
# Physical Activity At Home

**Long-term effectiveness of a community group exercise versus physiotherapist-led home-based physical activity program in middle-aged adults.**

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## Abstract

### Background

It is well recognised that the adoption and longer-term adherence to physical activity (PA) by adults to reduce the risk of chronic disease is a challenge. Interventions, such as group and home-based physical activity programs, have been widely reported. However, few studies have directly compared these interventions to determine their effectiveness, in terms of health benefits, long-term physical activity adherence, and cost. Some evidence suggests that home-based physical activity programs are preferred by the majority of middle-aged adults, and provide better long-term physical activity adherence. Physiotherapists may also be useful in increasing physical activity adherence, but research on their impact is limited.

### Methods

Using a pragmatic, mixed methods, quasi-experimental design, sedentary, community-dwelling, healthy 50-65 year olds were recruited to a non-randomized 6-month community group exercise program (G, n=93), or a physiotherapist-led home-based physical activity program (HB, n=65), targeting those not interested in, or unable to attend, a group exercise program. An 18-month no-intervention follow-up period was included, with outcome measures collected at baseline, 6, 12, 18 and 24-months. Outcomes measures comprised of 'sufficient' physical activity (Active Australia Survey (AAS)), minutes of moderate-vigorous physical activity (MVPA, ActiGraph GT1M), physical activity adherence (PA diaries), aerobic capacity (2-minute step-test), quality of life (SF-12v2), blood pressure, waist circumference, waist-to-hip ratio (WHR), and body mass index. Qualitative data was collected via focus groups with sub-groups of participants (group attendees (n=14), group non-attendees (n=9), and home-based (n=14)), and exit telephone calls (n=37) at the end of the intervention period. A validation of subjective physical activity measures was conducted over 7-days, with 76 participants (HB, n=39; G, n=37) wearing an ActiGraph GT1M accelerometer, completing the AAS and a daily PA diary, towards the end of the intervention period. A cost analysis (cost and effect (benefit)) was carried out, collecting direct costs of delivering the interventions prospectively. Mean differences in costs and effects between interventions were calculated at 6 and 24-months.

**Results**

Home-based participants were more likely to be younger, working full-time and not in a relationship ($p<0.05$). Thirty-three percent of the group participants attended ≥ 70% of group exercise sessions. Ninety percent of home-based participants received ≥ 4 of the planned 6 telephone support calls. At 6-months, intention-to-treat analysis found both interventions increased the number of participants achieving self-reported 'sufficient' physical activity ($p\leq0.001$), and decreased waist circumference ($p<0.001$) and WHR ($p<0.05$). At 2-years, these improvements were maintained for 'sufficient' physical activity ($p\leq0.001$), and waist circumference ($p<0.001$), with no difference between interventions. Home-based participants reported fewer barriers to the program and a number of enablers, including the flexibility of the program and physiotherapist instruction. Self-efficacy, work and carer commitments were major themes identified for all participants, and all participants preferred a variety of physical activity formats. Physical activity diaries for group participants had no significant correlations with the ActiGraph data, while home-based participants had fair-to-good agreement ($r=0.39–0.68$, $p<0.05$). The AAS had good correlations with the ActiGraph data for both interventions (MVPA: HB $r=0.56$, $p\leq0.001$; G $r=0.49$, $p<0.01$). At 2-years, the home-based program was less costly (HB AUS$47 vs. G $84 per participant), but less effective in achieving increased physical activity and decreased waist circumference.

**Conclusions**

The physiotherapist-led home-based physical activity program may be a low cost alternative to increase physical activity levels in the long-term, particularly for sedentary middle-aged adults not interested in, or unable to attend, a group exercise program. The home-based program appears to have increased the adoption of physical activity and adherence to the physical activity program requirements; although a variety of physical activity formats are indicated. When comparing physical activity formats, self-report physical activity data should be interpreted cautiously, with the AAS the preferred self-report tool. The evidence indicates that the physiotherapist-led home-based physical activity program has been successful, and could be an alternative option for physical activity program delivery in a number of different settings.

**Clinical Trial Registration number**

Australian New Zealand Clinical Trials Registry (ANZCTR), ACTRN12611000890932.

## Table of Contents

## List of Figures

## List of Tables

## Definitions

### Sedentary

Sedentary is defined in this thesis as no participation in regular moderate or vigorous exercise for 30 minutes 2 or more times a week for at least 6-months (Stewart et al. 2001; Wilbur et al. 2008). Other studies have used a much broader inclusion criteria for physical activity, with eligible participants needing to complete less than 150 minutes of moderate intensity physical activity per week (Jancey et al. 2006; Stevens et al. 2008). Targeting sedentary individuals is particularly important, as studies have shown that sedentary individuals have the most to gain, with any activity better than none (Warburton et al. 2006).

### Physical activity versus exercise

Caspersen et al (1985) defines physical activity as any bodily movement produced by skeletal muscles that results in energy expenditure. Exercise is a subset of physical activity. Exercise is physical activity that is planned, structured, repetitive, and purposive, aiming to improve or maintain one or more components of physical fitness (Caspersen et al. 1985). As such, the group exercise program was compared to the physiotherapist-led home-based physical activity program to determine the effectiveness of each intervention in increasing physical activity levels of sedentary middle-aged adults.

### Sufficient Physical Activity

The World Health Organisation recommends at least 30 minutes of regular, moderate intensity physical activity on most days to reduce the risk of disease and injury (World Health Organization 2004). Sufficient physical activity to gain the health benefits was therefore defined as 30 minutes of moderate intensity physical activity on at least 5 days per week. Thirty minutes could be accumulated in 10 minute bouts of physical activity per day (Department of Health and Ageing 2005).

### Group Physical Activity Program

In this thesis group physical activity programs are defined as a group of individuals participating in a supervised and structured physical activity program. For example, group sessions will be instructor-led, held the same day and time every week. Primarily group

physical activity programs are centre-based but they can also be carried out in various other settings, for example, parks.

**Home-based Physical Activity Program**

Home-based physical activity programs are defined as being unsupervised, unstructured or lifestyle physical activity programs. Physical activity will primarily be performed independently although this can be undertaken in a variety of settings, for example, during transit, within the home, garden, gym, and can be carried out with others, such as with a friend.

**PAAH physiotherapist-led home-based physical activity program**

An initial physiotherapy home visit was conducted using motivational interviewing to devise an individual physical activity program. A physiotherapist discussed type, frequency, intensity, duration, benefits, barriers, goals, self-monitoring and progression of physical activity with participants, aiming to achieve 30 minutes of moderate intensity physical activity most days of the week. This was followed by approximately 6 phone calls using motivational interviewing to offer advice and support over the 6-month intervention period. Home-based participants were encouraged to increase their physical activity levels in a number of different settings, for example, during transit, within the home, garden, gym, and could be carried out with others, such as with a friend.

**PAAH group exercise program**

The group exercise program was conducted during business hours replicating similar programs and times offered in this community setting. The sessions were run by a YMCA fitness instructor at the YMCA once a week, for 60 minutes, over 6 months. The exercise program involved upper and lower body strengthening exercises, gross motor skill training and aerobic fitness training. The exercise specifics were at the discretion of the YMCA fitness instructor. Participants were encouraged to increase their physical activity slowly and gradually in whichever way they preferred outside of the group sessions by the YMCA fitness instructors, aiming to achieve 30 minutes of moderate intensity physical activity most days of the week. An individual home-based exercise program was not specifically designed for this group.

## Publications and Presentations

*Papers published / in press*

Freene N, Waddington G, Chesworth W, Davey R, Goss J 2011 'Physical activity at home (PAAH)', evaluation of a group versus home-based physical activity program in community-dwelling middle-aged adults: rationale and study design. BMC Public Health 11: 883-883.

Freene N, Waddington G, Chesworth W, Davey R, Cochrane T 2013 Physiotherapist-led home-based physical activity program versus community group exercise for middle-aged adults: Quasi-experimental comparison. Open Journal of Preventive Medicine 3: 229-237.

Freene N, Waddington G, Chesworth W, Davey R, Cochrane T 2013 Community group exercise versus physiotherapist-led home-based physical activity program: barriers, enablers and preferences in middle-aged adults. Physiotherapy Theory and Practice Online: 1-9. DOI: 10.3109/09593985.2013.816894.

Freene N, Waddington G, Davey R, Cochrane T (accepted 30 October 2013) Longitudinal comparison of a physiotherapist-led home-based and group-based program for increasing physical activity in community-dwelling middle-aged adults. Australian Journal of Primary Health.

*Paper submitted and accepted for review*

Freene N, Waddington G, Chesworth W, Davey R, Cochrane T (submitted 17 May 2013) Validating two self-report physical activity measures in middle-aged adults completing a group exercise or home-based physical activity program. Journal of Science and Medicine in Sport.

*Conference presentations*

Australian Cardiovascular Health and Rehabilitation Association (ACRA) Conference, Brisbane, Queensland 2012. 'Are groups the panacea we think they are? Recruitment and attrition rates of two physical activity interventions' (oral).

Be Active 2012, 4th International Congress on Physical Activity and Public Health, Sydney, New South Wales 2012. 'Physical activity at home (PAAH), evaluation of a group versus home-based physical activity program in middle-aged adults' (oral).

Be Active 2012, 4th International Congress on Physical Activity and Public Health, Sydney, New South Wales 2012. 'Validating physical activity measures in middle-aged adults completing a group or home-based physical activity program' (poster).

American College of Sports Medicine Annual Meeting and 4th World Congress on Exercise is Medicine, Indianapolis, Indiana, USA 2013. 'Long-term effects of a community group versus physiotherapist-led home-based physical activity program' (poster).

