolitan Perth, the capital of the State of Western Australia. The intervention and evaluation design has been based on a large pilot project that produced encouraging results with respect to adherence and behaviour change [41].

The study will be a 12-month randomised controlled trial (RCT) (Ref Figure 1). Data will be collected from participants over three time points at pre-intervention, immediately post-intervention and at 6-months post-study. The project protocol has been approved by the Curtin University Human Research Ethics Committee (approval number HR 186/2008).

Recruitment

A stratified random sampling procedure will be adopted to recruit participants from 60 suburbs (neighbourhoods) within the Perth metropolitan area. Selection criteria for these suburbs are: (a) comprised of at least 14% 60 year-olds and above, reflecting the State average [42]; (b) containing at least 120 adults aged 60-70, to ensure a sample size sufficient for the matching of telephone numbers to the Perth Electronic White Pages [43]; and (c) are of low or medium socio-economic status (SES) based on the Socio-Economic Index for Area (SEIFA) [44], a value derived from income, education level, employment status and skill level. Suburbs will be arbitrarily matched for low and medium levels of socio-economic status. The suburbs will then be assigned to either the intervention group or the control group using a table of random numbers. The sample size will be n = 300 for each of the intervention and control groups at baseline. This strategy is based on a previous RCT conducted by the research group that successfully recruited a similar study sample [45].

Using the Federal Electoral Roll (FER), 7200 potential participants in total will be randomly drawn from the 60 Perth suburbs, with the aim to recruit 15 participants per suburb. Participants need to be: (a) "insufficiently active", i.e. not achieving 30 minutes of moderate-intensity physical activity on at least 5 days per week [25]; (b) aged 60 to 70 years; (c) healthy to the extent that participation in a low-stress physical activity and nutrition program would not place them at risk; (d) not to have taken part in any research studies that involve exercise or nutrition within the last five years; and (e) not to be on any special diet.

Procedure

The Survey Research Centre at Curtin University will match telephone numbers of the 7200 names from the FER to the Perth Electronic White Pages prior to making the initial contact. It is anticipated that the matching will yield an 80% success rate [45]. During the initial contact, the purpose of the study will be explained and the caller will determine whether the individual meets the selection criteria. Participants who give verbal consent will be assigned to an intervention or control group. A self-completion questionnaire will then be sent to them, along with an explanatory cover letter and

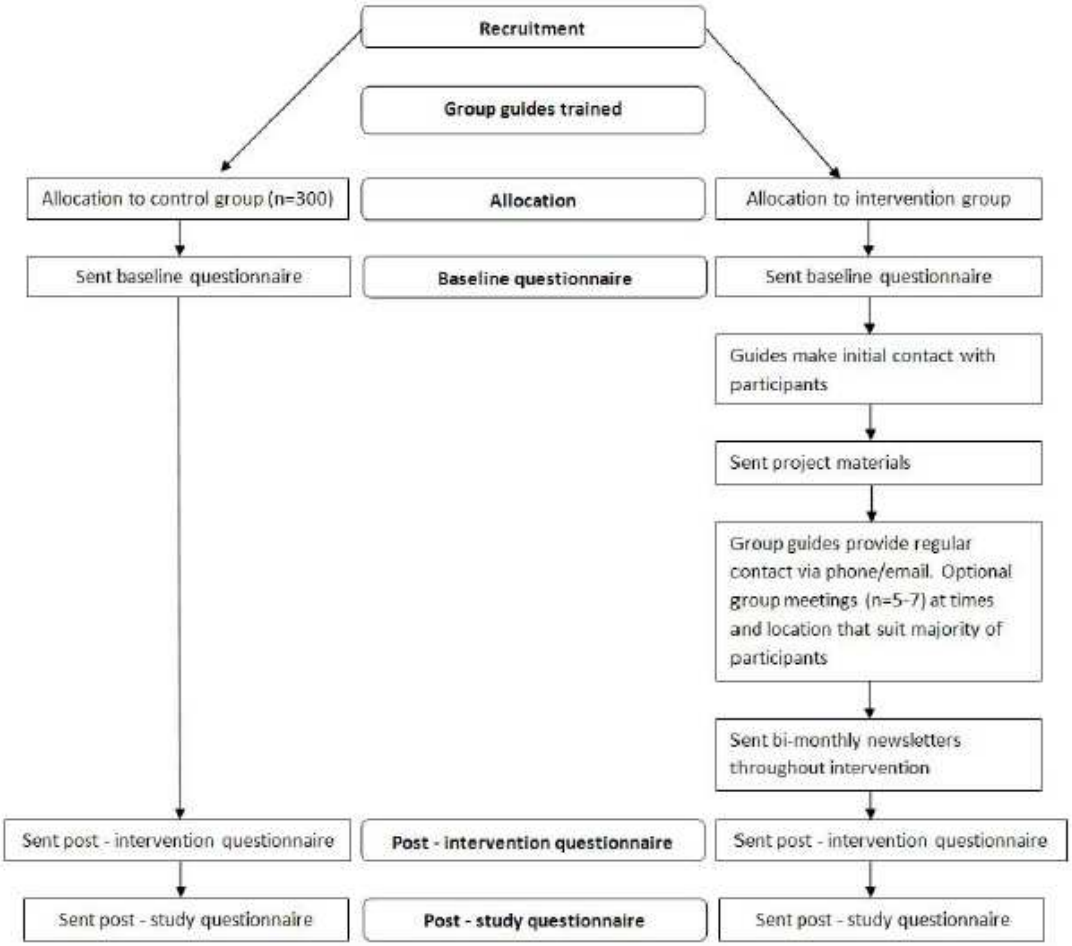

Figure 1 PANS study plan.

self-addressed envelope for returning the questionnaire. Participants will be advised to complete the Physical Activity Readiness Questionnaire and to furnish a medical clearance if deemed necessary before commencing the program.

Intervention implementation strategies

1. Staff training

Senior university Health Science students with expertise in physical activity, nutrition and health promotion will be recruited as "Guides". Potential Guides will undergo screening for suitability and intensive training; receive a comprehensive Guide's manual of dietary and physical activity guidelines; receive regular support via email and phone contact from the project coordinator; and be awarded a certificate upon completion of the training. The aim is for Guides to follow the successful New Zealand 'Green Prescription Program' [21,46,47]. They will be responsible for coordinating regular group meetings; phone/email contacts with participants; and be accessible for information sharing and answering questions. They will be supervised by an accredited Dietitian and a Human Movement Specialist.

2. Provision of resources and instructional materials to participants

The intervention group participants will receive a booklet designed to motivate them to improve their levels of physical activity and their nutrition, through goal setting. The booklet which has been updated from a pilot project [41,48,49]; will be supported by additional

written materials including an interactive calendar and exercise chart. The intervention group will also be provided with a resistance band to perform the exercises described in the program, and a pedometer to monitor walking and to record the number of daily steps. A bi-monthly newsletter will reinforce the key messages.

3. Follow-up and support

The intervention group will be allocated Guides who will conduct suburban-based group meetings (available to those who can attend) and monitor the progress of their group participants. Each Guide will supervise and support participants in one or two suburbs (n = 10 to 20). They will contact their participants via phone (or email if preferred). The Guides will make three pre-arranged motivational phone calls at 4, 12 and 20 weeks to give advice and individualised consultation, as well as to monitor attainment of goals and provide encouragement, support and feedback [46,47,50]. Guides will maintain a detailed log book of the contacts made with their allocated group of participants. To increase the likelihood of sustainability, the National Heart Foundation will provide 'Heartline', a website and 1-800 telephone number for further information. All resources are designed to support participants adoption of health-enhancing behaviours with the opportunity to access information and have questions related to physical activity and nutrition answered.

Control group

Requests to complete the self-administered questionnaires will be the only contact the control group will receive from the project staff.

Outcome measures

A self-administered questionnaire will be completed by both groups of participants at baseline (pre-intervention), 6-months (immediately post-intervention) and 12-months (6-months post-intervention). The questionnaire comprises of previously validated instruments [20], and will undergo further reliability testing prior to its initial use at baseline.

Physical activity will be measured using *The International Physical Activity Questionnaire* (IPAQ) [51]. IPAQ has undergone extensive reliability and validity testing in 12 countries. The instrument has acceptable measurement properties for use in many settings and is specifically designed for population-based prevalence studies of physical activity. A strength exercise question based on recommendations from the American Heart Association [32] will be included to ensure the main components of the home-based exercise program are also measured.

Dietary intake will be measured using a modified version of the *Fat and Fibre Barometer* [52]. A question from the New South Wales Government report on soft drinks [53] will be appended to measure frequency of soft drink consumption. Validated questions will also confirm participants' stages of change regarding fruit and vegetable consumption [54]. A question from the Western Australian Physical Activity Taskforce 2005 *State-wide adult physical activity survey* will be used to assess confidence to participate in at least 30 minutes of physical activity on five or more days of the week [55].

General physical and mental health will be measured by *The Medical Outcomes Study Short-Form Health Survey* (SF-8) [56]. SF-8 is a standard generic international instrument to assess health status and is comprised of two summary scales - the physical component summary (PCS) score and the mental component summary (MCS) score.

Social support will be measured by the *Dukes Social Support Scale* (DSSI) [31]. The Scale is a subjective evaluation of the type and number of social interactions and has been validated for use with older people. The instrument contains two sub-scales that measure social interaction and satisfaction and has good internal consistency (Cronbach's alpha 0.77) and test-retest scores (0.70 to 0.81)[31].

A single item from the *Social Support for Physical Activity questionnaire* [57] (SSPA) will also be used to measure perceived levels of social support for physical activity provided by friends and family. In addition, a single question will be asked about loneliness [58] while a standard validated question [59] will be used to confirm the participants' smoking status.

Demographics will be assessed by questions on gender, age, educational level, country of birth, marital status, socioeconomic status, financial status and co-morbidities. Anthropometric measures will include self-reported height and weight, waist and hip girth. A recent study has confirmed that self-assessment measures are suitable for such studies when a correction factor is applied [60].

A sub-sample of 100 participants will be selected from the intervention group. Following self-report of their height, weight, waist and hip girths the research team will measure each of these variables. Calculations of differences between self-reported and measured data will be undertaken to identify a correction factor based on the methodology of Dhaliwal et al. [60].

Process evaluation

A brief feedback sheet will be mailed to all participants to evaluate the booklet [48]. It invites the participants to rate the booklet in terms of interesting to read, easy to understand, usefulness of advice, suitability for the age group, and the relevance of messages. Participants will also be asked to comment on specific features they

particularly like or dislike, as well as suggestions for further improvement [61]. The calendar, exercise sheet and other program resources will also be evaluated via a similar previously utilised feedback format [48].

Sample size

This is a RCT with outcomes measured at three time points. Power calculations are based on linear mixed model and assuming 70% complete data across the three assessments due to attrition and non-respondents. In the power analyses, effect sizes of interest are associated with the correlation coefficient (or semi-partial correlation). For the mixed regression analyses of physical activity times and metabolic equivalent tasks, a sample size of n = 600 [150 per gender by intervention or control group] will provide sufficient power (80%) to detect a medium effect size (accounting for approximately 16% of the variance) for gender by age interactions at a single time point without covariate adjustment. Power to detect these same interactions in the trends (based on 3 assessments) is sufficient to detect a smaller effect, accounting for approximately 11% of the variability.

Discussion

Results from the PANS study are due in mid-2011

As the aging population increases there is an urgent need to develop sound interventions capable of making a positive change to health status with consequent reduction in pressure and cost to the health care system. This physical activity and nutrition program offers a unique approach compared to other such programs for older people previously conducted in Australia for the following reasons.

The target group will be selected from younger seniors groups (60-70 years), and low and medium SES groups rather than high SES groups. Samples will be randomly selected and actively recruited through the Australian FER, and not community volunteers recruited through advertising. The intervention will provide valuable data on the effectiveness of strategies to improve dietary intake and increase physical activity in the community. The project has been designed to evaluate the strength of combining both physical activity and nutrition in order to improve the health of seniors. The evaluation data will be collected from participants in their own communities and not in a research centre, making the program relevant to the normal population and not limited to a clinical group or setting. The project will provide guidelines for appropriate sample recruitment, and the development, implementation and evaluation of a minimal, home-based tailored physical activity and nutrition intervention program. The information gathered will be useful for minimising barriers to participation in physical activity and nutrition programs. The outcomes of the project will have significant potential benefits to the Australian community via increased physical activity and better nutrition to reduce chronic disease (and associated costs), as well as enhanced mental health and improved quality of life.

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Authors' contributions

LB coordinated the PANS program and drafted the manuscript. JJ, PH, AL, LB, TS, DK, AH and AA designed the study, and revised the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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Appendix B

Literature Review Table

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Galani and Schneider 2007	To assess the mid- to long-term effects in the prevention and treatment of obesity		Prevention studies (n=134) Treatment studies (n=17)	Overweight and obese subjects-minimum observation period of one year	Systematic lit review and meta-analysis	Lifestyle interventions effective mid- to long-term for prevention and treatment of obesity and lead to significant reduction in body weight and CVD risk factors	Promoted healthy lifestyle habits, dietary counselling, physical exercise training and behaviour change targets (goal setting). Combination intervention
Lemmens et al 2008	To identify effective interventions and intervention. elements		Jan 1996-June 2006 9 studies	Studies aimed at prevention of obesity, with overweight, not yet obese individuals	Systematic review	One dietary intervention and three combined dietary and physical activity. interventions produced significantly positive results at end of follow-up	Combination interventions successful
Greaves et al 2011	To identify intervention components associated with positive changes in diet and/or physical activity in individuals at risk of type 2 diabetes.			Focused on evidence re: individuals at risk of type 2 diabetes because of lifestyle (lack of physical activity) or clinical risk factors (high BP, overweight).	Systematic review	Intervention effectiveness increased with: use of social support, increased contact frequency, targeting both physical activity and diet, using well-defined behaviour change techniques (goal setting, self-monitoring).	Identified specific components in interventions that have been associated with improved changes in physical activity and nutrition.