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# 1 Introduction

## 1.1 Background

The health benefits of physical activity and aerobic exercise are well documented, playing a key role in reducing the risk of chronic disease (Booth et al. 2000; Warburton et al. 2006). In 2003, the Australian Burden of Disease study indicated that physical inactivity was the fourth leading cause of burden of disease in Australia (Begg et al. 2007). Physical inactivity increases all causes of mortality, doubles the risk of cardiovascular disease, type II diabetes and obesity, and increases the risk of colon and breast cancer, high blood pressure, lipid disorders, osteoporosis, depression and anxiety (Australian Bureau of Statistics 2006). The World Health Organization recommends at least 30 minutes of regular, moderate intensity physical activity on most days to reduce the risk of disease and injury (World Health Organization 2004). Despite this, in 2007-8 the Australian Bureau of Statistics reported approximately 66% of Australians aged 18-24 years were classified as sedentary or having low levels of exercise, increasing to 83% of adults aged 75 or older (Australian Bureau of Statistics 2011).

Community based physical activity programs, aiming to increase the exercise or physical activity levels of adults, have been widely reported in the literature (Bock et al. 2013). A number of physical activity formats have been investigated, such as group and home-based, with most studies reporting difficulties with recruitment and the longer-term adherence to physical activity (King et al. 1995; Jancey et al. 2006; Jancey et al. 2007; Hong et al. 2008; Linke et al. 2011). If the population is to receive the associated health benefits of physical activity, poor participant adoption and adherence to the physical activity intervention is a major concern for clinicians and public health providers. As Linke et al (2011) suggests '*…even the best-designed exercise program will not improve participants' fitness and health status if attrition is high and adherence rates are low.'*

Investigating whether one physical activity format, group or home-based, increases the adoption and maintenance of physical activity better than another, is therefore an important question.

There is some evidence that home-based physical activity programs provide better long-term adherence to physical activity than centre-based programs in adults 50 years or older (Ashworth et al. 2005). Participant preference for physical activity format, and who delivers the physical activity program may also be important determinants for physical activity adoption and maintenance (Booth et al. 1997; Wilcox et al. 1999; Beauchamp et al. 2007). Determining which physical activity format is more effective, including cost, will guide physical activity program implementation for clinicians and public health providers, and could ultimately allow more adults to increase their physical activity levels towards that needed to achieve the health benefits.

### 1.1.1 The effectiveness of group versus home-based physical activity programs.

**Health Benefits**

Group and home-based interventions in healthy middle-aged and older adults have been found to provide similar outcomes, increasing physical activity levels and cardio-respiratory fitness to a similar level (van der Bij et al. 2002; Muller-Riemenschneider et al. 2008). The systematic review conducted by Muller-Riemenschneider et al (2008) found that despite varying methods, significant improvements in physical activity were reported when interventions were compared to no intervention or a minimal-intervention control.

Additional health benefits, such as reductions in blood pressure and body composition, have been reported for both group and home-based physical activity formats by some authors (Dunn et al. 1999; Wilcox et al. 2009). While other studies, comparing group and home-based physical formats, have reported no change in these measures of disease risk (King et al. 1991). According to this evidence, the health benefits of group and home-based physical activity interventions can be assumed to be similar, although few studies have directly compared the two physical activity formats.

**Long-term adherence to physical activity**

The largest and highest quality rated study within a Cochrane review comparing home and centre-based physical activity programs in older adults was conducted by King et al (King et al. 1995; Ashworth et al. 2005). This study appeared to have a significantly higher adherence rate to physical activity in the home-based program compared with the centre-based program, especially in the long-term. King et al (1991) reported that at 12-months following the initiation of the group and home-based interventions, the group intervention had an

approximately 50% adherence to exercise, while the home-based intervention had an exercise adherence rate of 70% (Figure 1.1).

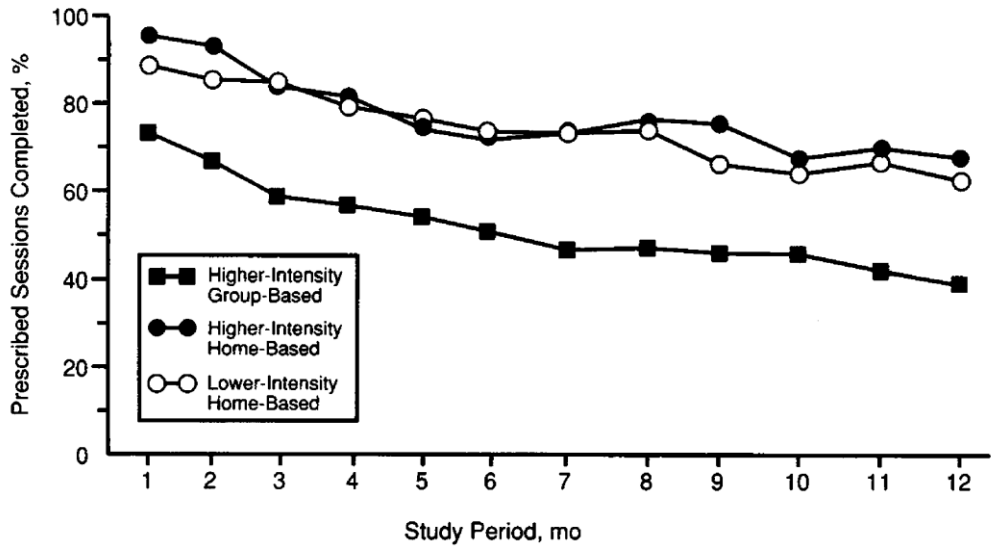


**Figure 1.1.** Adherence to prescribed exercise training, by training condition. For all months, differences between the group-based training condition and the other two exercise training conditions are significant at $p < 0.004$ (King et al. 1991).

A more recent study conducted by Opdenacker et al (2008; 2011) comparing a lifestyle (home-based) physical activity intervention to a structured (group) exercise intervention supported this result, finding that the lifestyle program was more efficient in maintaining the long-term improvements in physical activity. In further studies comparing group and home-based formats in the long-term, results have varied, with some suggesting no difference in long-term physical activity adherence between formats, and others finding that group participants had superior adherence to physical activity (Dunn et al. 1999; Cox et al. 2003).

**Cost-effectiveness**

Few studies report on the cost-effectiveness of physical activity interventions, including group and home-based formats (Wu et al. 2011). In a systematic review evaluating the cost-effectiveness of physical activity interventions in healthy adults, there was only one study that compared two different intervention strategies, a lifestyle (home-based) versus a structured (group) intervention (Müller-Riemenschneider 2009). Sevick et al (2000) found that the lifestyle physical activity program was as effective as the structured exercise program, and that the lifestyle program was generally more economically efficient in achieving the increase in physical activity among healthy sedentary adults. From a public

health perspective this is an important implication when considering an 'effective' intervention. Using aspects of the RE-AIM framework to evaluate public health innovations (reach, efficacy, adoption, implementation, and maintenance), an effective intervention can be defined as one which has positive health outcomes, has considerable reach, and is also cost-effective (Glasgow et al. 1999).

### 1.1.2 Participant preference

There is some evidence that a large number of middle-aged (50-65 years old) and older (>65 years old) community-dwelling adults may not be interested in group exercise but would undertake exercise on their own, in their local area, if they had access to appropriate exercise information and or support. Wilcox et al (1999) reports from a large community survey conducted in the USA, that 69% of middle-aged and 67% of older adults preferred to exercise on their own with some instruction, rather than in an exercise class. Similarly, it was found that less than one third of Australian adults "highly enjoyed" structured physical activity, such as instructor-led group exercise, reporting a decreasing desire to exercise in a group setting with increasing age (Booth et al. 1997; Salmon et al. 2003).

These results suggest that middle-aged and older adults may have a preference for exercising alone. Accordingly, more recent community-based physical activity interventions have trialed alternative physical activity formats, providing physical activity advice using telephone or internet support, aiming to increase middle-aged and older adults' physical activity participation (King et al. 2002).

### 1.1.3 Physiotherapy and Physical Activity

Tailored exercise prescription has always been one of the key skills of physiotherapy (Gormley and Hussey 2005). Physiotherapists have traditionally used exercise to treat injuries or conditions (for example, osteoarthritis), or provide secondary prevention (for example, cardiac rehabilitation), rather than prescribe exercise for the primary prevention of many conditions. The physiotherapy workforce in Australia is one of the largest contributors to healthcare after nurses and doctors, illustrating its potential to have an impact on the populations' physical activity levels (Australian Physiotherapy Association 2005). Yet, physiotherapy involvement in health care counselling for primary prevention has been limited, despite some evidence of its effectiveness (Sheedy et al. 2000; Verhagen and Engbers 2009; Frerichs et al. 2012).

The Australian Physiotherapy Association and worldwide physiotherapy professional bodies support the utilisation of the physiotherapists' skills to promote the health and well-being of individuals and the general population, emphasising the importance of physical activity and exercise (Australian Physiotherapy Association 2009; World Confederation of Physical Therapy 2011). Physiotherapists are able to deal with a number of comorbidities, having a broad skill base, experience in exercise prescription, and are highly trained to provide appropriate support to facilitate lifestyle modifications and self-management skills. Thus, further investigation of physical activity promotion and physiotherapy is needed to determine their potential role, exploring innovative programs for addressing physical inactivity and the usage of physiotherapy skills (Frerichs et al. 2012).