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Coberley et al 2011	To identify senior wellness programs that demonstrated reduced inpatient admissions and health care costs, as well as improved health-related quality of life as a direct result of participation.			Health promotion and wellness programs for seniors	Systematic review	Review demonstrated that health improvements and decreased health-care expenditures can be achieved through participation in programs that effectively engage seniors and encourage behaviour change.	Emphasises that more programs are required for increasing number of older adults in population to maintain/improve their health in order to reduce burden on health care.
Eakin et al 2007	To review physical activity and dietary behaviour change interventions that used telephones as primary method of intervention delivery.		26 interventions	Adults	Systematic review	Positive outcomes for 69% of physical activity interventions; 83% of dietary behave interventions: 75% of interventions addressing both physical activity and diet. Most favourable outcomes from interventions lasting 6 to 12 months, with 12 or more phone calls.	Supports use of phone calls for support
Muller-Riem et al 2009	To evaluate the cost effectiveness of physical activity interventions targeted at healthy adults and identify health effective components			Healthy adults	Systematic review		That print materials are cost effective intervention strategies for wider population group

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Ogilvie et al 2007	To assess effects of interventions to promote walking in individuals and populations (schools/work places) and to determine what characterises effective interventions in promoting walking; who walks more/ by how much as a result of effective interventions; and effects of such interventions on overall physical activity, health.		19 RCT's and 29 non-RCT's		Systematic review	Most effective were interventions delivered at the level of the individual or household or through group based approaches. 2 general characteristics of those interventions were effective: targeting (to particular population e.g. sedentary or people with particular medical conditions-to their needs) and tailoring (individual counselling/ written materials) and delivered either at the level of the individual or household or through group-based approaches.	Supports the use of: Home-based , individual and group-based interventions Also assessed characteristics of interventions: targeting sedentary older adults and individual/group-based approach
Sahyoun, Pratt and Anderson 2004	To identify nutrition interventions that could provide a basis for designing effective and measurable nutrition educational programs for older adults		25 studies included intervention and/or evaluation components and targeted older adults over 55 years	Older adults	Review Successful study components section: HBM re: perception of chance of developing chronic diseases applicable to older adults because of increased possibility of ill health	Interventions had limited success in behaviour change, but certain features had positive outcomes. Recommend-a theoretical framework that includes suggested features and is set within a social and environmental context	Features suggested: Limiting educational messages, reinforcing/personalising messages, incentives, cues, access to health professionals, using appro theories of behave change. Confirms scarcity of evidence-based research for older adults on community nutrition intervention programs.

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Morey et al 2009	To determine if Telephone and mailed print is effective to improve diet and exercise	12 months	641 I=319 C=322(delayed intervention)	65-91 o/weight survivors of colorectal, breast and prostate cancer Canada, United Kingdom and United States Less sedentary – less than 150mins/week of moderate to vigorous physical activity Self-referred and names from North Carolina Central Cancer Registry and permission from physicians, then letters of invitation sent to potential participants	RCT SCT and Transtheoretical models (Marcus BH et al 1996 Theories and techniques for promoting physical activity behaviours. Sports medicine 1996;22(5):321-331 Home-based, mailed personally tailored workbook and newsletters, telephone and automated prompts	Strength training exercise increased in intervention group (mean [SE], 18.7 [2.4] mins/ week), no change in control group . Endurance exercise increased in intervention group (mean [SE], 36.3 [4.9] mins/week) stable in the control group. Mean (SE) intake of fruits and vegetables increased by 1.24 (0.14) daily servings in intervention group and by 0.13 (0.11) daily servings in control group. Mean (SE) consumption of saturated fat decreased by 3.06 (0.51) g/day in intervention group and only 1.07 (0.49) g/day in the control group. Intervention group participants reported a mean weight loss of 2.06 kg (95% CI, 1.69-2.43 kg), more than twice that reported by control group.	Outcomes self- report Demographics- older age-group, overweight/obese cancer survivors (highly motivated individuals?) Home-based Mailed materials (personally tailored work book and newsletters) and telephone counselling (15 sessions) automated prompts (8 messages). Pedometer, exercise bands (3 levels of resistance), exercise chart, record logs.

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Villareal et al 2011	independent and combined effects of weight loss and exercise	12 months	107 C=27 Diet=26 Exercise=26 Combined=28	65 years of age or older and obese United States at Washington University School of Medicine. Recruited through advertisements	RCT No theory mentioned, just the interventions Home-based with meetings/exercise groups Diet group had regular meetings, Others had intensive programs: exercise group had regular exercise sessions (3/wk) diet and exercise group had meetings and exercise sessions	Physical Performance Test, highest increase in the diet–exercise group (21%) compared to diet group (12%) or exercise group (15%). All intervention groups' scores increased more than the control group. Functional Status Questionnaire results increased more in the diet–exercise group (10%) than diet group (4%, P<0.001). Body weight decreased by 10% in diet group and 9% in diet–exercise group, no decreases in exercise or the control groups (P<0.001). Lean body mass and bone mineral density at hip decreased less in diet–exercise group (3% and 1%), than in diet group (5% and 3%), (P<0.05 for both comparisons). Strength, balance, and gait improved consistently in diet–exercise group (P<0.05 for all comparisons).	Better results for combined exercise and weight loss group, compared to either alone. Very small numbers in each group Older age group

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Stewart et al 2001	Inclusive, choice based, physical activity promotion program to increase lifetime physical activity levels of seniors	12 months	173, 164(95%) completed trial),	65 to 90 years Sedentary with no serious medical conditions that may have limited light to moderate physical activity Recruited through medical health maintenance organisations (high quality setting) thru multispecialty group practices. USA-California	RCT-based on SCT including principles of self-efficacy enhancement and readiness to change and motivational techniques. Health care setting	I – increased estimated caloric expenditure by 487 calories/wk in moderate or greater activities (MET ≥3.0; p<0.001) and by 687 calories/wk in physical activities of any intensity. Control group changes were insignificant.	Older age group Recruited through medical health maintenance organisations (high quality setting) through group practices. Sedentary/underactive seniors Small sample size (fairly well educated and good SES, few from minority populations)
Kolt et al 2009	Comparing efficacy of a pedometer-based Green Prescription program with a conventional time-based Green Prescription program	3 month intervention, Follow-up-re tested at 6, then 12 months	330 Low-active I C Baseline165165 6mths 143 135 12mths140 130	Over 56 years. (See below) Actual age recruited 65 and older with low activity levels. Identified through physicians data bases as ok to participate in physical activity, no health conditions that may affect their participation North shore, Auckland, New Zealand	RCT-comparing two programs I=telephone counselling based within a framework of Transtheoretical Model of behaviour change and principles of motivational interviewing Goal setting used – re: number of daily steps. C=time-related goals instead of step-related goals	Protocol Home-based Primary care physical activity prescription	Older age group 3 month intervention Both groups were provided with an intervention to increase physical activity, no 'real' control group per se
Kolt et al 2010 Above study - results		as above	as above	Actual age of recruits ended up being 68-80 years	as above	At 12 months both groups sig increased mod-vigorous physical activity, walking for leis and total walking (p<0.0001 for each), no sig diff between groups.	as above

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Tudor-Locke et al 2004		16 wks (4months)	N=47 (post int at wk 16, I=24;C=23)	48 to 58 years BMI 33.3 ±5.6kg/m2 o/weight/obese sedentary individuals with type 2 diab, Recruited thru diabetes due centre London Ontario, Canada	RCT Facilitated behaviour modification program, based on theoretical principles of self-efficacy and social support. Behaviour modification techniques- goal setting, self-monitoring and feedback. Home-based and meetings	Intervention group - increased physical activity>3000 steps/day, approx. 30min/day during intervention (P<0.0001) and waist and hip girth decreased approx. 2-3cm, but didn't differ significantly between groups	Individuals with type 2 diabetes Small sample size and limited time frame (16 week intervention) Pedometers useful to help motivate older adults to increase physical activity
Berstein et al 2002	To increase consumption of fruits, vegetables and calcium-rich foods in community dwelling elders	6-months	N=70 (I=38, C=32)	Older than 69 years Participants must have reported at least two concerns in physical function, as recorded in the sub-scale of the Medical Outcomes Survey (Stewart 1988) Community dwelling, functionally impaired Recruited through newspaper advertisements and recruitment presentations Boston, MA, United States	Two group RCT Behaviour modification techniques: goal setting, rewards, food-log recording, role-playing, games and troubleshooting, continuous monitoring and positive reinforcement. home-based Nutrition education group – intensive x8 home visits. Both groups bi-weekly calls	Compared to the Exercise group (C), Nutrition group (I) increased self-reported intake of fruit 1.1 +/-0.2 (2.8 to 3.9, P=0.01) serves, intake of vegetables 1.1 +/-0.2 (2.3 to 3.4, P=0.001) serves, intake of milk/dairy 0.9 +/-0.2 (3.0 to 3.9, P=0.001) serves	Recommend – specific and individualised program to meet dietary pattern and lifestyle of the individual Older age group Must have reported at least two concerns in physical function to participate (restricted sample) Small numbers

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Thomson et al 2005	Whether a plant based diet without specific energy goals would result in weight loss or changes in body composition	4 years	N=77, 52 in final analysis I=21,C=31	43-65 years Convenience sample of Women (Ancillary study cohort) from Women's healthy eating and living study (WHEL, initiated in 1993) Arizona, USA	Randomised-Controlled dietary intervention. No theory mentioned Dietary counselling session; Intensive telephone dietary counselling Cooking classes Newsletters to support efforts to achieve/maintain the study dietary goals; General instructions/ materials re: cancer prevention (diet)	Significant and sustained increase in fibre, fruit, vegetable and vegetable juice consumption ($p<0.05$) in intervention group compared to comparison group. Significant decrease in body fat observed at 6 months for intervention group as compared to baseline, but not maintained at 12 months. Sig diff ($p=0.0439$) in % body fat change over time observed between diet groups (1.04% versus 2.27% for intervention and comparison groups respectively.	Previously treated for cancer, and recruited from another study (WHEL) Restricted sample Therefore may have higher motivation to improve diet, etc Small numbers
Wright et al 2011	Examine efficacy of tailored nutrition education in comparison to other nutrition education methods	3months	Tailored feedback (TF) group (n=58)48 Small group nutrition education (GE) (n=58)41 Control group (C) (n=62)50 Only 139-complete data	40-65 years Requiring primary or secondary prevention in CVD. Recruitment-newspaper adverts, community announcements and media publicity on broadcast radio and community television Perth Western Australia-education sessions at Curtin University otherwise home-based	RCT; Transtheoretical model using both stages of change and processes of change constructs. Tailored feedback GE-education: dietary messages, label-reading, goal setting.	Tailored feedback group reported sig greater increase in fruit intake (0.3 serves/day, $P=0.031$) in comparison to other two groups. All three groups showed a reduction in total saturated fat intake	Short intervention time frame Small sample size Younger age group

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Clark et al 2002	To investigate effectiveness of a multiple-behaviour intervention based on a single theoretical framework, compared to single behaviour interventions.	12 months Outcomes assessed at baseline, 12 and 24 months	Target population 1300 Age reduced to 'from 60 years' to allow adequate sample size	Older adults (65 years and older) in the Rhode Island community (approx. 30% Portuguese background) community dwelling older persons, minimal screening to get a broad and representative population Community-based recruitment: newspaper ads, tv programs, info at community sites (senior centres, housing projects, churches, supermarkets, pharmacies), networking (friends, neighbours) Rhode Island, Kingston, USA Home based	Community intervention trial Multiple-behaviour intervention Based on Transtheoretical Model of health behaviour change	Protocol paper	Home-based Mailed newsletters, manuals, coaching telephone calls Active recruitment method, community intervention- may have confounding influences on results (as majority of community could have been exposed to info on intervention, whether involved, or not)
Clark et al 2005	As above – Design, methods and baseline data.	As above	N=1274 4 groups: Exercise only; Fruit and vegetables only; Exercise and nutrition; and fall prevention materials.	As above, NB. Age reduced to from 60 years to allow adequate sample size Home-based-newsletters, manuals, coaching phone calls	As above		See above Reiterates importance of finding the most effective methods to promote increased physical activity and improved nutrition in seniors as rapidly growing segment of the population

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Greaney et al 2008 (SENIOR project – Clark et al 2002…)	To identify the efficacy of a stage-based intervention on physical activity intentions and behaviours of community dwelling older adults	24 months (int = 12 months – 24 months is 12 months post interv)	N=966	As above Home-based	As above	No changes ,except when analyses excluded those in maintenance stage. Then: a greater proportion of participants in intervention group progressed in stage by 24 months in comparison to control group. More participants in control group regressed in stages or remained stable.	See above Supports the use of tailored interventions to increase motivational readiness for exercise/physical activity
Greene et al 2008	As above- f avd v intake results	As above	N=1277 N=834 provided dietary data over all three time points	As above Home-based	As above	Intervention group increased intake by 0.5 to 1.0 serving more than control group over 24 months (measured by NCI fruit screener and a 5 day program screener)	See above
Bourke et al 2011	Investigated feasibility of lifestyle intervention program – exercise/diet advice in patients recovering from colon cancer	12 weeks	N= 18	52-80 years (mean age 69 years) Colon cancer survivors – sedentary, identified from specialist follow-up clinics and multidisciplinary team meeting lists at hospitals Sheffield, UK Home-based with meetings at University rehabilitation facility	Prospective RCT Pilot study No theory mentioned	Improvements in intervention group: exercise behaviour (p=0.068), fatigue (p=0.005), aerobic exercise tolerance (p=0.010) and waist-to-hip ratio (p=0.002). Positive change in fibre intake (p=0.044),	Larger scale RCT required to confirm findings. Aims - physical activity and dietary improvements Restricted sample Small sample Older-mean age 69

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Van Keulen et al 2011 (Protocol paper 2008, Costing paper 2010)	Compared the efficacy of tailored print communication and telephone motivational interviewing, to change physical activity and fruit and vegetable consumption.	43-week Follow-up at 47, 73 and 78 weeks	N=1629 to four groups 4 tailored print letters; 4 motivational telephone calls; 2 of each type of intervention; no information.	Middle-aged 45-70 years Recruited through general medical practices 50% hypertensive, other 50% recruited post-baseline questionnaire, if failed to meet at least 2 Dutch Public Health guidelines (excluding high consumption of saturated fats, as is high in most Dutch adults) Southern Netherlands Home-based newsletters and motivational phone calls	RCT Behaviour change, motivational interviewing and Transtheoretical Model of health behaviour change	All three intervention groups were equally and significantly more effective than control group in results. Increased physical activity (hours/day), fruit intake (servings/day), vegetable consumption (grams/day)	Supports use of tailored print and telephone interviewing to increase levels of physical activity and improved diet Restricted sample
Ross et al 2008	Evaluate effectiveness of pa and diet intervention to reduce obesity and related comorbidities in a primary health-care setting.	24 months	Usual care (n=242) Behavioural intervention (n=249)	25-75 years Abdominally obese men WC ≥102cm and women WC≥88cm BMI 25-39.9kg/m^2 Recruited through family medical clinics-physician patient lists Primary health care setting Kingston, Ontario, Canada	RCT Theory designed to build self-regulatory skills	Protocol	Aim to reduce obesity with physical activity and diet intervention Yet, clinical setting and age range was much larger Restricted sample-abdominally obese and high BMI
Ross et al 2012	As above	As above	As above, one less in Usual care – n=241	As above	As above Clinician and highly trained Health educator	Significant effect observed for waist circumference in intervention compared to control group ($p<0.001$), sustained at 24 months.	As above

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Baker et al 2008 (Fitzsimmons et al 2008 rationale and study design)	Assessed impact of a pedometer-based walking intervention on daily step counts, health outcomes and self-reported physical activity.	12 weeks	N=79 Men=16 Women=63	41-58 years Low active individuals in lowest SES groups (re: Scottish Index of Multiple Deprivation SIMD) Recruited via mail out leaflet, posters and leaflets in: GP surgeries, other health care providers, shops, veterinary practices, pubs, stands at local library, shopping centre and high rise blocks of flats, advertisements in local newspaper. Home-based (Group 1, x2 physical activity consultations) Glasgow, Scotland -within 1.5km of Strathclyde University campus (for ease of access of participants)	RCT Transtheoretical Model of behaviour change Consultation on increasing and maintaining physical activity	Significant improvements in intervention group for step counts ($p<0.001$), leisure time walking ($p<0.02$); with significant decreases in sitting on weekdays ($p<0.003$), weekends ($p<0.001$), and total sitting ($p<0.001$), no corresponding changes in the control group.	Supports a pedometer-based walking program. Younger age group Small sample Short time frame

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Jancey et al 2008	Study tested an intervention to mobilise older adults into a neighbourhood-based walking program	6 months	260 older adults	65-74 years healthy (low-stress walking program would not place them at risk, or exacerbate any existing health condition) , but insufficiently active, Recruited through Australian electoral roll from 30 Perth metropolitan neighbourhoods – postcard delivered and phone calls made to potential participants Neighbourhood based Perth, Western Australia	RCT HBM, PRECEDE-PROCEED model – central construct of self-efficacy	Successful – 65% completed program, Mean average walking time for recreation increased by approx. 100min/wk 80% reported they would continue to walk twice a week, post-program.	Focus on physical activity Written resources-only newsletters, unsure if developed with target group input. Walking good for older age group Same theoretical basis – positive results and good attrition rate, 65% completed program Importance of tailored program, enjoyment of walking group, receptiveness to learning new skills, usefulness of social support, value of tertiary students as a skilled resource.

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de Jong et al 2007 (de Jong et al 2006- recruitment)	To determine effects on energy expenditure, health and fitness outcomes after 12 months of program. (stimulating leisure time pa)	12 months	315 I C Baseline1631 52 6 month 79 102 12month 37 54	55-65 years sedentary and underactive (excluded people not interested in leisure-time physical activity) Recruited by written invitation in six randomly designated intervention neighbourhoods, visited by trained personnel and screened Netherlands – three municipalities and four neighbourhoods in each – 2 control/ 2intervention (12 neighbourhoods). Local gymnasium	Group-randomised (cluster) design Based on a process model of behavioural change in which behavioural change is seen as a multidimensional and dynamic process (TTM of behaviour change).	(F=fitness) Energy expenditure – recreational sport and total physical activity increased over the 12mths (F=20.51; P<0.01 and F=24.79; P<0.01 retrospectively). In leisure time physical activity an increase occurred from baseline to 6mths (F=9.17; P<0.01), then stabilised from 6-12mths. For Energy expenditure, leisure time physical activity a significant group x time group interaction was found (F=9.70; P<0.01).	Low retention/ completion of data (lack of time/inability to appear at testing facility- high subject burden) at 6 and 12 months
King et al 2007	study determined the 6- and 12-month effectiveness of telephone interventions delivered by health educators or by an automated computer system in promoting physical activity.	12 months	N =218 3 interventions: Human advice, Automated advice, Health education- control group N=188 completed trial	inactive men and women age 55 years and older in 'stable' health Recruited via promotion in local media outlets. Distribution of flyers and brochures to senior centres, pharmacies and other community settings. Home-based USA	Personalised verbal communication (communication theory) in combination with an emphasis on cognitive and behavioural processes of change e.g. personal commitment, enlisting support, self-efficacy enhancement, self-monitoring (Social cognitive theory, the TTM).	Using intention-to-treat analysis, at 6 months, participants in both interventions, showed significant improvements in weekly/physical activity compared to controls, although not differing from one another. Differences generally maintained at 12 months, with both intervention arms remaining above the target of 150 min/ week of mod-vigorous physical activity on average.	Human and automated telephone advice useful to promote physical activity to inactive older adults

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McClure et al 2011	To assess the feasibility and acceptability of a program designed to improve mental and physical well-being, by reducing depressive symptoms, promoting smoking cessation and increasing physical activity.	6 months – pilot trial	N=52	18-72 years Currently enrolled in health plan with depressive symptoms (but not being treated) and smokers, not meeting physical activity guidelines Recruited from membership of Good Health, large regional health plan in the Pacific Northwest USA, Pacific Northwest	Cognitive-behavioural multiple risk factor program To test the effectiveness of the intervention, to be expanded on at a later date.	Clinically significant improvement (50% reduction) in baseline depression score at four months (54% vs. 26%)	Call for for further interventions that can successfully affect more than one risk factor at a time. Although, still large gaps on how these can be best designed, implemented and evaluated. Large age range Very small sample Restricted sample: enrolled in health plan with depressive symptoms
Dishman et al 2010	To determine whether goal setting and theory-based moderators of goal setting had dose relations with increases in goal-related physical activity.	12 week USA	N=664	26-46 years from 8 intervention worksites recruitment -employees at sites who volunteered to participate. With no reported cardiovascular, pulmonary, or metabolic disease Workplace (16 geographically diverse worksites, ½ Int. ½ Con.)	Group randomised 'efficacy' trial -Community intervention (workplace) Goal-setting/personal goals : SCT	Participants exceeded 9000 daily pedometer steps and 300 mins/week of mod-vigorous physical activity during last 6 weeks of the study. Results showed a dose relationship between increased physical activity and changes in goal setting, self-efficacy, commitment and intention, satisfaction, consistent with goal-setting theory.	Supports use of goal setting Younger age group Small time frame Set in workplace

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Keller et al 2006	To provide nutrition education to older adults to prevent chronic disease, or maintain their current status	Programs ran for 10-months of the year/3 years	64.5% exposed to some aspect of program over 3 years approx. 2000 people	Members of a Seniors recreation centre Guelph, Ontario, Canada Senior centre	Community intervention trial (Seniors rec. centre) "community organisation approach"	Frequency of eating and fruit and veg consumption, were different from baseline to follow-up. B 57.4% consumed few fruit and vegetables and ate < 3 times/day, compared to 42.7% and 3.3% at follow-up. Sig diff's also seen by EAN participation, 37.3% of participants, as compared to 53.7% of non-partic had low consumption of f&v	Supports development with the target group: Positive to involve target group in planning, implementation and evaluation "community organisation approach"
Lee et al 2011	Evaluated effectiveness of 12 week, home-based physical activity and nutrition program for seniors.	As above	As above	65-74 years Home-based as above Perth, Western Australia	Pilot program-Participatory Action Research (PAR)	Average gain of 27 mins walking for participants, with average drop of 5 mins for controls ($p<0.01$). Intervention group had a significant intake of fibre ($p<0.01$).	Supports low-cost intervention program to improve seniors physical activity and nutrition, with phone calls, booklets and pedometer – with and extended time frame. Small time frame, older age group, small sample
Jancey et al 2011	If a booster program can improve seniors' levels of walking.	12 weeks	N=284 booster program I=114 C=134 N=231 complete results I=100 C=131	65-74 years Home-based Perth, Western Australia	Pilot program-Participatory Action Research (PAR)	Walking increased as a result of the booster program, with mean time spent walking for recreation increasing by 38 minutes/week for the intervention group	Supports low-cost intervention program to improve seniors physical activity, with phone calls, booklets and pedometer – with and extended time frame Small time frame, older age group, small sample

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Goodpaster et al 2010	To determine efficacy of a physical activity and weight loss intervention on the adverse health risks of severe obesity.	12 months	N=130 randomised N=101 completed Diet and physical activity intervention. Group 1: diet and physical activity; Group 2: diet (physical activity delayed for 6 months)	30-55 years with severe obesity BMI: 35-39.9, but not diabetic Recruited via television and newspaper advertisements and mass mailings Home-based with group meetings and phone calls USA	Single-blind randomised trial Behaviour-based approach Liquid and pre-packaged meal replacements provided for free for all, but one meal for months 1-3, then only one meal/day for months 4-6. Modest financial compensation for participation and were eligible to receive small financial incentives for adherence to behavioural goals of intervention periodically	Both groups lost significant amount of weight by 6 months, more for group 1 vs. group 2 in the first 6 months (10.9kg [95% CI, 9.1-12.7] vs 8.2kg [95% CI, 6.4-9.9], p=0.02 for groupxtime interaction). At 12 months weight loss was similar	Supports combining physical activity and nutrition behaviours to improve weight loss and reduce waist circumference. Meal replacements don't follow dietary guideline recommendations Financial incentives for participation and incentives to adhere to goals High cost to replicate Young sample Small sample size No real-'control group'
Frimel et al 2008	To evaluate the effect of adding exercise to a low calorie diet on changes in strength and lean mass in frail obese older adults.	6 months	N=30 15 to either diet behave therapy/ or diet behave therapy plus exercise, incorporating progressive resistance training	65-75 years community dwelling obese BMI: 37-42kg/m2, undergoing voluntary weight loss Home based diet and diet and exercise groups (both had weekly meetings/exercise sessions) Washington, St Louis, Missouri, USA	Behavioural therapy strategies: problem solving, relapse prevention and identification of high risk situations	Both groups had similar decreases in weight and fat mass, but the diet exercise group lost less fat-free mass and lean mass than diet group. The diet exercise group had greater increases in percentage of weight as fat free mass than diet only group; and also increased in upper and lower extremity strength.	Supports use of resistance training exercises in older adults to help increase muscle strength. Also the combination of improving diet and increasing physical activity as one intervention. Bit older age group Very small sample No control group

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Howard et al 2006	To report data on body weight in a long-term, low-fat diet trial for which the primary end points were breast and colorectal cancer and to examine the relationships between weight changes and changes in dietary components	Study enrolment between 1993 and 1998, this analysis includes a mean follow-up of 7.5 years	48 835 40% (19 541) randomised to intervention and 60% (29 294) to control groups.	50-79 years, postmenopausal women, diverse backgrounds and ethnicities. Participated in the Women's Health Initiative Dietary Modification Trial; baseline diet with fat intake of at least 32% of daily total calories as evaluated by food frequency questionnaire Clinical trial – 3 interventions: Group and individual sessions, controls-diet related education materials 1)Low-fat eating pattern, hormone replacement therapy (HRT), 3)calcium and vitamin supplementation USA	Randomised intervention trial Behaviour modification techniques. Participants self-monitor fat, fruit/vegetable, and grain intake, which helps them make appropriate food choices while receiving feedback on their performance in relation to the WHI nutrition goals. Group and individual sessions at clinical centres	Intervention group lost weight in the first year (mean of 2.2 kg, P.001) and maintained lower weight than controls during average 7.5 years of follow-up (difference, 1.9 kg, P.001 at 1 year and 0.4 kg, P=.01 at 7.5 years). No tendency toward weight gain observed in intervention group overall or when stratified by age, ethnicity, or body mass index. Weight loss was greatest among participants in either group who decreased their percentage of energy from fat. A similar but lesser trend was observed with increases in vegetable and fruit servings, and a non-significant trend toward weight loss occurred with increasing intake of fibre	A low-fat eating pattern does not result in weight gain in postmenopausal women Women only Clinical trial

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Lindstrome et al 2003	Diet and exercise intervention One of the main objectives in the DPS was to test a diet and exercise intervention feasible in Primary Health Care.	3 years	522 middle-aged (40-64 years), men (n=172) women (n=350)	Recruitment by local advertisements or identified in earlier epidemiological surveys. Overweight (BMI >25kg/m^2) middle-aged men (n=172) and women (n=350) with impaired glucose tolerance Primary Health Care Centres in Finland: Helsinki, Kuopio, Turku, Tampere and Oulu.	Controlled randomised study. Behaviour modification techniques. An extensive local and national network provided training, feedback and clinical support for the intervention group. Control group received general dietary and exercise advice at baseline and had an annual physician's examination. Intensive lifestyle intervention-individualised dietary counselling from a nutritionist and advice to increase overall physical activity and circuit-type resistance training sessions.	The intervention group showed significantly greater improvement in each intervention goal. After 1 and 3 years, weight reductions were 4.5 and 3.5 kg in the intervention group and 1.0 and 0.9 kg in the control group, respectively. Intensive lifestyle intervention produced long-term beneficial changes in diet and physical activity and reduced diabetes risk (reduced by 58% in the intervention group).	Goal-based, case managers or "lifestyle coaches", frequent contact and ongoing intervention throughout the trial to help participants achieve and maintain the weight and physical activity goals Strategies to tailor intervention to the individual Younger age group: middle-aged With impaired glucose tolerance (restricted sample)

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Lindstrome et al 2006	Assessed the extent to which the originally-achieved lifestyle changes and risk reduction remain after discontinuation of active counselling.	At 7 years follow-up	As above	As Above	As above	During total follow-up, the incidence of type 2 diabetes was 4.3 and 7.4 per 100 person-years in the intervention and control group, respectively (log-rank test p=0.0001), indicating 43% reduction in relative risk. This was related to the success in achieving the intervention goals of weight loss, reduced intake of total and saturated fat and increased intake of dietary fibre, and increased physical activity. These lifestyle changes in the intervention group were maintained post intervention. The corresponding incidence rates during post-intervention follow-up were 4.6 and 7.2 (p=0.0401), indicating 36% reduction in relative risk.	As above Lifestyle intervention - people at high risk for type 2 diabetes Resulted in sustained lifestyle changes and a reduction in diabetes incidence, - remained after the individual lifestyle counselling was stopped. Usefulness of counselling Younger age group: middle-aged With impaired glucose tolerance

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Norton et al 2011	Comparison of two physical activity interventions Home versus group based (at University)	40 days Adelaide, South Australia	3 groups Pedometer based walking n=251 Group based intensive structured n=148 Control n=135	18 to 60 years Insufficiently active (or if sufficiently active, were allocated to control group). Safe to take part in physical activity Recruited through email advertisement to a university, tertiary hospital and several government departments Home or group- at University	Pedometer-limited contact, info/pedometer strategy based on HBM versus an Intensive, structured, group based strategy, using multi layered soci-ecological approach	Post intervention compliance-Group:81.1% Pedometer 64.5% 12 months compliance-Group:53.5% Pedometer 46.6%	Younger age group Active recruitment – University/tertiary hospital and government departments Demonstrates that both group and individual interventions can be effective to increase physical activity
Schneider, Cook and Luke 2011	To compare self-reported exercise behaviour and functional outcomes at 3 month intervals over 1 year, across three groups of older adults	10 weeks Data-baseline,3,6, 9,12 months	N=332; 3 groups- men, women, couples Cognitive-behavioural therapy group, attention-control education group and a control group	68 to 77 years Recruited through newspaper articles and mailings to adults who attended outreach education USA Local community facility	Randomised intervention Cognitive behaviour therapy (CBT)	Therapy and education group increased strength training (0.05 and 0.06 hr/week more than controls) sig. in therapy group. Therapy and education group also sig. reduced their 6min walking distances over time (-1.6m. P=0.003 and -1.5m. P=0.026 respectively). Results of Education and therapy groups similar.	Self-report for exercise behaviour. Supports use of education to increase physical activity in older adults Community exercise facilities Bit older sample Sample technique