## 1.2 Justification for the physiotherapist-led home-based physical activity program.

### 1.2.1 Home-based intervention

**Theoretical considerations**

The physiotherapist-led home-based physical activity program developed for this research was based on practice-based evidence, utilising motivational interviewing (MI), operating within a pragmatic paradigm (Rollnick et al. 2008). The Physical Activity At Home (PAAH) study focuses on the practical outcomes and 'what works' (Onwuegbuzie and Johnson 2004). There has been more recent discussion in the literature that successful physical activity interventions need to be theory-based (King et al. 2007). Behavioural theories considered in the design of the physiotherapist-led home-based physical activity program were the Social Cognitive Theory, the Transtheoretical Model, and in particular, the Self-Determination Theory (Prochaska and DiClemente 1984; Bandura 1986; Ryan and Deci 2000).

The Self Determination Theory (SDT) focuses on the need to increase an individual's intrinsic motivation in order to achieve long-term behaviour change, and it may be a useful basis for increasing the long-term physical activity levels of the population (Deci and Ryan 2002). MI is based on a similar concept, aiming to activate an individual's own motivation for behaviour change and adherence to treatment (Rollnick et al. 2008). The 'spirit' of MI has been described as collaborative, evocative, and honouring of patient autonomy. Similarly, SDT relies on three psychological needs to self-determine behaviour: competence, autonomy and relatedness (Ryan and Deci 2000). Autonomy appears to be a common key element for both approaches and Miller and Rollnick (2012) agree that there may be a 'natural fit'. They

argue that one of the main differences between these two approaches is in the source of the hypotheses. MI is based on intuitive experience, whereas SDT relies on rational deduction from a pre-existing theory. Utilising a pragmatic approach, PAAH is not based on a particular theory of behaviour. Similar to MI, the home-based program is based on practice-based evidence, where in practice a proportion of the population are unwilling, or unable, to attend group exercise programs.

**Format**

Home-based interventions to increase physical activity levels have been provided using different forms of support, such as telephone, mail, and more recently, internet and mobile phone based interventions (Eakin et al. 2007; Davies et al. 2012; Cowan et al. 2013).

The physiotherapist-led home-based physical activity program consisted of one home visit, and telephone support using MI, over 6-months. Telephone counselling has been found to be effective in promoting physical activity in middle-aged and older adults, in both healthy and chronic illness samples, and has the potential for being a lower cost and more convenient alternative to face-to-face contact (King et al. 2002; Reeder et al. 2008; Eakin et al. 2009). Eakin et al (2007) conducted a systematic review and found that 69% of physical activity studies, where telephone support was the primary intervention, resulted in a significant improvement in physical activity levels.

The home visit is likewise an important component of the home-based intervention. The one-off face-to-face contact during the home visit allows a relationship to develop between the physiotherapist and the participant. Physiotherapists are effective communicators, able to establish a rapport, gain trust, support and empower an individual (Mueller 2010). The home visit enables individual tailoring of the physical activity program. A number of reported barriers to exercise or physical activity are also removed by visiting participants in their own environments, such as access to facilities and costs to the participant, for example costs associated with travel (Trost et al. 2002). In contrast to a number of studies that claim to be home-based, the physiotherapist-led home-based physical activity program was completely home-based, involving no group component or attendance at a centre for assessments, education or exercise (Reeder et al. 2008; Van Roie et al. 2010).

The length of the intervention period was influenced by reports that for exercise to be maintained it must be sustained for 6-months according to the Social Cognitive Theory

(Marcus et al. 2000). Jancey et al (2007) also report that most of the attrition from physical activity programs occurs within the first 3 months of the intervention, indicating that increased input is required in this time period. Therefore, it was felt that 6-months would allow time for participants to adopt, address any barriers to exercise or physical activity, and maintain an increase in physical activity, without making the intervention too lengthy to commit to.

### 1.2.2 Middle-aged adults

The incidence of chronic disease, such as cardiovascular disease, increases in middle-age (50-65 years old) and later years (Australian Bureau of Statistics 2009). Increasing physical activity in middle-age could, therefore, have a significant impact on future quality of life and health service utilisation (King et al. 1995; World Health Organization 2004).

To increase physical activity levels in middle-aged adults, consideration needs to be given to the demands placed upon this age group. A large number of middle-aged adults in Australia are still in the work force and also caring for others (Australian Bureau of Statistics 2009; Australian Bureau of Statistics 2012). McNaughton et al (2012) suggests that in order to increase physical activity levels, physical activity strategies need to be age-appropriate. Therefore, when planning successful physical activity interventions in this age-group, careful consideration needs to be given to lifestyles, with factors such as work and carer commitments acting as potential barriers.

A physiotherapist-led home-based physical activity program may be a suitable approach to increase the physical activity levels of middle-aged adults. Home-based physical activity programs have been found to deliver similar health benefits to group exercise programs, with some indication that they provide better long-term adherence to physical activity and are more cost-effective (King et al. 1995; Dunn et al. 1999; Sevick et al. 2000). The majority of middle-aged adults have shown a preference for home-based physical activity programs, and considering their work and carer commitments, this approach, utilizing the skills of a physiotherapist, may increase the adoption and maintenance of physical activity in this population (Wilcox et al. 1999).

## 1.3 Aims

The aim of this study was to evaluate a new model for increasing the adoption and maintenance of physical activity in sedentary community-dwelling middle-aged adults. The

study design specifically targeted those individuals who were less likely to adopt and maintain physical activity, as they may not wish to, or be able to, access the currently available community group exercise programs.

By comparing participants in a 6-month physiotherapist-led home-based physical activity program to those undertaking a 6-month community group exercise program over the longer-term, the aims were to determine:

i. the health benefits (increased physical activity, aerobic capacity and quality of life; decreased blood pressure, waist circumference, waist-to-hip ratio and body mass index),

ii. the longer term maintenance of physical activity over a 2-year period (including an 18-month no-intervention follow-up), and

iii. the direct costs of delivering such programs.

### 1.4 Thesis Outline

To evaluate the effectiveness of the novel physiotherapist-led home-based physical activity program the research project consists of three studies. The main intervention study directly compared the home-based program to a 'usual practice' community based group exercise program using a pragmatic, quasi-experimental design over a 2-year period. Two smaller studies were conducted to i) identify, through the use of qualitative interviews and focus groups, the barriers, enablers and physical activity preferences of middle-aged adults for both interventions, and ii) validate subjective measures of physical activity assessment in both interventions, to determine if there were any differences in self-reporting of physical activity.

Chapter 2 of this thesis reviews the literature, identifying and summarising primary research study outcomes comparing group and home-based physical activity interventions in sedentary community-dwelling middle-aged adults. Research studies have been critically analysed, reviewing the effectiveness of reported interventions in increasing the adoption and maintenance of physical activity, both in the short and long-term, when directly compared. Literature reporting on participant preference for physical activity format and the role of physiotherapy in physical activity promotion is also reviewed. Considering current knowledge on the effectiveness of physical activity program formats, including participant preference and the potential role of physiotherapy, gaps in the literature have been identified, further justifying the purpose of this study.

To investigate whether the physiotherapist-led home-based physical activity program was effective in terms of health benefits, adherence to exercise and cost-effectiveness, the study protocol for the intervention study is described in Chapter 3, proposing a comparison between group exercise and home-based physical activity. Results of the pragmatic quasi-experimental intervention study at 6-months are described in Chapter 4.

The outline of the qualitative study is provided in Chapter 5. Focus groups were conducted with study participants to gather information concerning physical activity behaviours, with the intention to inform future physical activity interventions. The aim of the focus groups was to report on the barriers and enablers of PAAH's two physical activity interventions and the participants' preferences for physical activity format. A suitable theoretical framework for the home-based program is discussed at this time, as well as practical implications for program delivery.

To test the effectiveness of an intervention to increase physical activity, physical activity levels need to be accurately evaluated. Physical activity diaries and questionnaires are commonly employed as outcome measures due to their low cost and ease of use in the clinical setting, with recognized limitations (Troiano et al. 2008; Sternfeld and Goldman-Rosas 2012). The main purpose of the validation study was to determine whether self-reported duration of perceived moderate and vigorous intensity physical activity via physical activity diaries matched potentially more accurate measures of physical activity, the Active Australia Survey and accelerometer data, for PAAH's two physical activity interventions. Results from this study are reported in Chapter 6.

Few studies report on the long-term adherence to physical activity following an intervention. The 18-month follow-up post intervention in this study, with assessments taking place at 6-monthly intervals, provides an indication of the effectiveness of the physiotherapist-led home-based physical activity program, in terms of long-term adherence, health benefit and cost. The 2-year results of PAAH are reported in Chapter 7. Finally, in Chapter 8, the findings from all aspects of this research project have been brought together to clearly demonstrate the original contribution of this work in the field of physical activity, outlining the practical implications and future directions. If the physiotherapist-led home-based physical activity program is found to be successful it could provide an alternative option for physical activity program delivery, giving potential participants a wider range of choices that may suit their lifestyle. In turn, the comparison between the 'usual practice' community

group exercise program and the physiotherapist-led home-based physical activity program could guide clinicians and public health providers in delivering effective health promotion strategies, in both urban and rural settings.

# 2 Literature Review: Which format is more (cost)-effective: group versus home-based physical activity programs?

## 2.1 Introduction

A number of barriers and enablers to physical activity adoption and maintenance in adults have been identified in the literature, such as, lack of time and access to facilities (Trost et al. 2002). A variety of physical activity interventions have been trialled to address these barriers and enablers, basically falling into two distinct categories; home or group-based interventions. A review of the current literature directly comparing these formats in middle-aged adults, will provide an indication of their value, guiding clinicians and public health providers on which program is more effective over the short and long-term. Additional factors considered will be participant preference for physical activity format, and the provision of physical activity advice, presenting a background for the physiotherapist-led home-based physical activity program.

### 2.1.1 Aim

The main aim of the review was to identify primary research studies comparing group and home-based physical activity programs for sedentary, community-dwelling middle-aged adults. Evidence from these studies has been evaluated to determine which format, group or home-based, is more effective in increasing the adoption and maintenance of physical activity, in terms of physical activity adherence, health benefits and cost of delivering such programs.

### 2.1.2 Methods

**Types of studies & interventions**

Randomised or quasi-randomised controlled studies were considered, directly comparing home-based and group-based programs in sedentary middle-aged adults. Studies needed to consist of at least two treatment arms that were classified as a home-based physical activity intervention and a group-based physical activity intervention. Exercise interventions were also considered, as exercise is a subset of physical activity (Caspersen et al. 1985).

**Types of participants**

Study participants were between 50-65 years old (middle-aged), and preferably trials consisted of both males and females. The diagnostic criterion included no serious medical

conditions in the last 6-months, and no severe functional impairments. Studies only involved participants who were classified as sedentary at baseline.

**Types of outcome measures**

The ability of a particular physical activity format, home-based or group-based, to increase population physical activity levels is the main outcome of interest in this review. Therefore, adherence or long-term maintenance of physical activity, measured using subjective (e.g.: exercise diaries or physical activity questionnaires) or objective methods (e.g.: accelerometry), was the primary outcome of the comparison studies.

Secondary outcome measures considered were indicators of aerobic capacity (for example, treadmill test, 6-minute walk test), quality of life (for example, SF-36 survey), measures of disease risk (for example, blood pressure, cholesterol levels), body composition (for example, waist circumference, waist-to-hip ratio), and measures of cost and health service utilization.

**Search strategy**

The following electronic databases were used to identify suitable research studies: MEDLINE, CINAHL, SPORT Discus, Health source: Nursing/Academic Edition, PsycINFO, PEDro, Cochrane database and Google Scholar. Hand searches of the reference lists of relevant journal articles and text books were used as a search strategy, as well as scanning prominent journals in the area.

Electronic database search terms used were:

1 MeSH "Exercise"
2 AND (home OR lifestyle OR unstructured)
3 AND (group* or structured or cent* or hospital).

The Medical Subject Headings (MeSH) definition of "Exercise" is restricted to humans (US National Library of Medicine.). It is defined as '*Physical activity which is usually regular and done with the intention of improving or maintaining PHYSICAL FITNESS or HEALTH. Contrast with PHYSICAL EXERTION which is concerned largely with the physiologic and metabolic response to energy expenditure. Term Exercise. Term Exercise, Physical.'*

Searches were further restricted to studies published no earlier than 1990, peer-reviewed articles, middle-aged adults 45-64 years and English language only papers.

### 2.1.3 Description of studies

Five primary research studies were identified that satisfied the above inclusion criteria, consisting of eighteen journal articles (1991-2013). A Cochrane review was also found, comparing home and centre-based physical activity programs in older adults (Ashworth et al. 2005). Studies were primarily excluded if they did not directly compare home and group-based physical activity programs, or participants had a serious medical condition at baseline. Each of the five studies identified have been briefly summarised in Table 2.1.

## 2.2 Recruitment methods for the physical activity programs

Table 2.1 shows that most of the comparison studies used randomisation in their recruitment process, with two studies including a control group (King et al. 1991; Opdenacker et al. 2008). All of the studies targeted the same population using similar recruitment methods (Table 2.1). The King et al (1991) study was the only trial to use a random-digit-dial telephone survey in an attempt to provide a more representative sample of the population, minimizing self-selection.

The definition of sedentary varied between studies, ranging from less than 40 minutes per week of moderate-vigorous physical activity (MVPA), in less than two sessions, in the last 6-months; to less than 120 minutes per week of MVPA, in less than two sessions, at the time of recruitment (King et al. 1991; Cox et al. 2003; Wilcox et al. 2006; Opdenacker et al. 2008). Therefore, participants did not start at the same baseline level, although all participants were not meeting the public health physical activity guidelines and would be considered insufficiently active (World Health Organization 2004).

Recruitment rates were not reported within the studies, and it was difficult to calculate these for each trial, as it was unclear what the total number of the target population was. King et al (1991) was the only study that attempted to report a recruitment rate, although this was not a true representation as they included the number of individuals contacted through the random-digit-dial telephone survey (n=2668), plus those that responded to the media promotion (n=449). Forty-four percent of this population were ineligible based on the inclusion criteria, 44% declined participation in the study, and 1% were excluded for medical reasons, leaving only 11% for randomization. None of the identified studies reported recruitment costs.

**Table 2.1.** Characteristics of group (G) versus home-based (HB) physical activity programs in the comparison trials.

| Author | Study design and recruitment [ab] | Description of interventions | Follow-up support and length | Retention rates[c] | Long-term physical activity adherence measures | Long-term health measures | Cost analysis |
|---|---|---|---|---|---|---|---|
| Opdenacker et al, 2008 & 2011 | Randomised, controlled (non-randomised), n=186. | Intervention length = 11 months.<br>• G: 3 times per week at a centre, 60-90 minutes.<br>• HB: 5 group sessions + 16 telephone support calls. | No support.<br>Follow-up length = 12 months. | No significant difference between HB & G (23 months: G 81% vs HB 77%). | Improvements in total physical activity and cardio-respiratory fitness, with no significant difference between all three arms of study at 23 months. | BMI, percentage body fat, waist circumference, and BP unchanged at 23 months for all interventions. | No. |
| King et al, 1991 & 1995 | Randomised, controlled, recruitment primarily via random-digit-dial telephone survey, n=269. | Intervention length = 2-years.<br>• G: 3 times per week at a centre.<br>• HB x 2: High-intensity (60 minutes, 3 times/week); Low-intensity (30 minutes, 5 times/week). Centre visit x 1 + telephone support (6 calls first 8 weeks, monthly until 12 months, bimonthly until 2-years). | Decreasing telephone support in the HB intervention. Group exercise sessions continued to be offered to G intervention.<br>Total study length = 2-years. | Retention rates 89% for HBx2 & G. | At 2-years: adherence to sessions prescribed was highest in high intensity HB intervention. Low intensity HB adherence was more similar to G intervention. Improved treadmill performance in all 3 interventions. | At 2-years: HDL cholesterol levels higher in HB interventions. BMI, WHR, percentage body fat, BP, diet, smoking, and medication use unchanged for all interventions. | No. |
| Cox et al, 2003 | Randomised, females only, n=126. | Intervention length = 6-months<br>• G x 2 (moderate or vigorous intensity): 3 times per week at a centre.<br>• HB x 2 (moderate or vigorous intensity): 10 | Home-based support for both interventions (written material and telephone support).<br>Follow-up length = 12 months. | 6-months: G 97% vs HB 87%; 12-months: G 94 vs HB 76%; 18-months: G | G intervention had higher adherence to total number of physical activity sessions prescribed at 18-months. No significant difference | No between intervention comparisons. | No. |

*Continued*

| Author | Study design and recruitment [ab] | Description of interventions | Follow-up support and length | Retention rates[c] | Long-term physical activity adherence measures | Long-term health measures | Cost analysis |
|---|---|---|---|---|---|---|---|
| | | sessions initially at centre, followed by HB with written and audio-visual materials + 6 telephone support calls. | | 81% vs HB 61%. | in energy expenditure between interventions at 18-months. | | |
| Dunn et al, 1998 & 1999; Kohl et al, 1998; Sevick et al, 2000 | Randomised, n=235. | Intervention length= 6-months.<br>• G: 3 – 5 times per week at a centre.<br>• HB: First 4 months weekly group meetings, last 2 months fortnightly group meetings utilising behavioural techniques related to physical activity. | • HB: decreasing frequency of group meetings (monthly, bimonthly, quarterly).<br>• G: quarterly group activities, continued access to the group exercise classes & telephone support offered.<br>Follow-up length= 18-months. | No significant difference between G & HB (24 months: G 79% vs HB 83%). | Improvements in physical activity and cardio-respiratory fitness, with no significant difference between interventions at 2-years. | Decreased systolic and diastolic blood pressure, total cholesterol and percentage body fat, with no significant difference between interventions at 2-years. | Yes. HB more cost-effective than G. |
| Wilcox et al, 2006, 2008 & 2009 | Quasi-experimental, n=1244 (6-months post). | Intervention length = 6-months.<br>• G: 3 times per week at a centre.<br>• HB: Centre visit x 1 + telephone support (biweekly for first 2 months & monthly for last 4 months). | No support.<br>Follow-up length = 6-months. | No difference between G & HB at 6-months (G 88% vs HB 93%). | HB maintained increased physical activity; G significantly decreased physical activity from 6 to 12 months. | Decreased BMI and increased satisfaction with body appearance and function for both interventions at 12 months. | No. |

[a]All studies aimed to recruit sedentary, healthy, community-dwelling middle-aged and older adults, both males and females, except Cox et al (2003).
[b]All studies primarily used media advertising to recruit participants, except King et al (1991).
[c]All assessments conducted at a centre.

The majority of participants recruited for these studies were female, white and highly educated, despite attempts to recruit a generalised sample of the population. Translating the evidence into practice Wilcox et al (2008) provided a more diverse sample, and found over a 4-year recruitment period that the home-based program increased recruitment of ethnic minorities, those with less than high school education and those who were sedentary. The group program increased recruitment of those greater than 75 years old, less than high school education, those who suffered with arthritis and/or hypertension, but decreased the recruitment of participants who were sedentary. These results were not discussed further by the authors. A possible interpretation may be that those with lower exercise self-efficacy found the home-based program more attractive, and those that were already active but were older, with comorbidities, sought out exercise guidance via the group intervention.