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Johnson et al 2004	To determine if the program increased fruit and vegetables intake in individuals who received the baskets	5-months	Int-n=100, pre and post; Con-n=52	Low-income, home-bound seniors – at least 60 years old Meals on Wheels recipients were sent postage paid post-card inviting them to participate, which they could return in agreement, or phone to confirm participation. Seattle, USA Home-based	Experimental/intervention study Telephone survey (pre-post intervention) 6 fruit and vegetable questions from the Behavioural Risk Factor Surveillance System (Wolfe et al 2001)	Seniors who received baskets reported consuming an increase of 1.04 servings of f & v. Diff between mean servings of I to C was 1.31 (95%CI, 0.68-1.95, P<.001). At baseline 22% intervention group consumed 5 or more servings of f & v/day, this went up to 39% at end of 5 months.	Positive results, but costly, lots of community support required.
Moschny et al 2011	To analyse barriers to physical activity in older adults and compare gender and age groups	Computer assisted telephone interviews	Of N=1937, N=286 stated insufficiently active – these were questioned about barriers to physical activity	72-93 years Sought primary health care during a pre-determined week in 2001 recruited through 344 general practitioners Germany	Cross-sectional prospective observational cohort study. Telephone interviews (7 year follow-up to German epidemiological trial on ankle brachial index)	Most 3 most important barriers were poor health (57.7%), lack of company (43%), lack of interest (36.7%). Others were lack of transport to sports programs, facilities and lack of opportunities, lack of time.	Increasing physical activity can improve health (chronic disease) Older age group
Haveman -nies et al 2003	To identify lifestyle and dietary factors that contribute to healthy ageing.	Analysed results of 10 year longitudinal study	N= 2200 M=1091 F=1109	70-79 years Quantitative data on diet, lifestyle and health Europe-Belgium, France, Denmark, Italy, The Netherlands, Portugal, Spain, Switzerland and Poland.	Retrospective study that focused on diet, physical activity and smoking re: survival and maintenance of health at old age	Unhealthy lifestyle habits including having a low-quality diet, being physically inactive and smoking relate to an increased mortality risk (hazard ratio ranged from 1.2 to 2.1).	Supports idea that health promotion at older ages can positively contribute to healthy ageing Older age group

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Simkin-Silverman et al 2003 (Silverman et al 1995)	The efficacy of a dietary and physical activity lifestyle intervention to prevent weight gain and elevations in cardiovascular disease (CVD) risk factors from the peri- to post menopause is unknown. Objective: To report the 54-month results of a lifestyle dietary and physical activity program on weight, body composition, physical activity, diet, and other CVD risk factors.	5-year behavioural dietary and physical activity program or to an assessment-only control group.	N=535	Ages 44 to 50 at study entry healthy, premenopausal women not using HRT no hysterectomy BMI between 20 and 34 Home based with meetings Recruited by mail from a random sample of postal/ zip/ area codes in Allegheny County, Pennsylvania, USA Interviewed by phone and attended an initial meeting and baseline visit to determine their eligibility to participate in study	Retrospective study -Data from a 5-year randomised clinical trial known as the Women's Healthy Lifestyle Project Cognitive behaviour approach to weight control: study meal plan, slowly modified to suit preferences. Intensive program- consultation on diet modification and increasing physical activity	55% (136/246) of intervention participants were at or below baseline weight compared to 26% (68/261) of controls after 4.5 years. The mean weight change in the intervention group was 0.1 kg below baseline (SD = 5.2 kg) compared with an average gain of 2.4 kg (SD = 4.9 kg) for the controls. Waist circumference significantly decreased more in intervention group compared to controls (M = –2.9 cm, SD = 5.3 vs. M = –0.5 cm, SD = 5.6, p<.001). Participants in lifestyle intervention group were consistently more physical activity and reported eating fewer calories and less fat than controls. Long-term adherence to physical activity and a low-fat eating pattern was associated with better weight maintenance.	Demonstrates that in healthy women, weight gain and increased waist circumference during the peri- to post menopause can be prevented with a long-term lifestyle dietary and physical activity intervention. Younger age group All women

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Dorgo et al 2010	Assessing the applicability and effectiviness of a peer-mentored exercise program, vs student mentor program.	35 weeks X3 75 minute training sessions/wk	N=60	62-75 years Recruited from local community. Aged 60 years or more, written statement from physician re: ability to take part in physical activity program, written statement from participant re: commitment to regular participation, reliable personal transport	Peer mentoring-provided motivation and support	Same retention rates in both groups. Student mentor group had higher participation. Both groups made significant improvements in majority of fitness measures from baseline to mid-term Peer Mentor ($p<0.0147$) and Student Mentor ($p<0.0132$), both groups improved significantly from baseline to post-test in all fitness measures ($p<0.0076$).	Addressing barriers of older adults to participate in physical activity. For e.g. individual attention, assistance and support, sometimes lack in community based programs. Need for information on understanding the benefits of exercise for disease prevention, and knowledge and experience to exercise alone. Increasing physical activity can improve health (chronic disease) and reduce falls. Small sample Peer mentoring worth investigation?
Withall, Jago and Fox 2011	Examined perceptions of participants, non-participants and exercise leaders in a low-income area re: barriers, motivators…		Total participants (n=152) Interview participants (n=33) group members (n=12) non-group members(n=21) Exercise leaders (n=14)	U18-54(n=58) 55+(n=82) some missing data(n=12) U18-54(n=31) 55+(n=2) Southmead, Bristol, UK Lowest life expectancy in Bristol (75.3years) Low SES-UK Government Index of Multiple Deprivation (IMD) People who currently attended community based physical activity programs, some people who did not and exercise leaders	Survey: Mixed methods research approach used to guide data collection and analysis: both qualitative and quantitative research	Aware of benefits of being physically active. Positive effects of mental well-being mentioned almost as often as those on physical well-being. Cost major barrier to starting physical activity. Suggests the use of Self Determination Theory (SDT) theoretical framework to study the motivations and behaviours of this population	Importance of physical activity programs addressing factors including: low income groups, costs, accessible times and socialisation aspect

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Leone et al 2012	To assess barriers and facilitators to eating and purchasing fruit and vegetables from local farmers' markets, identifying individual and environmental influences on these behaviours. Secondary-Compare between urban/rural and whites/other races		(n=341)	82% female 15.2% of adults Low –income Annual $15000 or less Potential participants-recruited in waiting rooms of Division of Social Services (DSS) offices in 15 counties North Carolina, USA	Self-completion survey 24 questions addressing behaviours, barriers and facilitators to fruit and vegetable consumption and farmers' market usage	Main barrier sited was cost (26.4%) Potential facilitator to eating more fruit and vegetables was cost (58.9%)	Information on barriers and facilitators of fruit and vegetable consumption Low SES

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Appleton et al 2009	To investigate barriers to increasing fruit and vegetable intakes in older population in relation to current intakes	approx. 20 mins.	426 older people	Over 65 years 37% men, 63% women Names, addresses and phone numbers of 1000 potential participants from data sampling company Northern Ireland	Telephone survey 22 closed responses and 1 open response item	There were significant associations with current intakes: a greater fruit and vegetable consumption was associated with greater 'liking' for fruit and vegetables (B=0.675, P<0.01), greater 'awareness of current recommendations' for consumption (B=0.197, P<0.01) and greater 'willingness to change' (B=0.281, P<0.01). Similar associations between fruit and vegetable intakes and 'liking' and 'awareness' were also found in those consuming low intakes of fruit and vegetables or those at risk of consuming low intakes. All groups reported low awareness and knowledge of recommendations with some commenting on environmental difficulties, such as cost and access.	Barriers to fruit and vegetable intake Older adults

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Glasson, Chapman and James 2010	Investigate whether fruit and vegetables should be treated as separate groups in HP programs, via examination of consumption levels, barriers, knowledge and stages of readiness for change	average 11mins	N=1403	25-44 years, 84% women parents and carers of primary-school-aged children Hunter and New England regions of New South Wales, Australia	Telephone interview survey Computer Assisted telephone Interview (CATI) administered by a market research company. Results presented using Stages of Change/Transtheoretical Model of behaviour change	57% reported consuming 2 or more servings fruit/day (mean=1.71, median=2) 31% 5 or more servings of vegetables/day (mean=3.31, median=3). Barriers Fruit-cost; vegetables-lack of time and food preferences	Increasing fruit and vegetable intake can improve health/reduce risk of chronic disease Provides knowledge of what constitutes a serving and recommended servings/day. Food preparation info.
Pan et al 2009	To examine factors of physical activity participation including: individual, social and physical environmental factors.	Telephone survey	N=5167	15-79 years Random-digit dialling from household-based telephone exchanges Canada	Telephone survey	Greatest effect on physical activity was self-efficacy and intention. Self-rated health, perceived barriers and family income were associated with physical activity. Older people perceived health benefits, education and family income more important in relation to physical activity.	Supports low cost pa program for older adults that promotes health benefits and provides education. Should be tailored to enhance people's confidence to engage in physical activity; motivate to be active; educate on physical activity benefits and reduce barriers; target differing Soc-economic/ demographic groups)
Jancey et al 2009	To identify issues and perceptions concerning physical activity in older adults	60-90 min interviews	N=16	65-74 years purposely selected from various SES backgrounds, as determined by SEIFA (socio-economic index for area), insufficiently active Perth metropolitan area, Western Australia	Qualitative study One-to-one semi-structured interviews	Benefits of physical activity and desire to participate in less age appropriate activities. Main barrier-pain. Need for more specific info on benefits of physical activity; role of pain management	Variety in physical activity to suit individuals semi-tailored, suggest more than walking Information on benefits of physical activity and appro/varied exercise to do depending on ability

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Mathews et al 2010	perceived physical activity enablers and barriers among racial and ethnic diverse older adults		42 focus groups	African Americans, American Indians, Latinos, Chinese, Vietnamese, non-Hispanic Whites/Whites USA	focus groups	Common barriers-health, fear of falling and inconvenience. Common enablers – positive outcome expectations, social support and physical activity program access. Importance of physical activity programs designed for older adults.	Increasing physical activity can improve health (chronic disease) and reduce falls.
Kamphuis et al 2006	To explore how perceptions of environmental influences on health behaviour patterns across socioeconomic groups in the Netherlands.		4 Focus groups	Mean age 61(n=38) From an existing cohort study (GLOBE study), based on neighbourhood deprivation level and highest educational attainment to determine SES (x2 high SES (n=24) x2 low SES(n=14)) Eindhoven, the Netherlands.	Focus groups	Low SES groups perceived more barriers for behaving healthy, specifically barriers related to accessibility, availability, neighbourhood characteristics, and cost considerations.	Low SES groups – barriers to physical activity.

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Price et al 2011	Older adults perceptions of physical activity and cognitive health	90-120mins	N=55, 10 focus groups	65-74 years irregularly active (active less than 150mins/wk) Recruited by telephone and radio advertisements, flyers announcements at group meetings in community centres, housing facilities and churches Columbia, South Carolina, USA	Focus groups- Discussion guide: guided by the Extended parallel process model (EPPM; Witte& Allen 2000) and Elaboration likelihood model (ELM; Petty & Cacioppo 1986) (like HBM/SCT) EPPM – 4 central constructs: perceived susceptibility, perceived severity, self-efficacy and response efficacy	Perceived cognitive decline as a severe threat, concerned about losing independence and susceptible to cog decline, Most recognised link between cog decline and physical activity, but several said association was not clear. Many suggested evidence of physical activity benefits for cog decline would enhance message credibility. Suggested messages paired with social support to increase physical activity.	Developed for older adults and allows for – socialising. Cognitive decline and physical activity
Pollard, Lewis, Binns 2008	Select priority interventions to develop strategies to improve fruit and vegetable consumption, supply and identify implementation priorities		Desktop audit of progress on framework interventions	Fruit and vegetable interventions Department of Health Perth, Western Australia	Desktop audit	Plan for actions to improve fruit and vegetable consumption and supply.	Names some barriers to increasing fruit and vegetable consumption in WA

Author / year	Aim	Time frame	Sample size	Study population	Study design/Theory	Results/Stats	Comments/findings
Griffin et al. 2009	Process evaluation of intervention to increase physical activity physical activity in midlife and older adults			62-73 years Various community organisations across the USA (Health centres, Councils on/for Ageing, YMCA's)	Both programs incorporate behaviour change strategies consistent with the Transtheoretical Model and SCT	Process evaluation: Active for Life initiative examined the translation of two programs shown to be effective in increasing physical activity in controlled research settings to non-research settings.	Benefits of using process evaluation Usefulness of flexibility in program delivery and tailoring of program to suit participants needs. Importance of process evaluation being set up from the start of program, to be part of the evaluation process throughout the study and also to inform adoptions of the program during delivery/intervention period.

Appendix C

Cover Letters

Control group – Baseline questionnaire cover letter

Thank you for agreeing to be part of our important health research project and assisting us by completing this survey being conducted by Curtin University and the National Heart Foundation.

The aim of the project is to learn more about the extent to which physical and nutrition influence the health of people aged 60 to 70 years. We are interested in finding out about your level of physical activity and your eating habits.
Enclosed is the first of three questionnaires that we would like you to complete over the next 12 months. We need you to complete all the questionnaires so that we can compare responses over time. Because you are part of a small number of local people who have been selected randomly to give your opinion, your responses are particularly valuable.
This questionnaire should take about 15 minutes to complete. All information will be kept strictly confidential – your name and address will not be available to anyone. Your answers will be combined with those of others to produce the survey results. The identification number on the first page is used simply to check whether we have received your questionnaire back. Please answer the questions honestly and as accurately as you can. There are no right or wrong answers.
Please complete this questionnaire and return in the self-addressed envelope by Friday 14th May 2010. By doing so, you will place yourself in the running to win one of several $50.00 vouchers.
Should you require any further information please don't hesitate to contact Linda Burke on 9266 4535 (Weekdays 10am to 2pm) or send me an email: L.Burke@curtin.edu.au
Thank you for taking the time to be part of this study. Your help is greatly appreciated.

Yours sincerely

PANS Project Coordinator
Linda Burke

Intervention group – Baseline Questionnaire cover letter

Thank you for agreeing to be part of our important health research project and assisting us by completing this survey being conducted by Curtin University and the National Heart Foundation.