Thus, exact recruitment methods, recruitment rates and recruitment costs are poorly reported in the literature, yet are a critical factor, as they can be a time consuming and expensive component of a physical activity study. In addition, many physical activity interventions do not reach those people who would benefit the most (Stevens et al. 2008). Accurate reporting of the recruitment process may impact clinical and public health implementation of physical activity programs, particularly if different program formats recruit different target populations.

## 2.3 Retention versus adherence to the physical activity programs

### 2.3.1 Description of the physical activity programs

Brief descriptions of the home-based and group interventions for each trial are included in Table 2.1. All group programs in the comparison studies were offered three times per week. The intervention period for both the group and home-based interventions varied between 6-months and 2-years but were the same for both interventions, group and home-based, within each trial. All studies were based on a combination of at least two behavioural theoretical models, the Transtheoretical model and Social Cognitive Theory (Prochaska and DiClemente 1984; Bandura 1986). In addition, Opdenacker et al (2008) utilised Self-Determination Theory (Deci and Ryan 2000).

The support provided during the home-based intervention period varied (Table 2.1). All programs required attendance at a centre for exercise prescription. All the home-based programs required attendance at group sessions for exercise or lifestyle education sessions at

varying times throughout the intervention and maintenance periods, with the exception, the trial conducted by King et al (1991). Both home-based and group programs were delivered by exercise leaders / instructors for all studies, with the addition of an exercise / health psychologist for the home-based program in the studies conducted by Dunn et al (1998) and Opdenacker et al (2008). Telephone counselling was provided in four of the studies during the home-based intervention period, with group support provided in the remaining study for home-based participants (King et al. 1991; Kohl et al. 1998; Cox et al. 2003; Wilcox et al. 2006; Opdenacker et al. 2008).

Home-based or lifestyle programs have been investigated in response to some of the barriers to physical activity adoption, such as lack of time and poor access to facilities. Yet, all of the above home-based interventions required some level of attendance at a centre, whether it be for a one-off exercise prescription or a number of group education sessions, indicating an absence of completely 'home-based' physical activity programs (Trost et al. 2002).

### 2.3.2 Retention rates

The retention rate of participants is the number participating in the study at each time point, expressed as a percentage of the number of participants at the commencement of the study (Cox et al. 2003). For most studies retention rates were high and similar for both group and home-based interventions, varying from 77 to 93% (Table 2.1). In contrast, Cox et al (2003) found that the centre-based group had higher retention rates than the home-based group at all time-points (Table 2.1). Regardless, reasons for study withdrawal were similar across all trials and interventions. Retention rates are important for study outcomes, but they do not give an indication of adherence to the physical activity program itself.

### 2.3.3 Adherence rates

Similar methods were used to assess adherence to the group program between studies, but these methods were not the same in assessing the adherence to the home-based program, both within and between trials. Group adherence was assessed in four studies using attendance lists to record attendance at the group exercise sessions. Participants were required to attend 3 sessions per week to achieve 100% adherence, or 5 sessions in 2 consecutive weeks (King et al. 1995; Dunn et al. 1998; Cox et al. 2003; Opdenacker et al. 2011).

To assess the home-based program adherence, King et al (1995) and Cox et al (2003) used a similar method. Home-based participants were required to complete an exercise log and return

it fortnightly or monthly. From the exercise logs, adherence was calculated by dividing sessions completed by sessions prescribed. Sessions prescribed were either 3 or 5 sessions per week. Dunn et al (1998) assessed home-based adherence without considering exercise adherence at all. Adherence was based on the attendance list for group meetings as part of the home-based program. It was unclear how the home-based adherence was calculated in the Opdenacker et al (2008) study, other than participant's having self-reported their adherence during the telephone support calls. Wilcox et al (2008) did not report adherence to either the group or home-based intervention.

Reported adherence rates at the end of the intervention period, or at 12 months, varied between studies. Dunn et al (1998) found a similar adherence rate for the group and home-based interventions, 80% versus 78% respectively, but the home-based adherence rate was not based on exercise participation. Similarly, Opdenacker et al (2008) found that participant's adhered to each intervention equally, group 82% and home-based 85%. Cox et al (2003) found that group participants were significantly more likely to adhere to their program than home-based participants at the end of the intervention period (group 84% versus home-based 63%, $p<0.001$). While King et al (1991) found the opposite for each month of a 12 month period, with home-based adherence rates higher than the group-based program (home-based 77% versus group 52%, $p<0.0005$).

Therefore, it is unclear which format is the most effective to ensure participants maintain or adhere to exercise or physical activity, at least in the short term. Differing methods for calculating adherence rates make it difficult to compare results, both within and between studies. The same method for assessing adherence for all interventions, and regular reporting of adherence rates, may improve comparisons, providing a better indication of which intervention is more effective in adopting and maintaining physical activity.

## 2.4 Long-term adherence to physical activity

### 2.4.1 Follow-up length and support

Before discussing long-term adherence to physical activity, the length of follow-up and level of support provided during this time needs to be taken into account, varying both within and between studies, as outlined in Table 2.1.

### 2.4.2 Evidence of long-term adherence

When considering adherence to physical activity, physical activity and aerobic fitness measures were also taken into to account to allow for comparisons between studies. With no support provided during the follow-up period, Opdenacker et al (2011) found that there was a decrease in cardiorespiratory fitness in group participants during the 11-month follow-up period, while there was no change for the home-based participants. Interestingly though, the control group had also increased their cardiorespiratory fitness, as well as their total self-reported physical activity over the 2-year period, with no significant differences in both measures between all three study arms at 2-years (Table 2.1). At 2-years, the home-based participants were more able to maintain an increase in active transportation and daily steps, compared to the group-based and control participants. Therefore, the authors concluded that the home-based program had superior exercise participation compared to a group program.

Similarly, Wilcox et al (2009) provided a no-intervention follow-up for 6-months. In agreement with Opdenacker et al (2011), both the home-based and group programs were able to maintain an increase in physical activity during the follow-up period, with the group program showing a significant decline in physical activity from the end of the intervention period to follow-up.

A similar trend was found in the remaining three trials, where some form of maintenance intervention was provided during the follow-up period. All interventions reported a decrease in physical activity adherence, physical activity and cardiorespiratory fitness during the follow-up period, except for Cox et al (2003), where home-based participants increased their adherence to physical activity over the 12-month follow-up period (King et al. 1995; Dunn et al. 1999). At 2-years, King et al (1995) found that home-based exercise adherence continued to be higher than the group program but only for the higher-intensity home-based training condition, with the lower-intensity home-based condition significantly lower and more similar to the group-based condition. Like Opdenacker et al (2011), Dunn et al (1999) found that group participants had a significantly larger decrease in cardiorespiratory fitness compared with the home-based intervention during the 18-month follow-up, resulting in no significant difference between interventions at 2-years. In none of the five trails did the physical activity levels or cardiorespiratory fitness return to baseline over the longer-term.

Hence, it can be seen that comparisons are difficult to make as studies use varying methods to assess physical activity adherence, and different levels of support during the follow-up period.

There does seem to be some indication that home-based interventions provide better long-term adherence to physical activity, or better maintenance of physical activity. The evidence suggests that measures of physical activity and aerobic fitness are more likely to decline in group participants during the follow-up period. Whether one format provides a more lasting improvement in physical activity levels to participants than the other is worth considering, and further investigation of this issue will better inform clinical practice.

## 2.5 Health benefits

Documented health benefits, other than changes in physical activity levels and cardiorespiratory fitness, were few in all comparison studies (Table 2.1). Changes in body composition and disease risk markers, such as cholesterol and blood pressure, were generally not found and if they were reported, one format did not appear to provide significantly better results than the other (Table 2.1). All five studies used intention-to-treat (ITT) analysis, with at least one study also performing an on-protocol analysis, resulting in no difference in their findings (Dunn et al. 1999). In summary, it appears that the long-term improvements (up to 2-years) in body composition and measures of disease risk are difficult to achieve in middle-aged adults using a physical activity intervention, regardless of which format.

## 2.6 Cost effectiveness

Only one study completed a cost effectiveness analysis (Table 2.1). Sevick et al (2000) found that the home-based (lifestyle) intervention was more cost-effective than the group (structured) intervention, with total costs one third to a quarter of the group exercise intervention. This study demonstrated that the home-based intervention was more economically efficient in achieving improvements for a number of outcome variables, such as additional minutes walked each day, reduction in systolic and diastolic blood pressure, and reduction in sitting time per week. This was despite both the group and home-based physical activity programs achieving similar outcomes (Dunn et al. 1999).

For the remaining studies there were no cost analysis reports provided comparing the group and home-based interventions. Although, Wilcox et al (2008) strongly recommend cost effective analyses be completed in the future to better inform policy decisions.

## 2.7 Participant preference

Limited literature exists on participant preference for physical activity format, although there was some evidence that the majority of middle-aged adults prefer not to attend group

programs. Wilcox et al (1999) conducted a large survey (n=1820) in the USA in the late 1980s. Using random-digit telephone dialling, middle-aged adults (50-64 years old) participated in a telephone survey framed using Social Cognitive Theory. Participants were primarily white (88%), female (60%), married (67%), well-educated (14.3 years of education) and not regularly active (85%). The main outcome variable was a dichotomous measure, considering the structural domain: *"Which is more appealing to you, exercising in a group with an exercise leader or exercising on your own, with some instruction?"* Sixty-nine percent of middle-aged adults preferred to exercise on their own with some instruction rather than in an exercise class.

Beauchamp et al (2007) investigated the physical activity preferences of a smaller sample (n=549) of middle-aged adults (50-69 years old) living in the UK. Here the social domain was considered, with questions based on the Self-Categorization Theory. Participants were asked to rate on a 5-point Likert scale (ranging from very unappealing to very appealing) four exercise settings: (a) exercising alone, (b) exercising in a group comprised mostly of people in their 20s and 30s, (c) exercising in a group comprised mostly of people in their 40s and 50s, and (d) exercising in a group comprised mostly of people in their 60s and 70s. Convenience sampling was used, with interviews conducted "on the street". To allow comparison, Beauchamp et al (2007) used the same measures of health and physical activity as Wilcox et al (1999). Most of the participants were Caucasian (87%) and not regularly active (90%). Approximately half of the participants were female (47%).

Beauchamp et al (2007) found that participants had comparable demographic and health variables to the USA sample and conceded that the sampling method used, convenience sampling, was less robust than that used by Wilcox et al (1999). In contrast to the Wilcox et al (1999) findings, the Beauchamp et al (2007) results indicated that those in their 50s had a significantly greater preference to exercise in age-matched groups as opposed to exercising alone. For participants in their 60s there was no significant preference. In conclusion, the authors suggested that older adults do not have a stronger preference for exercising alone compared to age-matched group settings.

Debate arose between the above authors following Beauchamp's paper (Beauchamp and Carron 2008; King and Wilcox 2008). Essentially, King and Wilcox (2008) describe their work as targeting the structural domain, acknowledging that the question they used did not address whether 'exercising on your own' differentiated between choosing to exercise

completely alone or with others (the social domain). Beauchamp and Carron (2008) disagreed with this comment, stating that if people are exercising on their own, by definition they are not exercising with other people. Obviously there is some confusion about these terms, with both authors noting that the structural and social domains are overlapping, yet distinct. Future research was suggested, with various exercise contexts or preference domains considered (Beauchamp et al. 2007; King and Wilcox 2008).

Despite the controversy, there does seem to be a preference in white, well-educated, insufficiently active, female, middle-aged adults to exercise in an unsupervised environment and this may be the key to this debate. Beauchamp et al (2007) does not consider whether the groups are supervised or not, and Wilcox et al (1999) does not consider whether the unsupervised exercise is conducted completely alone or with others.

In the Australian context, Booth et al (1997) conducted a large survey of insufficiently active (less than 150 minutes per week of moderate-to-vigorous physical activity) adults 18-78 years old (n=1232), in the early 1990s. Random sampling was used and participants were interviewed in their homes. Both males and females were included in the study, however demographic information was not reported, nor was the sample size of the age sub-groups. Participants were asked what activities they would most like to do if they were to exercise, with nine activities listed (walking, swimming, team sports, racquet sports, jogging, gym, aerobics, cycling and other). Participants were also asked what type of help they would prefer if they were to exercise more, with eight alternatives provided (medical advice, group of people to exercise with, telephone advice, exercise video, exercise book, exercise kit with pamphlets and practical tips, a course sent through the mail and no assistance). Considering only the 40-59 year old sub-group, 67% of participants preferred walking and only 27% of participants wanted to exercise with a group of people. Booth et al (1997) concluded that group-based approaches for insufficiently active older people may be a strategy which is unappealing. The difficulty in interpreting this result is that ‘a group of other people to exercise with’ does not specify if there is an exercise leader for the group as used in the Wilcox et al (1999) study, nor does it specify whether the group is age-matched, as in the Beauchamp et al (2007) survey. The context of the question is quite broad and open to interpretation, although it does again indicate that a component of middle-aged adults prefer not to attend groups.

In a more recent Australian study, Salmon et al (2003) conducted a large cross-sectional study, randomly selecting adults (≥18 years old) from the AEC electoral roll to complete a mail survey (n=1332). The mean age of respondents was 45 years old, half were women (55%) and half were tertiary educated (48%). Age sub-groups were not considered in this study. The survey was based on Behavioural Choice Theory and respondents were asked to rate on a 5-point Likert-scale (no enjoyment to a lot of enjoyment) how much they enjoyed four activities: (i) structured physical activity (team sports, racquet sports, cycling, jogging, aerobics or exercise class, swimming, dancing), (ii) unstructured physical activity (digging, raking leaves, washing car), (iii) walking and (iv) sedentary behaviour. Eighty-six percent of respondents reported high enjoyment of walking, with structured physical activity being the least likely to be highly enjoyed (31%). Enjoyment of physical activity was a significant predictor of participation. The types of activities considered under the label of 'structured physical activity' do not necessarily involve an exercise leader and do not mean these activities were conducted in groups. Walking may also be conducted in groups. Therefore, it is difficult to draw conclusions regarding adults' preferences for physical activity format, group or home-based, from this study.

Considering the above literature, more evidence is required, with better defined physical activity contexts, to provide a clear indication of middle-aged adults' physical activity preferences. Well-defined recent evidence is indicated with the largest study identified conducted in the USA 25 years ago, noting that attitudes to physical activity in a different country, in the 1980s, may be different to what they are today. Attempts should also be made to recruit a more representative sample of participants to allow increased generalizability. By identifying the preference of middle-aged adults for physical activity program format, this should allow for the more targeted tailoring of physical activity interventions to meet the needs of these participants.

### 2.8 The role of physiotherapy

Insufficiently active Australians have shown a preference for physical activity advice from a doctor or health professional as they get older (Booth et al. 1997). The survey in this study, as reported above, asked randomly selected participants in a face-to-face interview what type of help they would prefer if they were to exercise more, with eight alternatives provided. Booth et al (1997) found that greater than 50% of 60 plus year olds wanted advice from a doctor or other health professional, 41% of 40 to 59 year olds and only 22% of 18-39 year

olds. The authors suggested that physical activity strategies which target older adults may be best promoted by doctors and other health professionals, emphasising walking and tailoring the activity to the individual's health status.

There is some evidence that Australian physiotherapists perceive the provision of physical activity advice as part of their role. Shirley et al (2010) reported a cross-sectional survey using random sampling of New South Wales Australian Physiotherapy Association members (n=319), conducted in 2008. The survey was based on a similar survey used with Australian primary care physicians. The majority of survey respondents worked in private practice (57%), were female (73%) and had been in practice for a mean of 14 years. Over 90% of physiotherapists saw providing physical activity advice as part of their role, were confident in doing this and felt that physical activity advice could be incorporated into a treatment session. When asked to name the physical activity guidelines for Australian adults though, only one third could do so. Sheedy et al (2000) found a similar result in a small number of Australian public out-patient physiotherapists (n=26), involved in an intervention study. At baseline only 39% of physiotherapists were able to accurately describe the physical activity recommendations. After involvement in one education session and the intervention period (approximately 3 months), 71% of physiotherapists were able to accurately describe the recommendations (p=0.02). Thus, physiotherapists are confident in providing physical activity advice and are potentially willing to do so. With minimal additional training, the use of the physiotherapists' skills could play an important part in public health.

Frerichs et al (2012) conducted a systematic review to determine if physiotherapists can effectively counsel patients with lifestyle-related health conditions. Despite substantial heterogeneity between the seven studies identified, results indicated that physiotherapists can counsel effectively for lifestyle behaviour change. Yet, it was difficult to determine whether physiotherapists were more effective as sole providers, or as part of a multidisciplinary team. Two studies were identified where the physiotherapist was the sole provider of the intervention and a comparison group was included. Sheedy et al (2000) conducted a quasi-experimental pilot study in Australia, recruiting participants 18 years or older (mean age, 51 years) attending public hospital out-patient departments for treatment (n=204). The intervention was aimed at increasing physical activity and was based on the Transtheoretical Model, incorporating the Stages of Change. In the intervention, participants were provided with brief counselling (5 minutes) in their treatment session, based on their stage of change

for physical activity, with up to two subsequent brief counselling sessions over 6 weeks. Physical activity was self-reported via a survey that was not reported as being assessed for validity or reliability. Both the intervention and control groups improved their self-reported level of physical activity at 6-weeks, with no significant difference between groups, indicating that brief physiotherapy counselling to increase physical activity may not be effective.

Taylor et al (2009) conducted a randomised control study, comparing physiotherapy counselling plus the use of a fitness centre to supervised exercise sessions over 2 months, aiming to increase exercise capacity in type 2 diabetics. Sample size was small (n=24), with equal numbers of males and females and a mean age of 55 years. Participants in the physiotherapy counselling group received two face-to-face counselling sessions based on the 5 A's (address the agenda, assess, advise, assist and arrange follow-ups), at baseline and one month. Weekly telephone calls (length 10 minutes) from the physiotherapist were included in the physiotherapy counselling group, as well as access to a fitness centre. The supervised exercise session was conducted in a laboratory. All participants were expected to complete 16 training sessions over the 2-month intervention period. Using intention-to-treat analysis, both interventions improved their exercise capacity (treadmill test), with no difference between groups. There was also no difference in adherence to the sessions prescribed or exercise time, with both groups attending approximately 12 of the 16 sessions.

There are a number of limitations to the above evidence, such as small sample size, lack of blinding, concerns regarding optimum measurement tools and study design. This makes it difficult to determine whether physiotherapists can effectively counsel adults to increase their physical activity levels as a sole provider, thus more research is indicated (Sheedy et al. 2000; Taylor et al. 2009).