The aim of the project is to assess the effectiveness of a home-based physical and nutrition program for older adults aged 60 to 70 years that aims to ultimately reduce chronic disease (obesity, diabetes, cardiovascular disease) and improve mental health.

The 6 month home-based program will provide you with a number of physical activity and nutrition resources that include a booklet, calendar and exercise chart, as well as a pedometer and resistance band for exercising. A trained Guide will support you and a small group of people residing in your suburb via several pre-arranged meetings and phone or email contact.

Being a small group of people randomly selected to be part of this research your responses are very important. This is the first of three questionnaires that we would like you to complete over the next 12 months. We need you to complete all three questionnaires so that we can compare responses over time.

This questionnaire should take about 15 minutes to complete. All information will be kept strictly confidential – your name and address will not be available to anyone. Your answers will be combined with those of others to produce the survey results. The identification number on the first page is used simply to check whether we have received your questionnaire back. Please answer the questions honestly and as accurately as you can. There are no right or wrong answers.

Please complete this questionnaire and return in the self-addressed envelope by Friday 14th May 2010. By doing so, you will place yourself in the running to win one of several $50.00 vouchers.

Should you require any further information please don't hesitate to contact Linda Burke on 9266 4535 (Weekdays 10am to 2pm) or send me an email: L.Burke@curtin.edu.au

Thank you for taking the time to be part of this study. Your help is greatly appreciated.

Yours sincerely

PANS Project Coordinator
Linda Burke

Control and Intervention group – Post-program Questionnaire cover letter
Physical Activity and Nutrition for Seniors Project (PANS)

14th October 2010

Dear Participant

Thank you for agreeing to be part of our research project. Your answers will help us to understand the food intake and physical activity level of people your age.

Please complete the attached questionnaire and send it back to us in the enclosed self-addressed envelope by Friday the 29th October. We have enclosed a $5 scratchie as a small token of our appreciation.

If you have any questions, please contact me on 9266 4535 (Weekdays 10am to 2pm) or send me an email: L.Burke@curtin.edu.au

Thank you

Linda Burke
PANS Project Coordinator

This is a joint Curtin University and National Heart Foundation project funded by the National Health and Medical Research Council.

Questionnaire 2

Id:_____

Appendix D

Consent

Physical Activity and Nutrition for Seniors Project
Screening Questions

Interviewer Introduction

Good Morning/afternoon. My name is _____ I am calling on behalf of Curtin University and the National Heart Foundation.

Could I please speak to Mr/Mrs _____?

If the person is not available ask, "What would be an appropriate time to call back Mr /Mrs _____. Record suggested➔Call back date/time.

If person is there, then <u>continue</u>

Good morning/afternoon Mr/Mrs_____
I'm calling on behalf of the Curtin University and the National Heart Foundation.

<u>Introduction</u>
We are would like to speak to people aged 60 to 70 about physical activity and nutrition. We would like to find out what physical activities, if any, they are currently involved in and find out a little more about what they eat.

We are not selling anything. The interview is very short and will only take about 5 minutes of your time. Is now a convenient time for you to answer the questions?

If **Yes 1➔** Thanks and go to screening question 1.
If **No 2➔**
🡻

Could I call back at another time? **If yes**
What would be an appropriate time Record date/time
Thanks, I call you then
If No Thank you and close interview

No.	Date	Time	Interviewer Name	Disposition Code	Screening Complete	Call Back date	Call back time
1							
2							
3							
4							
5							
6							

Screening Questions

First I'd like to confirm if you are in the 60-70 age group.
(More than one person in age group - include both, if interested)

Yes	1	go to question 2
No	2	We are looking for people specifically in this age group - Thank you for your time.

I would like to ask you about your previous involvement in research programs.

1. Have you been involved in any research programs over the past 5 years that were to do with exercise or diet? *(completing surveys is ok – not actual participation in programs)*
   (Researcher may need to follow – up if they are unsure)

Yes	1	Congratulations on your involvement in much needed research – Thank you for your time.
No	2	go to question 2

I would like to ask you about your level of physical activity.

2. In a usual week, would you do moderate physical activity for at least 30 minutes in total on at least 5 days?
   (I mean activities that cause some increase in breathing or heart rate for example brisk walking, swimming, tennis, dancing)

Yes	1	Congratulations on being so active – Thank you for your time.
No	2	go to question 3

I would like to ask you about your diet.

3. Are you currently following a special diet?

Yes	1	Thank you for your time.
No	2	go to question 4

Vegetarian - include if ovo/lacto / exclude if vegan
Weight reduction (trying to lose weight, on a low fat diet)- exclude
Diabetic – exclude
Fat modified – exclude
Gastric banding (have/ or are planning to have) - exclude

I would now like to ask you about your health in regard to being able to walk.

4. Do you have any medical conditions that would make it dangerous for you to do moderate walking twice per week?

Yes	1	Thank you for your time.
No	2	Invite them to join program **Their suburb will determine whether they are allocated to the intervention group or the control group**

Intervention Group

- **Program Explanation**

Thank you for answering those questions. Your answers indicate that you would be an ideal participant in our health research.

Curtin University and the National Heart Foundation will be conducting a **free** physical activity and nutrition program in your suburb.

The program will involve meeting 5 times during May to October, with a small group of people in your suburb. The group will be led by an expert group leader and all participants will receive educational material to support their involvement. The program will provide you with the opportunity to become more active and to meet people who live in your area.

If you agree to be part of the Health research program, we require that you fill in a questionnaire prior to commencing the 6-month program. Any information that you provide will be anonymous and confidential. The questionnaire will take about 20 minutes to complete.

Would you like to be part of this program?

A	No	☐	Thank you for your time	☐
B	Yes	☐	**Check address details** I will place a questionnaire & self-addressed envelope in the mail and your group leader will contact you in about a week or two. Would you be able to answer a couple more questions? Yes - go to question 4 No - Thank you for your time and good-bye	☐
C	Unsure	☐	Would like time to think about whether you wish to be involved in the program? I could send you some information on the program and phone you in a few days to check what you have decided. **Check Address details**	Yes ☐ No ☐ ☐

If you wish to be part of this program, what times would you prefer to meet?

Morning Afternoon Evening

The group leader for your suburb will contact you in about a week or two to confirm your first meeting.

So I can send some information to you, can I please check your address?

Name_____
Address _____
Suburb_____ postcode
Phone number _____

Program 0 (Control Group)

- **<u>Program Explanation</u>**

Thank you for answering those questions, your answers indicate that you are the kind of person who has opinions and interests that we would like to know more about.

Our health research aims to find out about people in your age group's level of physical activity, their attitude to physical activity and the impact that family and friends have on their level of physical activity. We also aim to find out more about older people's nutrition, the types of food they eat, how they prepare their food and what influences what they eat.

We would be grateful if you would assist us with our health research by agreeing to complete up to three questionnaires over a 12-month period. The questionnaire takes about 20 minutes to complete and all the information will remain confidential and anonymous.

If you agree to assist us, we would post the questionnaire to you and provide a self-addressed envelope so that you incur no cost in returning the completed questionnaire.

Do you think you could assist us?

Yes	1	Thank you – I'll place a questionnaire in the mail this week If you could complete this questionnaire, and return it, as soon as possible, in the supplied self-addressed envelope Could I please check your postal address _____ Would you be able to answer a couple more questions? Yes - go to question 4 No - Thank you for your time and good-bye
No	2	Thank you for your time and good-bye

Name_____
Street _____
Suburb_____ postcode
Phone number _____

These questions are about your computer usage

5. Do you have or use a computer?

Yes	1	go to question 6
No	2	Thank you for your time and good-bye.

6. Do you use email/face book?

Yes	1	go to question 7
No	2	go to question 7

7. Do you use the internet?

Yes	1	go to question 8
No	2	Thank you for your time and good-bye.

8. Do you use the internet to search for advice/information?

Yes	1	Thank you for your time and good-bye.
No	2	Thank you for your time and good-bye.

Appendix E

Questionnaires

Physical Activity and Nutrition for Seniors Project (PANS)

Control and Intervention - Baseline questionnaire

Dear Participant

Thank you for agreeing to be part of our research project. Your answers will help us to understand the food intake and physical activity level of people your age.

Please complete the attached questionnaire and send it back to us in the enclosed self-addressed envelope by Friday the 14th May to go in the draw for one of several $50 shopping vouchers.

If you have any questions, please contact me on 9266 4535 (Weekdays 10am to 2pm) or send me an email: L.Burke@curtin.edu.au

Thank you

Linda Burke
PANS Project Coordinator

This is a joint Curtin University and National Heart Foundation project funded by the National Health and Medical Research Council.

Questionnaire 1 Id:_____

The following questions ask you about the time you spend on physical activity in a usual week.

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

Q1. Think about the time you spend walking in your usual week. This includes walking you do at work, walking at home, walking for travel from place to place, and any other walking that you might do in your spare time solely for recreation, sport, exercise, or leisure (for example, walking on a golf course; but do not include jogging)

a. During your usual week, on how many days did you walk for at least 10 minutes continuously?

_____ days per week **[If "0" days per week, go to Q2]**

b. How much time did you usually spend walking on each of those days?

_____ minutes per day

Q2. Think about all the moderate activities that you do in your usual week. Moderate activities refer to activities that cause a slight but noticeable increase in your breathing and heart rate, for example: mowing the lawn, digging in the garden, or medium-paced swimming or cycling, bicycling at a regular pace, or doubles tennis. **[Include only those physical activities that you did for at least 10 minutes continuously]**

a. During your usual week, on how many days did you do moderate physical activities?
[Please do not include walking]

_____ days per week **[If "0" days per week, go to Q3]**

b. How much time did you usually spend doing moderate physical activities on each of those days?

_____ minutes per day

Please list the moderate physical activities you do:
_____

_____

Q3. Think about all the vigorous activities that you do in your usual week. Vigorous activities refer to activities that cause you to "huff and puff", where talking in full sentences between breaths is difficult for example: squash, jogging, circuit training, brisk rowing, bicycling at a fast pace, actively participating in aerobics or fast swimming. **[Include only those physical activities that you did for at least 10 minutes continuously]**

a. During your usual week, on how many days did you do vigorous physical activities?

[Please do not include walking.]

_____ days per week **[If "0" days per week, go to Q4]**

b. How much time did you usually spend doing vigorous physical activities on each of those days?

_____ minutes per day

Please list the vigorous physical activities you do:

_____

_____

Q4. Think about the time you spent sitting during your usual week. Include time spent at work, at home, while doing study and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

a. During your usual week, how much time did you spend sitting on a week day?

_____ minutes per day

b. During your usual weekend, how much time did you spend sitting on a Saturday or Sunday?

_____ minutes per day

Please list the sitting activities you do:

_____

_____

Q5. Think about all the strength exercises that you do in your usual week. For example activities such as resistance or weight training using large muscle groups.

a. During your usual week, on how many days did you do strength activities?

_____ days per week **[If "0" days per week, go to Q6]**

b. How much time did you usually spend doing strength activities on each of these days?

_____ minutes per day

_____

For each question please circle one number to best describe your eating habits.

Q6. The following questions ask about the number of **days per week** you eat certain foods.

How many days a week do you eat	**Number of days per week**
a. Two or more serves of fruit? (One serve is equal to one apple, banana, orange or pear; two apricots, plums or kiwi fruit; 1 cup diced pieces or canned fruit; ½ cup 100% juice; 1½ tablespoons dried sultanas or 4 dried apricots)	0…..1…..2…..3…..4…..5…..6…..7
b. Five or more serves of vegetables? (One serve is equal to one medium potato; ½ cup of cooked vegetables; 1 cup of salad vegetables; ½ cup of cooked, dried or canned beans, peas or lentils)	0…..1…..2…..3…..4…..5…..6…..7
c. Pasta or rice?	0…..1…..2…..3…..4…..5…..6…..7
d. Fried food with a batter or bread crumb coating?	0…..1…..2…..3…..4…..5…..6…..7
e. Legumes (e.g., baked beans, three bean mix, lentils, split peas or dried beans)?	0…..1…..2…..3…..4…..5…..6…..7
f. High fibre breakfast cereal (e.g. weet-bix, allbran, untoasted muesli or porridge)?	0…..1…..2…..3…..4…..5…..6…..7
g. Other cereals such as polenta, barley, buckwheat or wheatgerm?	0…..1…..2…..3…..4…..5…..6…..7
h. Meat pies, pasties or sausage rolls?	0…..1…..2…..3…..4…..5…..6…..7
i. Take-away foods such as fried or BBQ chicken; fish and chips; pizza; hamburgers?	0…..1…..2…..3…..4…..5…..6…..7
j. Cheese (e.g. cheddar, feta or cream cheese)?	0…..1…..2…..3…..4…..5…..6…..7
k. Fish (fresh or tinned)?	0…..1…..2…..3…..4…..5…..6…..7

Q7. The following questions ask about your food choices.

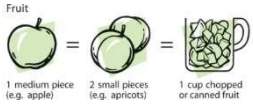
How often do you	**Never**	**Rarely**	**Sometimes**	**Usually**	**Always**	**Not applicable**
a. Choose wholemeal bread in preference to white bread?	1	2	3	4	5	9
b. Spread butter on bread?	1	2	3	4	5	9
c. Use a solid fat such as butter or lard when cooking?	1	2	3	4	5	9
d. Choose reduced-fat cheese in preference to regular cheese?	1	2	3	4	5	9
e. Trim all visible fat off the meat?	1	2	3	4	5	9
f. Remove the skin from chicken before it is cooked?	1	2	3	4	5	9

g. Choose low-fat milk (hilo or skim) in preference to full cream milk?	1….....2...….….3..….....4..….….5	9

Please complete each question as accurately as possible.

Q8. One serve of fruit equals:

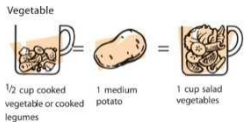
- 1 medium piece (an apple, banana, orange or pear)
- 2 small pieces (apricots, plums or kiwi fruit)
- 1 cup diced pieces or canned fruit
- ½ cup 100% juice
- 1½ tablespoons dried sultanas or 4 dried apricots



How many serves of fruit do you eat in a typical day? ____ serves per day

Q9. One serve of vegetables equals:

- 1 cup of salad
- 1 medium potato
- ½ a cup of cooked vegetables
- ½ a cup of cooked, dried or canned beans, peas or lentils



How many serves of vegetables do you eat in a typical day? _____ serves per day

Q10a. How many different types of fruits would you eat on a typical day?

_____ types of fruits per day

Q10b. How many different types of vegetables would you eat on a typical day?

_____ types of vegetables per day

Q11. Do you add sugar to your drinks (e.g. tea, coffee, milo)?

Yes……1

No…….2 → **Go to Q16.**

If "Yes", approximately how many teaspoons of sugar do you have in total on a usual day?

_____ teaspoons of sugar per day

Q12. How many cups of soft drink (e.g. lemonade), if any, do you drink in a usual week?