## 2.9 Conclusion

There are a limited number of studies in the literature directly comparing group and home-based physical activity formats in sedentary middle-aged adults, with only five studies identified. Despite this, there is some indication that home-based physical activity programs have similar retention rates and health benefits to group-based programs, are less costly and have better long-term physical activity adherence. Interpretation of the available literature is further limited by the lack of RCTs, although the value of pragmatic quasi-experimental studies cannot be dismissed, providing important information on whether effective interventions work in real-world settings (Des Jarlais et al. 2004; Wilcox et al. 2008).

None of the home-based interventions reviewed appear to be truly home-based, involving some group component or attendance at a centre, presenting as possible confounding factors. Recruitment bias is likely, as most studies primarily used media advertising, potentially recruiting highly motivated volunteers. Participants were mainly white, female and well-educated, limiting the generalizability of the findings. The heterogeneity of the interventions, particularly the home-based programs, and follow-up support, makes it difficult to draw strong conclusions about the effectiveness of both formats, group and home-based. The variability in the definition of some outcome measures, such as adherence, both within and between studies, adds to this confusion. In addition, only one known study reported on the cost-effectiveness of each format. Overall, a number of limitations have been identified in the few comparison studies of group and home-based physical activity programs found in healthy middle-aged adults over the longer term, limiting the available evidence to guide effective practice.

Participant preference for physical activity program format has been investigated in single studies in Australia, the UK and USA. There is some evidence that the majority of middle-aged adults prefer not to attend instructor-led group exercise sessions, although controversy prevails over the context of these results. Further research has been suggested investigating the structural and social domains in preferences for group and home-based physical activity formats. There is also some evidence that middle-aged and older adults prefer physical activity advice from a health professional. Physiotherapists have been shown to be a confident and willing group, with a limited number of studies providing unclear evidence as to whether or not they can counsel effectively to achieve changes in physical activity behaviour.

Seeking to address some of these gaps in the literature, in the current study, sedentary middle-aged adults not interested in, or unable to attend, a group exercise program were recruited to a 6-month physiotherapist-led home-based physical activity program with telephone support. Outcome measures from this intervention were compared to those of participants in a community group exercise program of 6-months duration, with both programs having an 18-month follow-up. In an attempt to increase the numbers of participants adopting physical activity, the ‘Physical Activity At Home’ study was designed to recruit participants who provided an indication of preference for the home-based format, as they were not interested in, or unable to attend, a group exercise program. Physical activity format preferences have been further explored within focus groups conducted at the end of the intervention period. By

designing a completely home-based program, provided by a physiotherapist, with no support during the follow-up period for both programs, and using the same measure of adherence for all participants, some of the confounding factors have been limited, allowing the effectiveness of each format to be evaluated over the longer-term. Including the costs of each program, in addition to the health benefit measures and long-term adherence to physical activity, should provide an indication of which format is more (cost)-effective in increasing physical activity levels of sedentary middle-aged adults. The results of the 'Physical Activity At Home' trial extends the evidence available to allow the direct comparison of group and home-based physical activity programs, guiding clinicians and public health providers in physical activity program implementation. Finally, the physiotherapist-led home-based program may be an alternative option to increase overall population adoption of and adherence to physical activity, since there is evidence from the research reported here and elsewhere that the majority of middle-aged adults do not have a preference for participating in a group exercise program.

# 3 Physical Activity At Home

## 3.1 'Physical activity at home (PAAH)', evaluation of a group versus home-based physical activity program in community-dwelling middle-aged adults: rationale and study design.

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# 'Physical activity at home (PAAH)', evaluation of a group versus home based physical activity program in community dwelling middle aged adults: rationale and study design

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## Abstract

**Background:** It is well recognised that the adoption and longer term adherence to physical activity by adults to reduce the risk of chronic disease is a challenge. Interventions, such as group and home based physical activity programs, have been widely reported upon. However few studies have directly compared these interventions over the longer term to determine their adherence and effectiveness. Participant preference for home based or group interventions is important. Some evidence suggests that home based physical activity programs are preferred by middle aged adults and provide better long term physical activity adherence. Physiotherapists may also be useful in increasing physical activity adherence, with limited research on their impact.

**Methods:** 'Physical Activity at Home' is a 2 year pragmatic randomised control trial, with a non-randomised comparison to group exercise. Middle-aged adults not interested in, or unable to attend, a group exercise program will be targeted. Sedentary community dwelling 50-65 year olds with no serious medical conditions or functional impairments will be recruited via two mail outs using the Australian federal electoral roll. The first mail out will invite participants to a 6 month community group exercise program. The second mail out will be sent to those not interested in the group exercise program inviting them to take part in a home based intervention. Eligible home based participants will be randomised into a 6 month physiotherapy-led home based physical activity program or usual care. Outcome measures will be taken at baseline, 6, 12, 18 and 24 months. The primary outcome is physical activity adherence via exercise diaries. Secondary outcomes include the Active Australia Survey, accelerometry, aerobic capacity (step test), quality of life (SF-12v2), blood pressure, waist circumference, waist-to-hip ratio and body mass index. Costs will be recorded prospectively and qualitative data will be collected.

**Discussion:** The planned 18 month follow-up post intervention will provide an indication of the effectiveness of the group and home based interventions in terms of adherence to physical activity, health benefits and cost. If the physiotherapy-led home based physical activity program is successful it could provide an alternative option for physical activity program delivery across a number of settings.

**Trial registration:** Australia and New Zealand Clinical Trials Register (ANZCTR): ACTRN12611000890932

## Background

The incidence of chronic disease dramatically increases in middle age. Conditions such as cardiovascular disease, type II diabetes and cancer are mostly experienced by people in the middle or older age groups [1]. A major risk factor for chronic disease is physical inactivity [2]. By improving physical activity levels towards the recommended level in this age group, it can have a significant effect on their quality of life and future health [3,4].

In 2004-5 the Australian Bureau of Statistics reported approximately 70% of Australians aged 15 years or more were classified as sedentary or having low levels of physical activity [5]. To increase our physical activity levels a

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number of health promotion strategies have been employed, such as General Practitioner advice, mass media campaigns, tailored information for communities and community programs targeting groups or individuals [6]. Yet physical activity interventions in middle and older age adults have reported difficulties with the adoption and adherence to physical activity with a number of barriers identified [7,8].

Physiotherapy-led home based programs may be an alternative option to increase the adoption and long term adherence to physical activity. As primary health care providers physiotherapists are well placed to promote physical activity in both the private and public sector for primary prevention of chronic disease [9]. Physiotherapists prescribe exercise for a wide range of conditions and comorbidities utilising a strong background in disease pathologies and body systems. They are well equipped to provide a thorough assessment, individually tailored prescription of exercise and appropriate counselling to achieve an increase in physical activity [10,11]. However, primary prevention of chronic disease via physical activity programs appears to be under utilised in physiotherapy [12]. Shirley [9] found that physiotherapists were far more likely to incorporate physical activity advice into a regular treatment session for a condition rather than a non-treatment one-on-one or group physical activity consultation. Further investigation of physical activity promotion and physiotherapy is needed to determine its impact.

One of the barriers to physical activity adoption may be that individuals prefer to exercise on their own. There is some evidence that a large number of community dwelling individuals may not be interested in group exercise but would undertake exercise on their own in their local area if they had access to appropriate exercise information and or supports. Wilcox reports from a large community survey conducted in the USA that 69% of middle-aged and 67% of older adults preferred to exercise on their own with some instruction rather than in a group exercise class [13]. Yardley reports that 41% of respondents in a large survey conducted in the UK over the age of 54 would not attend group sessions for falls prevention [14]. Some people may also not be suited to groups, particularly those that are lonely and depressed and have decreased cognition [8].

Community based physical activity studies have found that longer term retention of participants within an intervention is difficult [15,16]. Jancey [8] in a 6-month community physical activity intervention for older adults found that participants lost to attrition (35%) came from areas of lower socioeconomic status, were overweight and less physically active, had lower walking self-efficacy scores and higher loneliness scores. Participants reported that they were unable to continue with the physical activity program due to work and travel commitments, and group times being unsuitable. Attrition was not related to age, relationship status, level of education, or gender.

Participant choice and suitability of physical activity programs needs to be considered in order to increase the adoption and adherence to physical activity. A number of physical activity promotion strategies are group or centre based. Home based physical activity programs have been investigated although many appear not to be completely home based, involving some group component or attendance at a centre for assessments [17,18]. To our knowledge there are no known trials reported in the literature of targeted interventions for those individuals who do not wish to take part in group programs.

There is also some evidence that home based programs provide better long term adherence to exercise than centre based programs [19]. This Cochrane review included only 6 studies on home versus centre based physical activity programs in adults older than 50 years. The largest and highest quality rating study in this review found that there was a significantly higher adherence rate to physical activity in the home based program compared with the centre based program, especially in the long term [20]. King [20] reported that at 12 months following the initiation of group and home based interventions, the group intervention had an approximately 50% adherence to exercise, while the home based intervention had a 70% adherence to exercise. Recommendations from this review included investigation of reasons for better adherence in home based programs and exploring the cost-effectiveness of centre and home based programs.

Individual home based physical activity programs with telephone support can be a viable strategy for home based physical activity program provision [18,21]. Telephone counselling has been found to be effective in promoting physical activity in middle-aged and older adults in both healthy and chronic illness samples and has the potential for being a lower cost and more convenient alternative to face-to-face contact [21,22].

Therefore by targeting middle aged adults, where the number of chronic diseases begins to increase noticeably, with a physiotherapy-led home based physical activity program it may increase the adoption and adherence to physical activity over the longer term. By comparing the home based intervention with telephone support to a standard community group exercise program and usual care we will determine the health benefits, longer term adherence to physical activity and the cost effectiveness of delivering such programs.