[For example: one cup is 250ml; one can of soft drink is 1.5 cups; and one 600ml bottle is 2.4 cups] [Do not include diet or sugar free soft drinks]

_____ cups per week

Q13. Which of the following best describes your cigarette smoking habit?

Never smoked…….. 1

Ex-smoker…… 2

Current smoker……. 3 → How many cigarettes do you smoke in a usual week?

_____ cigarettes per week

Q14. How many standard alcoholic drinks do you have in a usual week?
[For example one standard drink is: 375ml can/bottle mid strength beer; middy/ ¾ can full-strength beer, UDL can, bottle of alcopop, 100ml glass wine, full nip of spirits; or 60ml glass of port or sherry]

_____standard drinks per week

The following questions ask for your views about your health . . . .

For each of the following questions please circle one number only.

Q15a. Overall, how would you rate your health over the past 4 weeks?

Excellent	Very good	Good	Fair	Poor	Very poor
1	2	3	4	5	6

Q15b. Over the past 4 weeks, how much did physical health problems limit your usual physical activities (walking, climbing stairs)?

Not at all	Very little	Somewhat	Quite a lot	Could not do physical activities
1	2	3	4	5

Q15c. Over the past 4 weeks, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?

None at all	A little bit	Some	Quite a lot	Could not do daily work
1	2	3	4	5

For each of the following questions please circle one number only.

Q15d. How much bodily pain have you had over the past 4 weeks?

None	Very mild	Mild	Moderate	Severe	Very severe
1	2	3	4	5	6

Q15e. Over the past 4 weeks, how much energy did you have?

Very much	Quite a bit	Some	A little	None
1	2	3	4	5

Q15f. Over the past 4 weeks, how much did your physical health or emotional problems limit your usual social activities with family or friends?

None at all	A little bit	Some	Quite a lot	Could not do social activities
1……..	2……..	3……..	4……..	5

Q15g. Over the past 4 weeks, how much have you been bothered by emotional problems (such as feeling anxious, depressed or irritable)?

None at all	Slightly	Moderately	Quite a lot	Extremely
1……..	2……..	3……..	4……..	5

Q15h. Over the past 4 weeks, how much did personal or emotional problems keep you from doing your usual work, studies or other daily activities?

None at all	Very little	Somewhat	Quite a lot	Could not do daily activities
1……..	2……..	3……..	4……..	5

Q15i. Please indicate how lonely you have felt during the past 4 weeks.

Always feel lonely	Often feel lonely	Sometimes feel lonely	Never feel lonely
1……..	2……..	3……..	4

Q16. Do you have a diagnosed health condition? **[Please circle all that apply]**

Heart disease……1

Stroke……....2

Diabetes……..…..... 3

Cancer……..... 4

Osteoporosis……..... 5

Arthritis……... 6

High blood pressure…..7

High cholesterol….....8

Constipation……..9

Other (please list):

_____

Please complete each question as accurately as possible.

Q17. What is your waist circumference in centimeters or inches?

[Use tape measure provided to measure your waist.

Measure halfway between your lowest rib and the top of your hipbone, roughly in line with your belly button.

Measure directly against your skin. Breathe out normally.

Make sure the tape is snug and not twisted, without compressing the skin.

Record to the nearest 0.5 inch or cm]

_____ centimeters or _____inches

Q18. What is your hip circumference in centimeters or inches?

[Use tape measure provided to measure your hip circumference.

Measure at the point where your buttocks protrudes the most.

Measure directly against your skin. Breathe out normally.

Make sure the tape is snug and not twisted, without compressing the skin.

Record to the nearest 0.5 inch or cm]

_____ centimeters or _____inches

Q19. What is your height in centimeters or feet/inches (without shoes)?

_____ centimeters or _____feet/inches

Q20. What is your weight in kilograms or pounds (without shoes)?

_____kilograms or _____pounds

Q21. Are you:

Male…….. 1

Female……...2

Q22. What is your date of birth?

_____ _____ _____
Day Month Year

For each of the following questions please circle one number only.

Q23. Which of the following best describes the highest level of education you have completed?

Primary school or lower……. 1
High school/Secondary school……... 2
TAFE or trade certificate/Diploma…… 3
University or other tertiary education…… 4

Q24. What is your marital status?

Married/Defacto…… 1
Single……. 2
Separated/Divorced……... 3
Widowed……...… 4

Q25. What is your employment status?

Retired…….……...…1
Working part-time…….....2
Working full-time…….……..3

Q26. Over most of your life, would you say that making ends meet was?

Always a struggle…….…..……1
Often a struggle...…….....2
Rarely a struggle……3
Sometimes a struggle…… ……4
Never a struggle…….5

Thank you so much for answering the questions. We really appreciate your time and assistance.

Please check through your questionnaire to make sure you have answered all of the questions.

Remember to send this questionnaire back to us in the enclosed self addressed envelope by Friday the 14th May to go in the draw for one of several $50 shopping vouchers.

Physical Activity and Nutrition for Seniors Project (PANS)

(Control post-program questionnaire)

14th October 2010

Dear Participant

Thank you for agreeing to be part of our research project. Your answers will help us to understand the food intake and physical activity level of people your age.

Please complete the attached questionnaire and send it back to us in the enclosed self-addressed envelope by Friday the 29th October. We have enclosed a $5 scratchie as a small token of our appreciation.

If you have any questions, please contact me on 9266 4535 (Weekdays 10am to 2pm) or send me an email: L.Burke@curtin.edu.au

Thank you

Linda Burke
PANS Project Coordinator

This is a joint Curtin University and National Heart Foundation project funded by the National Health and Medical Research Council.

Questionnaire 2

Id:_____

The following questions ask you about the time you spend on physical activity in a usual week.

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

Q1. Think about the time you spend walking in your usual week. This includes walking you do at work, walking at home, walking for travel from place to place, and any other walking that you might do in your spare time solely for recreation, sport, exercise, or leisure (for example, walking on a golf course; but do not include jogging)

a. During your usual week, on how many days did you walk for at least 10 minutes continuously?

_____ days per week **[If "0" days per week, go to Q2]**

b. How much time did you usually spend walking on each of those days?

_____ minutes per day

Q2. Think about all the moderate activities that you do in your usual week. Moderate activities refer to activities that cause a slight but noticeable increase in your breathing and heart rate, for example: mowing the lawn, digging in the garden, or medium-paced swimming or cycling, bicycling at a regular pace, or doubles tennis. **[Include only those physical activities that you did for at least 10 minutes continuously]**

a. During your usual week, on how many days did you do moderate physical activities?
[Please do not include walking]

_____ days per week **[If "0" days per week, go to Q3]**

b. How much time did you usually spend doing moderate physical activities on each of those days?

_____ minutes per day

Please list the moderate physical activities you do:

_____

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

Q3. Think about all the vigorous activities that you do in your usual week. Vigorous activities refer to activities that cause you to "huff and puff", where talking in full sentences between breaths is difficult for example: squash, jogging, circuit training, brisk rowing, bicycling at a fast pace, actively participating in aerobics or fast swimming. **[Include only those physical activities that you did for at least 10 minutes continuously]**

a. During your usual week, on how many days did you do vigorous physical activities?
[Please do not include walking.]

_____ days per week **[If "0" days per week, go to Q4]**

b. How much time did you usually spend doing vigorous physical activities on each of those days?

_____ minutes per day

Please list the vigorous physical activities you do:

Q4. Think about the time you spent sitting during your usual week. Include time spent at work, at home, while doing study and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

a. During your usual week, how much time did you spend sitting on a week day?

_____ minutes per day

b. During your usual weekend, how much time did you spend sitting on a Saturday or Sunday?
_____ minutes per day

Please list the sitting activities you do:

Q5. Think about all the strength exercises that you do in your usual week. For example activities such as resistance or weight training using large muscle groups.

a. During your usual week, on how many days did you do strength activities?

_____ days per week **[If "0" days per week, go to Q6]**

b. How much time did you usually spend doing strength activities on each of these days?

_____ minutes per day

For each question please circle one number to best describe your eating habits.

Q6. The following questions ask about the number of **days per week** you eat certain foods.

How many days a week do you eat	**Number of days per week**
a. Two or more serves of fruit? (One serve is equal to one apple, banana, orange or pear; two apricots, plums or kiwi fruit; 1 cup diced pieces or canned fruit; ½ cup 100% juice; 1½ tablespoons dried sultanas or 4 dried apricots)	0…..1…..2…..3…..4…..5…..6…..7
b. Five or more serves of vegetables? (One serve is equal to one medium potato; ½ cup of cooked vegetables; 1 cup of salad vegetables; ½ cup of cooked, dried or canned beans, peas or lentils)	0…..1…..2…..3…..4…..5…..6…..7
c. Pasta or rice?	0…..1…..2…..3…..4…..5…..6…..7
d. Fried food with a batter or bread crumb coating?	0…..1…..2…..3…..4…..5…..6…..7
e. Legumes (e.g., baked beans, three bean mix, lentils, split peas or dried beans)?	0…..1…..2…..3…..4…..5…..6…..7
f. High fibre breakfast cereal (e.g. weet-bix, allbran, untoasted muesli or porridge)?	0…..1…..2…..3…..4…..5…..6…..7
g. Other cereals such as polenta, barley, buckwheat or wheatgerm?	0…..1…..2…..3…..4…..5…..6…..7
h. Meat pies, pasties or sausage rolls?	0…..1…..2…..3…..4…..5…..6…..7
i. Take-away foods such as fried or BBQ chicken; fish and chips; pizza; hamburgers?	0…..1…..2…..3…..4…..5…..6…..7

j. Cheese (e.g. cheddar, feta or cream cheese)?	0…..1…..2…..3…..4…..5…..6…..7
k. Fish (fresh or tinned)?	0…..1…..2…..3…..4…..5…..6…..7

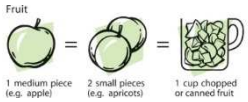
Q7. The following questions ask about your food choices.

How often do you	Never Rarely Some Times Usually Always	Not applicable
a. Choose wholemeal bread in preference to white bread?	1…....2...…..3..….....4..……..5	9
b. Spread butter on bread?	1…....2...…..3..….....4..……..5	9
c. Use a solid fat such as butter or lard when cooking?	1…....2...…..3..….....4..……..5	9
d. Choose reduced-fat cheese in preference to regular cheese?	1…....2...…..3..….....4..……..5	9
e. Trim all visible fat off the meat?	1…....2...…..3..….....4..……..5	9
f. Remove the skin from chicken before it is cooked?	1…....2...…..3..….....4..……..5	9
g. Choose low-fat milk (hilo or skim) in preference to full cream milk?	1…....2...…..3..….....4..……..5	9

Please complete each question as accurately as possible.

Q8. One serve of fruit equals:

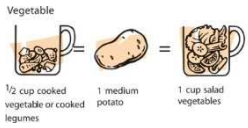
- 1 medium piece (an apple, banana, orange or pear)
- 2 small pieces (apricots, plums or kiwi fruit)
- 1 cup diced pieces or canned fruit
- ½ cup 100% juice
- 1½ tablespoons dried sultanas or 4 dried apricots



How many serves of fruit do you eat in a typical day? _____ serves per day

Q9. One serve of vegetables equals:

- 1 cup of salad
- 1 medium potato
- ½ a cup of cooked vegetables
- ½ a cup of cooked, dried or canned beans, peas or lentils



How many serves of vegetables do you eat in a typical day?_____ serves per day

Q10a. How many different <u>types of fruits</u> would you eat on a typical day?

_____ types of fruits per day

Q10b. How many different types of vegetables would you eat on a typical day?

_____ types of vegetables per day

Q11. Do you add sugar to your drinks (e.g. tea, coffee, milo)?

Yes……1
No…….2 → **Go to Q16.**

If "Yes", approximately how many teaspoons of sugar do you have in total on a usual day?

_____ teaspoons of sugar per day

Please complete each question as accurately as possible.

Q12. How many cups of soft drink (e.g. lemonade), if any, do you drink in a usual week?
[For example: one cup is 250ml; one can of soft drink is 1.5 cups; and one 600ml bottle is 2.4 cups] [Do not include diet or sugar free soft drinks]

_____ cups per week

Q13. Which of the following best describes your cigarette smoking habit?

Never smoked…….. 1
Ex-smoker…… 2
Current smoker……. 3 → How many cigarettes do you smoke in a usual week?

_____ cigarettes per week

Q14. How many standard alcoholic drinks do you have in a usual week?
[For example one standard drink is: 375ml can/bottle mid strength beer; middy/ ¾ can full-strength beer, UDL can, bottle of alcopop, 100ml glass wine, full nip of spirits; or 60ml glass of port or sherry]

_____standard drinks per week

The following questions ask for your views about your health . . . .

For each of the following questions please circle one number only.

Q15a. Overall, how would you rate your health over the past 4 weeks?

Excellent Very good Good Fair Poor Very poor

1……..2……..3……..4……..5……..6

Q15b. Over the past 4 weeks, how much did physical health problems limit your usual physical activities (walking, climbing stairs)?

Not at all Very little Somewhat Quite a lot Could not do physical activities

1……..2……..3……..4……..5

Q15c. Over the past 4 weeks, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?

None at all A little bit Some Quite a lot Could not do daily work

1……..2……..3……..4……..5

For each of the following questions please circle one number only.

Q15d. How much bodily pain have you had over the past 4 weeks?

None Very mild Mild Moderate Severe Very severe

1……..2……..3……..4……..5……..6

Q15e. Over the past 4 weeks, how much energy did you have?

Very much Quite a bit Some A little None

1……..2……..3……..4……..5

Q15f. Over the past 4 weeks, how much did your physical health or emotional problems limit your usual social activities with family or friends?

None at all A little bit Some Quite a lot Could not do social activities

1……..2……..3……..4……..5

For each of the following questions please circle one number only.

Q15g. Over the past 4 weeks, how much have you been bothered by emotional problems (such as feeling anxious, depressed or irritable)?

None at all	Slightly	Moderately	Quite a lot	Extremely
1	2	3	4	5

Q15h. Over the past 4 weeks, how much did personal or emotional problems keep you from doing your usual work, studies or other daily activities?

None at all	Very little	Somewhat	Quite a lot	Could not do daily activities
1	2	3	4	5

Q15i. Please indicate how lonely you have felt during the past 4 weeks.

Always feel lonely	Often feel lonely	Sometimes feel lonely	Never feel lonely
1	2	3	4

Please complete each question as accurately as possible.

Q16. What is your waist circumference in centimeters or inches?

[Use tape measure provided earlier in the year to measure your waist.

Measure halfway between your lowest rib and the top of your hipbone, roughly in line with your belly button.

Measure directly against your skin. Breathe out normally.

Make sure the tape is snug and not twisted, without compressing the skin.

Record to the nearest 0.5 inch or cm]

_____ centimeters or _____inches

Q17. What is your hip circumference in centimeters or inches?

[Use tape measure provided earlier in the year to measure your hip circumference.

Measure at the point where your buttocks protrudes the most.

Measure directly against your skin. Breathe out normally.

Make sure the tape is snug and not twisted, without compressing the skin.

Record to the nearest 0.5 inch or cm]

_____ centimeters or _____inches

Q18. What is your height in centimeters or feet/inches (without shoes)?

_____ centimeters or _____feet/inches

Q19. What is your weight in kilograms or pounds (without shoes)?

_____kilograms or _____pounds

Thank you so much for answering the questions. We really appreciate your time and assistance.

Please check through your questionnaire to make sure you have answered all of the questions.

Remember to send this questionnaire back to us in the enclosed self-addressed envelope by Friday the 29th October.

Physical Activity and Nutrition for Seniors Project (PANS)

(Intervention post-program questionnaire)

14th October 2010

Dear Participant

Thank you for agreeing to be part of our research project. Your answers will help us to understand the food intake and physical activity level of people your age.

Please complete the attached questionnaire and send it back to us in the enclosed self-addressed envelope by Friday the 29th October. We have enclosed a $5 scratchie as a small token of our appreciation.

If you have any questions, please contact me on 9266 4535 (Weekdays 10am to 2pm) or send me an email: L.Burke@curtin.edu.au

Thank you

Linda Burke
PANS Project Coordinator

This is a joint Curtin University and National Heart Foundation project funded by the National Health and Medical Research Council.

Questionnaire 2 Id:_____

The following questions ask you about the time you spend on physical activity in a usual week.

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

Q1. Think about the time you spend walking in your usual week. This includes walking you do at work, walking at home, walking for travel from place to place, and any other walking that you might do in your spare time solely for recreation, sport, exercise, or leisure (for example, walking on a golf course; but do not include jogging)

a. During your usual week, on how many days did you walk for at least 10 minutes continuously?

_____ days per week **[If "0" days per week, go to Q2]**

b. How much time did you usually spend walking on each of those days?

_____ minutes per day

Q2. Think about all the moderate activities that you do in your usual week. Moderate activities refer to activities that cause a slight but noticeable increase in your breathing and heart rate, for example: mowing the lawn, digging in the garden, or medium-paced swimming or cycling, bicycling at a regular pace, or doubles tennis. **[Include only those physical activities that you did for at least 10 minutes continuously]**

a. During your usual week, on how many days did you do moderate physical activities?
[Please do not include walking]

_____ days per week **[If "0" days per week, go to Q3]**

b. How much time did you usually spend doing moderate physical activities on each of those days?

_____ minutes per day

Please list the moderate physical activities you do:

_____

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

Q3. Think about all the vigorous activities that you do in your usual week. Vigorous activities refer to activities that cause you to "huff and puff", where talking in full sentences between breaths is difficult for example: squash, jogging, circuit training, brisk rowing, bicycling at a fast pace, actively participating in aerobics or fast swimming. **[Include only those physical activities that you did for at least 10 minutes continuously]**

a. During your usual week, on how many days did you do vigorous physical activities?
[Please do not include walking.]

_____ days per week **[If "0" days per week, go to Q4]**

b. How much time did you usually spend doing vigorous physical activities on each of those days?

_____ minutes per day

Please list the vigorous physical activities you do:

_____

_____

Q4. Think about the time you spent sitting during your usual week. Include time spent at work, at home, while doing study and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

a. During your usual week, how much time did you spend sitting on a week day?

_____ minutes per day

b. During your usual weekend, how much time did you spend sitting on a Saturday or Sunday?

_____ minutes per day

Please list the sitting activities you do:

_____

_____

Q5. Think about all the strength exercises that you do in your usual week. For example activities such as resistance or weight training using large muscle groups.

a. During your usual week, on how many days did you do strength activities?

_____ days per week **[If "0" days per week, go to Q6]**

b. How much time did you usually spend doing strength activities on each of these days?

_____ minutes per day

Q6. These questions are about <u>your physical activity since starting the PANS program</u>.

How has your physical activity changed…

Strongly agree	Agree	Unsure	Disagree	Strongly disagree

a. I walk more often

1……2……3……4……5

b. I am generally more active

1……2……3……4……5

c. I have become involved in new activities

1……2……3……4……5

These questions are about <u>your intentions to be active</u>.

Strongly agree	Agree	Unsure	Disagree	Strongly disagree

d. I believe I will continue to use the PANS materials regularly to help me to stay active when the program concludes

1……2……3……4……5

e. I believe I will continue to use the PANS materials regularly to help me to stay active in 6 months time

1……2…….……3…....…..…4…….……5

f. I believe I will continue to use the PANS materials regularly to help me to stay active in 12 months time

1……2…….……3…....…..…4…….……5

This question is about your nutrition/eating habits since starting the PANS program.

Strongly agree	Agree	Unsure	Disagree	Strongly disagree

g. My nutrition/eating habits have improved since starting the PANS program

1……2…….……3…....…..…4…….……5

For each question please circle one number to best describe your eating habits.

Q7. The following questions ask about the number of **days per week** you eat certain foods.

How many days a week do you eat	**Number of days per week**
a. Two or more serves of fruit? (One serve is equal to one apple, banana, orange or pear; two apricots, plums or kiwi fruit; 1 cup diced pieces or canned fruit; ½ cup 100% juice; 1½ tablespoons dried sultanas or 4 dried apricots)	0…..1…..2…..3…..4…..5…..6…..7
b. Five or more serves of vegetables? (One serve is equal to one medium potato; ½ cup of cooked vegetables; 1 cup of salad vegetables; ½ cup of cooked, dried or canned beans, peas or lentils)	0…..1…..2…..3…..4…..5…..6…..7
c. Pasta or rice?	0…..1…..2…..3…..4…..5…..6…..7
d. Fried food with a batter or bread crumb coating?	0…..1…..2…..3…..4…..5…..6…..7
e. Legumes (e.g., baked beans, three bean mix, lentils, split peas or dried beans)?	0…..1…..2…..3…..4…..5…..6…..7
f. High fibre breakfast cereal (e.g. weet-bix, allbran, untoasted muesli or porridge)?	0…..1…..2…..3…..4…..5…..6…..7

g. Other cereals such as polenta, barley, buckwheat or wheatgerm?	0…..1…..2…..3…..4…..5…..6…..7
h. Meat pies, pasties or sausage rolls?	0…..1…..2…..3…..4…..5…..6…..7
i. Take-away foods such as fried or BBQ chicken; fish and chips; pizza; hamburgers?	0…..1…..2…..3…..4…..5…..6…..7
j. Cheese (e.g. cheddar, feta or cream cheese)?	0…..1…..2…..3…..4…..5…..6…..7
k. Fish (fresh or tinned)?	0…..1…..2…..3…..4…..5…..6…..7

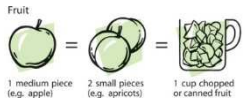
Q8. The following questions ask about your food choices.

How often do you	Never Rarely Some Times Usually Always	Not applicable
a. Choose wholemeal bread in preference to white bread?	1…....2..... .3...….....4...……..5	9
b. Spread butter on bread?	1…....2..... .3...….....4...……..5	9
c. Use a solid fat such as butter or lard when cooking?	1…....2..... .3...….....4...……..5	9
d. Choose reduced-fat cheese in preference to regular cheese?	1…....2..... .3...….....4...……..5	9
e. Trim all visible fat off the meat?	1…....2..... .3...….....4...……..5	9
f. Remove the skin from chicken before it is cooked?	1…....2..... .3...….....4...……..5	9
g. Choose low-fat milk (hilo or skim) in preference to full cream milk?	1…....2..... .3...….....4...……..5	9

Please complete each question as accurately as possible.

Q9. One serve of fruit equals:

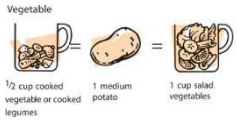
- 1 medium piece (an apple, banana, orange or pear)
- 2 small pieces (apricots, plums or kiwi fruit)
- 1 cup diced pieces or canned fruit
- ½ cup 100% juice
- 1½ tablespoons dried sultanas or 4 dried apricots



How many serves of fruit do you eat in a typical day? _____ serves per day

Q10. One serve of vegetables equals:

- 1 cup of salad
- 1 medium potato
- ½ a cup of cooked vegetables
- ½ a cup of cooked, dried or canned beans, peas or lentils



How many serves of vegetables do you eat in a typical day?
_____ serves per day

Q11a. How many different types of fruits would you eat on a typical day?

_____ types of fruits per day

Q11b. How many different types of vegetables would you eat on a typical day?

_____ types of vegetables per day

Q12. Do you add sugar to your drinks (e.g. tea, coffee, milo)?

Yes……1
No…….2 → **Go to Q16.**

If "Yes", approximately how many teaspoons of sugar do you have in total on a usual day?

_____ teaspoons of sugar per day

Please complete each question as accurately as possible.

Q13. How many cups of soft drink (e.g. lemonade), if any, do you drink in a usual week?
[For example: one cup is 250ml; one can of soft drink is 1.5 cups; and one 600ml bottle is 2.4 cups] [Do not include diet or sugar free soft drinks]

_____ cups per week

Q14. Which of the following best describes your cigarette smoking habit?

Never smoked…….. 1
Ex-smoker…… 2
Current smoker……. 3 → How many cigarettes do you smoke in a usual week?

_____ cigarettes per week

Q15. How many standard alcoholic drinks do you have in a usual week?
[For example one standard drink is: 375ml can/bottle mid strength beer; middy/ ¾ can full-strength beer, UDL can, bottle of alcopop, 100ml glass wine, full nip of spirits; or 60ml glass of port or sherry]

_____standard drinks per week

The following questions ask for your views about your health . . . .

For each of the following questions please circle one number only.

Q16a. Overall, how would you rate your health over the past 4 weeks?

Excellent	Very good	Good	Fair	Poor	Very poor
1	2	3	4	5	6

Q16b. Over the past 4 weeks, how much did physical health problems limit your usual physical activities (walking, climbing stairs)?

Not at all	Very little	Somewhat	Quite a lot	Could not do physical activities
1	2	3	4	5

Q16c. Over the past 4 weeks, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?

None at all	A little bit	Some	Quite a lot	Could not do daily work
1	2	3	4	5

For each of the following questions please circle one number only.

Q16d. How much bodily pain have you had over the past 4 weeks?

None	Very mild	Mild	Moderate	Severe	Very severe
1	2	3	4	5	6

Q16e. Over the past 4 weeks, how much energy did you have?

Very much Quite a bit Some A little None

1……..2……..3……..4……..5

Q16f. Over the past 4 weeks, how much did your physical health or emotional problems limit your usual social activities with family or friends?

None at all A little bit Some Quite a lot Could not do social activities

1……..2……..3……..4……..5

For each of the following questions please circle one number only.

Q16g. Over the past 4 weeks, how much have you been bothered by emotional problems (such as feeling anxious, depressed or irritable)?

None at all Slightly Moderately Quite a lot Extremely

1……..2……..3……..4……..5

Q16h. Over the past 4 weeks, how much did personal or emotional problems keep you from doing your usual work, studies or other daily activities?

None at all Very little Somewhat Quite a lot Could not do daily activities

1……..2……..3……..4……..5

Q16i. Please indicate how lonely you have felt during the past 4 weeks.

Always feel lonely Often feel lonely Sometimes feel lonely Never feel lonely

1……..2……..3……..4

Q16. Since starting the PANS program how do you feel?

Strongly agree Agree Unsure Disagree Strongly disagree

a. I feel fitter since starting PANS

1……..…2…….…..…3……..…4……...…5

b. I have become more aware of my health and well-being

1……..…2…….…..…3……..…4……...…5

Please complete each question as accurately as possible.

Q17. What is your waist circumference in centimeters or inches?

[Use tape measure provided earlier in the year to measure your waist.

Measure halfway between your lowest rib and the top of your hipbone, roughly in line with your belly button.

Measure directly against your skin. Breathe out normally.

Make sure the tape is snug and not twisted, without compressing the skin.

Record to the nearest 0.5 inch or cm]

_____ centimeters or _____inches

Q18. What is your hip circumference in centimeters or inches?

[Use tape measure provided earlier in the year to measure your hip circumference.

Measure at the point where your buttocks protrudes the most.

Measure directly against your skin. Breathe out normally.

Make sure the tape is snug and not twisted, without compressing the skin.

Record to the nearest 0.5 inch or cm]

_____ centimeters or _____inches

Q19. What is your height in centimeters or feet/inches (without shoes)?

_____ centimeters or _____feet/inches

Q20. What is your weight in kilograms or pounds (without shoes)?

_____kilograms or _____pounds

For each of the following questions please circle one number only.

Q21. These questions are about your Group Guide.

Please indicate whether you agree or disagree with the following statements when describing your Group Guide.

My Group Guide…

Strongly agree	Agree	Unsure	Disagree	Strongly disagree

a. Encouraged me to do well
1……2……3……4……5

b. Gave me helpful guidance
1……2……3……4……5

c. Motivated me to be more active
1……2……3……4……5

d. Motivated me to improve my diet
1……2……3……4……5

Please be as honest as possible with your responses.

Q22. What did you like the most about the PANS Program?

_____

_____

_____

_____

_____

Q23. What do you think we could do to improve the PANS program?

_____

_____

_____

_____

Thank you so much for answering the questions. We really appreciate your time and assistance.

Please check through your questionnaire to make sure you have answered <u>all of the questions.</u>

Remember to send this questionnaire back to us in the enclosed self-addressed envelope by Friday the 29th October.

Exit Interview
Target group: Completers

Interviewer Introduction
Good Morning/afternoon. My name is _____ I am from Curtin University, phoning on behalf of the Physical activity and nutrition program, also known as PANS.

Could I please speak to Mr/Mrs _____?

If the person is not available ask, "What would be an appropriate time to call back Mr /Mrs _____. Record suggested ➔Call back date/time.

If person is there, then <u>continue</u>

Good morning/afternoon Mr/Mrs_____

<u>We are phoning people who participated in the PANS program to find out their opinions of the program. We would really value your feedback and input. Is now a convenient time to chat? If not, can I arrange a convenient time to phone back?</u>

<u>Time to phone back……</u>
<u>Or</u>

Thank you. I am going to ask you a series of questions about the program and its materials. We need to know what worked and what didn't work so that we can improve the program, so please try to be as honest as possible with your responses.

Questions

(To identify the design aspects of a physical activity program that encouraged participation)

Firstly, I would like to ask you about the program and its materials

1. *What did you think of the PANS program overall?*

2. *What did you think of the PANS program materials overall...* (Booklet, calendar, exercise chart, guide etc)

3. Do you have any suggestions to improve the program materials?

4. *What did you think of your PANS guide in terms of:*
   Encouragement?
   Guidance on how to - set and reach goals?
   Motivation to improve your physical activity/diet?

We want to know what you thought about the meetings that were part of the intervention program.

5. What did you like about the meetings?

6. What did you dislike about the meetings? (eg time of meeting, location, meeting format/information provided)

7. Approximately how many times did you attend your PANS group meetings over the 6 months?
0……....1……..2……..…..3……..4……..5……..…..6……..7

8. What were your reasons for not attending the group meetings?

(To establish preferred methods of communication and information sharing)

I would now like to ask you about what you thought of our way of communicating with you throughout the program…

Thinking back over this program and considering the role of the Group Guide

9. What did you think of the amount of contact you received?

10. What was your preferred means of contact (phone, email mail)?

11. Approximately how *many times were you contacted?*

12. How often would you have preferred to be contacted over the six month time frame by your group guide?

13. How do you think your guide could have better communicated with you?

14. How do you think the research team could have better communicated with you?

To establish changes in attitude to physical activity since starting the PANS program
I would now like to ask you about your attitude to physical activity since starting the PANS program

15. Do you think the program encouraged you to increase your physical activity levels?
Why/why not?

16. Do you think the PANS program motivated you to find out more information about physical activity? (suggestions from guides and information in the materials) How?

17. Have you tried any different types of physical activity since starting the PANS program? (for example: weights, aqua aerobics, dancing)

Please list

_____

18. What would be your ideal physical activity program?

(To establish changes in attitude to eating habits since starting the PANS program)
I would now like to ask you about your attitude to eating habits since starting the PANS program

19. Do you think the program encouraged you to make any changes to your eating habits?
Why/why not?

20. Do you think the PANS program motivated you to find out more information about food/ nutrition?
How did it motivate you?

21. Are there any different foods or recipes that you tried, since starting the PANS program?

Please list

_____

22. What would be your ideal nutrition program?

(To identify reasons for being involved in the PANS program)
I would now like to ask about your reasons for being involved in the program

23. You completed the program
What motivated or enabled you to complete the program?

24. How do you think we could improve the program or make it more appealing to people in your age group?

25. Are there any other comments you would like to make about the PANS program?

Thank you very much for your time

Exit Interview
Target group: Non-Completers

Interviewer Introduction
Good Morning/afternoon. My name is _____ I am from Curtin University, phoning on behalf of the Physical activity and nutrition program, also known as PANS.

Could I please speak to Mr/Mrs _____?

If the person is not available ask, "What would be an appropriate time to call back Mr /Mrs _____. Record suggested ➔Call back date/time.

If person is there, then <u>continue</u>

Good morning/afternoon Mr/Mrs

<u>We are phoning people who didn't complete the Curtin PANS program (Seniors physical activity and nutrition program) to find out their opinions of the program. We would really value your feedback and input. Is now a convenient time to chat? If not, can I arrange a convenient time to phone back?</u>

<u>Time to phone back……</u>
<u>Or</u>

Thank you. I am going to ask you a series of questions about the program and its materials. We would really like to know what you thought worked and what you thought didn't work so that we can improve the program so please try to be as honest as possible with your responses.

Questions

(To identify the design aspects of a physical activity program that encouraged participation)

Firstly
1. What did you think about the PANS program overall?

2. What did you think of the PANS program materials overall?.... Booklet, calendar, exercise chart, guide etc)(***if they didn't complete the program they probably aren't familiar with them)***

3. Do you have any suggestions to improve the program materials?

4. What did you think of your PANS guide in terms of:
Encouragement

Guidance on how to - set and reach goals

Motivation to improve your physical activity/diet

(To establish preferred methods of communication and information sharing)

I would now like to ask you about what you thought of our way of communicating with you throughout the program

Thinking back over this program and considering the role of the Group Guide

5. What did you think of the amount of contact you received?

6. What was your preferred means of contact (phone, email mail)?

7. Approximately how many times were you contacted?

8. How often would you have preferred to be contacted over the six month time frame by your group guide?

9. How do you think your guide could have better communicated with you?

10. How do you think the research team could have better communicated with you?

(To identify reason for non-involvement in PANS program)

11. What stopped your involvement in the program?

12. What could we have done to encourage you stay with the program?

13. What would be your ideal physical activity program?

14. What would be your ideal nutrition program?

15. Are there any other comments you would like to make about the PANS program?

Thank you very much for your time

Appendix F

Ethics Approval

memorandum

To	Professor Peter Howat, Public Health
From	A/Professor Stephan Millett, Chair, Human Research Ethics Committee
Subject	Protocol Approval **HR 186/2008**
Date	4 December 2008
Copy	Prof Andy Lee, Dr Jonine Jancey, Mr Trevor Shilton, Prof Andrew Hills, Prof Annie Anderson, A/Prof Deb Kerr

Curtin
University of Technology
Office of Research and Development

Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for your application submitted to the Human Research Ethics Committee (HREC) for the project titled "*Physical Activity and Nutrition for Seniors (PANS)*". Your application has been reviewed by the HREC and is **approved**.

- You are authorised to commence your research as stated in your proposal.
- The approval number for your project is **HR 186/2008.** *Please quote this number in any future correspondence.*
- Approval of this project is for a period of twelve months **02-12-2008** to **02-12-2009**. To renew this approval a completed Form B (attached) must be submitted before the expiry date **02-12-2009**.
- If you are a Higher Degree by Research student, data collection must not begin before your Application for Candidacy is approved by your Divisional Graduate Studies Committee.
- The following standard statement **must be** included in the information sheet to participants:

  This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR 186/2008). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. Its main role is to protect participants. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784 or by emailing hrec@curtin.edu.au.

Applicants should note the following:

It is the policy of the HREC to conduct random audits on a percentage of approved projects. These audits may be conducted at any time after the project starts. In cases where the HREC considers that there may be a risk of adverse events, or where participants may be especially vulnerable, the HREC may request the chief investigator to provide an outcomes report, including information on follow-up of participants.

The attached **FORM B** should be completed and returned to the Secretary, HREC, C/- Office of Research & Development:
When the project has finished, or

- If at any time during the twelve months changes/amendments occur, or
- If a serious or unexpected adverse event occurs, or
- 14 days prior to the expiry date if renewal is required.
- An application for renewal may be made with a Form B three years running, after which a new application form (Form A), providing comprehensive details, must be submitted.

Regards,

A/Professor Stephan Millett
Chair
Human Research Ethics Committee

memorandum

Curtin
University of Technology

To	Professor Peter Howat, Public Health
From	Miss Linda Teasdale, Manager, Research Ethics
Subject	**PROTOCOL APPROVAL – EXTENSION 186/2008**
Date	20 November 2009
Copy	Prof Andy Lee, Public Health Dr Jonine Jancey, Public Health Mr Trevor Shilton, CBRCC Prof Andrew Hills, Queensland University of Technology Prof Annie Anderson, University of Dundee A/Prof Deb Kerr, Public Health

Office of Research and Development

Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for keeping us informed of the progress of your research. The Human Research Ethics Committee acknowledges receipt of your Form B progress report for the project *"Physical Activity and Nutrition for Seniors (PANS)."*

Approval for this project is extended for the year to **02/12/2010.**

Your approval number remains **186/2008.** Please quote this number in any further correspondence regarding this project.

Please note: An application for renewal may be made with a Form B three years running, after which a new application form (Form A), providing comprehensive details, must be submitted.

Thank you.

Linda Teasdale
Manager, Research Ethics
Office of Research and Development

Curtin University

Memorandum

To	Professor Peter Howat, Public Health
From	Miss Linda Teasdale, Manager, Research Ethics
Subject	**PROTOCOL APPROVAL – EXTENSION HR186/2008**
Date	15 November 2010
Copy	Prof Andy Lee, Public Health Dr Jonine Jancey, Public Health A/Prof Deb Kerr, Public Health Linda Burke, Public Health

Office of Research and Development

Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for keeping us informed of the progress of your research. The Human Research Ethics Committee acknowledges receipt of your Form B progress report for the project *"Physical Activity and Nutrition for Seniors (PANS)."*

Approval for this project is extended for the year to **02/12/2011.**

Your approval number remains **HR186/2008.** Please quote this number in any further correspondence regarding this project.

Please note: An application for renewal may be made with a Form B three years running, after which a new application form (Form A), providing comprehensive details, must be submitted.

Thank you.

Linda Teasdale
Manager, Research Ethics
Office of Research and Development

Appendix G

Statements of Contributions (Co-authors)

Curtin University

February 20th, 2013

To Whom It May Concern

I, Peter Howat, contributed as a Supervisor of the PhD. I had an ongoing close involvement with the research, including contributing to the project proposal, discussing the structure of papers, the reading of drafts and making suggestions for improvements to the papers entitled:

a) Physical activity and nutrition program for seniors (PANS): protocol of a randomized controlled trial. BMC Public Health 2010, 10(1):751.

b) Physical activity and nutrition program for seniors (PANS): Process evaluation. Health Promotion Practice 2012, doi:10.1177/1524839921461504.

c) Effects of a physical activity and nutrition program for seniors on body mass index and waist-to-hip ratio: A randomised controlled trial. Preventive Medicine 2012, 54 (6):397-401.

d) Physical activity and nutrition behavioural outcomes of a home-based intervention program for seniors: A randomized controlled trial. International Journal of Behavioral Nutrition and Physical Activity 2013, 10:14.

PA Howat

Peter A Howat (supervisor/co-author)

Linda Burke.

Linda Fiona Burke (candidate)

Curtin University

February 20th, 2013

To Whom It May Concern

I, Andy Lee, contributed as a Co-supervisor of the PhD. I had an ongoing close involvement with the research, including contributing to the project proposal, discussing the structure of papers, the reading of drafts and making suggestions for improvements to the papers entitled:

a) Physical activity and nutrition program for seniors (PANS): protocol of a randomized controlled trial. *BMC Public Health* 2010, 10(1):751.

b) Physical activity and nutrition program for seniors (PANS): Process evaluation. *Health Promotion Practice* 2012, doi:10.1177/1524839921461504.

c) Effects of a physical activity and nutrition program for seniors on body mass index and waist-to-hip ratio: A randomised controlled trial. *Preventive Medicine* 2012, 54 (6):397-401.

d) Physical activity and nutrition behavioural outcomes of a home-based intervention program for seniors: A randomized controlled trial. *International Journal of Behavioral Nutrition and Physical Activity* 2013, 10:14.

Andy H Lee (supervisor/co-author)

Linda Burke.

Linda Fiona Burke (candidate)

Curtin University

February 20th, 2013

To Whom It May Concern

I, Jonine Jancey contributed as Co-supervisor of this PhD and had on-going involvement with the research. This involvement included contributing to the development of the project proposal; the intervention, and the structure and content of the following papers.

a) Physical activity and nutrition program for seniors (PANS): protocol of a randomized controlled trial. BMC Public Health 2010, 10(1):751.

b) Physical activity and nutrition program for seniors (PANS): Process evaluation. Health Promotion Practice 2012, doi:10.1177/1524839921461504.

c) Effects of a physical activity and nutrition program for seniors on body mass index and waist-to-hip ratio: A randomised controlled trial. Preventive Medicine 2012, 54 (6):397-401.

d) Physical activity and nutrition behavioural outcomes of a home-based intervention program for seniors: A randomized controlled trial. International Journal of Behavioral Nutrition and Physical Activity 2013, 10:14.

Jancey

Jonine M Jancey (Co-supervisor/co-author)

Linda Burke.

Linda Fiona Burke (candidate)

Curtin University

February 20th, 2013

To Whom It May Concern

I, Deborah Kerr, contributed as an Associate-supervisor of the PhD. I had an ongoing close involvement with the research, including contributing to the project proposal, discussing the structure of papers, the reading of drafts and making suggestions for improvements to the papers entitled:

a) Physical activity and nutrition program for seniors (PANS): protocol of a randomized controlled trial. *BMC Public Health* 2010, 10(1):751.

b) Effects of a physical activity and nutrition program for seniors on body mass index and waist-to-hip ratio: A randomised controlled trial. *Preventive Medicine* 2012, 54 (6):397-401.

c) Physical activity and nutrition behavioural outcomes of a home-based intervention program for seniors: A randomized controlled trial. *International Journal of Behavioral Nutrition and Physical Activity* 2013, 10:14.

Deborah A Kerr (Associate-supervisor/co-author)

Linda Fiona Burke (candidate)

Curtin University

February 20th, 2013

To Whom It May Concern

I, Trevor Shilton, provided advice on the intervention design and measurement instruments, reviewed drafts and suggested revisions to the papers entitled:

a) Physical activity and nutrition program for seniors (PANS): protocol of a randomized controlled trial. *BMC Public Health* 2010, 10(1):751.

b) Physical activity and nutrition program for seniors (PANS): Process evaluation. *Health Promotion Practice* 2012, doi:10.1177/1524839921461504.

Trevor Shilton (co-author)

Linda Fiona Burke (candidate)

Curtin University

February 20th, 2013

To Whom It May Concern

I, Andrew Hills, provided advice on the intervention design and measurement instruments, reviewed drafts and suggested revisions to the papers entitled:

a) Physical activity and nutrition program for seniors (PANS): protocol of a randomized controlled trial. *BMC Public Health* 2010, 10(1):751.

b) Physical activity and nutrition behavioural outcomes of a home-based intervention program for seniors: A randomized controlled trial. *International Journal of Behavioral Nutrition and Physical Activity* 2013, 10:14.

Andrew P Hills (co-author)

Linda Fiona Burke (candidate)

Curtin University

February 20th, 2013

To Whom It May Concern

I, Annie S. Anderson, provided advice on the intervention design and measurement instruments, reviewed drafts and suggested revisions to the papers entitled:

a) Physical activity and nutrition program for seniors (PANS): protocol of a randomized controlled trial. *BMC Public Health* 2010, 10(1):751.

b) Physical activity and nutrition behavioural outcomes of a home-based intervention program for seniors: A randomized controlled trial. *International Journal of Behavioural Nutrition and Physical Activity* 2013, 10:14.

Annie S. Anderson.

Annie S. Anderson (co-author)

Linda Burke.

Linda Fiona Burke (candidate)

Curtin University

February 20th, 2013

To Whom It May Concern

I, Liming Xiang, provided statistical advice with analysis on the paper entitled:

a) Physical activity and nutrition behavioural outcomes of a home-based intervention program for seniors: A randomized controlled trial. International Journal of Behavioral Nutrition and Physical Activity 2013, 10:14.

Liming Xiang (co-author)

Linda Fiona Burke (candidate)

Curtin University

February 20th, 2013

To Whom It May Concern

I, Maria Pasalich, reviewed draft and suggested revisions to the paper entitled:

a) Effects of a physical activity and nutrition program for seniors on body mass index and waist-to-hip ratio: A randomised controlled trial. *Preventive Medicine* 2012, 54 (6):397-401.

Maria Pasalich (co-author)

Linda Burke

Linda Fiona Burke (candidate)