We hypothesize that:

1. There are a large number of individuals in the community aged 50-65 years who are not interested in group exercise, a commonly used method to increase the population's level of physical activity in the community.

2. A proportion of this group would commence exercising if an alternative method of increasing physical activity was available, such as a home based approach.

3. The home based physical activity program would produce health benefits equivalent to those seen in the group based exercise program for sedentary adults 50-65 years old.

4. Those that commence the home based physical activity program are more likely to continue with an increase in physical activity in the long term, as compared to a group based program.

5. A home based approach to increasing physical activity with minimal support is more cost effective than a group based intervention, taking into consideration long term physical activity adherence.

## Methods

### Design

'Physical Activity at Home' is a 2 year, pragmatic, two arm randomised control trial (RCT) targeting middle-aged adults not interested in, or unable to attend, a group exercise program. Participants eligible for the home based intervention will be randomised, via computer generated numbers, to a physiotherapy-led home based physical activity program or usual care.

Comparison of the physiotherapy-led home based physical activity program and usual care to a non-randomised group exercise program will also be completed. The group exercise program has been included to replicate a standard community physical activity program for middle-aged adults. Using a quasi-experimental design the three interventions will be compared to determine the long term adherence to physical activity, health benefits and cost.

### Participants

To be eligible for this study, participants will be between 50 and 65 years old. Participants must be sedentary; that is, no participation in regular moderate or vigorous exercise or physical activity for 30 min 2 or more times a week for at least 6 months. They will have no serious medical conditions that could limit participation in moderate physical activity, such as unstable angina, uncontrolled hypertension, diagnosed or hospitalized with chest pain, heart attack or heart surgery in the past 6 months and no severe functional impairments due to multiple medical or psychiatric diseases. They will not be planning to move from the area within 2 years and only one person per household will be eligible. Participants will be English speaking and have appropriate cognitive skills to provide informed consent and actively engage in the physical activity program. Medical clearance screening will be undertaken using the Sports Medicine Australia (SMA) Pre-Exercise Screening System [23]. If the participant answers 'yes' to any of the SMA screening questions, they will be asked to attend their local medical officer to receive medical clearance before they can be included in the study.

### Recruitment

Recruitment to the 'Physical Activity at Home' study will take place between February and April 2011. Two mail outs will be conducted using the Australian Electoral Commission (AEC) federal electoral roll to target 50-65 year olds in six suburbs of the Australian Capital Territory (ACT). These suburbs were chosen due to their geographical proximity to a local YMCA. The first letter will ask for expressions of interest in joining a once weekly group exercise program at the local YMCA. The second letter will be sent to those not interested in the group exercise program inviting them to participate in a health project that will consist of either a 6 month physiotherapy-led home based physical activity program or the completion of a number of basic health measures in their homes giving them an indication of their fitness and health status. All individuals that respond to the mail outs will be screened via telephone. The flow of participants through the trial is illustrated in Figure 1.

### Intervention

(i) Home-based intervention

Assessments for the home based program in this study will be conducted in participant's homes eliminating a number of barriers to physical activity adoption as discussed earlier [24]. Participants will be encouraged to invite a support person to attend during their initial assessment. After baseline measures are completed motivational interviewing will be used to devise an individual physical activity program [25]. A physiotherapist will discuss type, frequency, intensity, duration, benefits, barriers, goals, self-monitoring and progression of physical activity, aiming to achieve 30 min of moderate intensity physical activity most days of the week. Participants will be contacted by a physiotherapist via phone providing advice and support 2 weeks after the initial assessment and then monthly over a 6 month period, a total of approximately 6 phone calls.

(ii) Usual Care

Participants randomised to usual care will be visited by the physiotherapist in their homes. Baseline measures for the study will be completed giving participants an indication of their fitness and health status. Participants will receive two brochures 'An active way to better health. National Physical Activity Guidelines

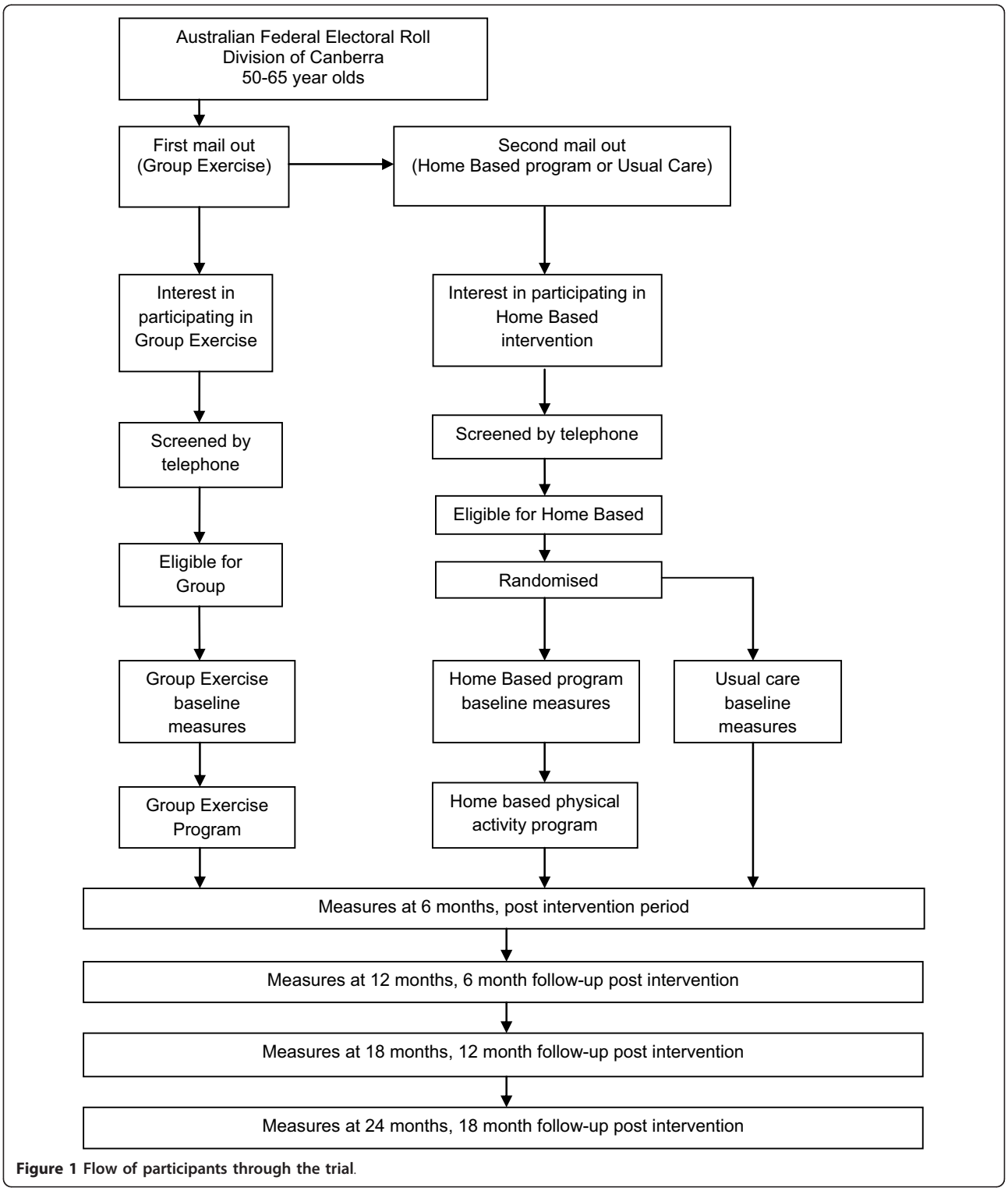


**Figure 1 Flow of participants through the trial**.

for Adults' and 'Dietary Guidelines for Australian Adults' from the Department of Health and Ageing [26,27]. They will not receive any other advice or support for increasing exercise or physical activity levels.

(iii) Group exercise program

Participants in the group based program will attend the YMCA for their baseline measures. Baseline

measures will be conducted by the same physiotherapist as the home based interventions. Participants will then have a choice of times for the group based exercise program which will be during business hours replicating similar programs and times offered in this community setting. These sessions will be run by a YMCA fitness instructor at the YMCA once a week, for 60 min, over 6 months. The exercise program will involve upper and lower body strengthening exercises, gross motor skill training and aerobic fitness training. The exercise specifics will be at the discretion of the YMCA fitness instructor, with no involvement from the physiotherapist, aiming to mimic 'usual practice'. Participants will be encouraged to increase their physical activity slowly and gradually in whichever way they prefer outside of the group sessions by the YMCA fitness instructors, aiming to achieve 30 min of moderate intensity physical activity most days of the week. An individual home based exercise program will not specifically be designed for this group.

#### Outcome measures

The methods of participant assessment have been carefully considered as assessments are taking place in people's homes. All study measures will be assessed at baseline, 6, 12, 18 and 24 months.

The main outcome measure of this study is long term adherence to physical activity. Adherence will be measured using exercise diaries completed over the 2 year study period, a continuous measure. Exercise diaries have been found to be both reliable and valid [28]. Participants will be encouraged to record date, type, duration and intensity, using the modified Borg rating of perceived exertion scale (RPE) [29], every time they are physically active. Participants will be encouraged to return the diaries in the supplied prepaid envelope at the end of each month over the study period.

Average monthly adherence rates across the 2 year period will be calculated as follows: number of physical activity sessions reported as a percentage of physical activity sessions prescribed for the month. This is similar to the method described by King [20] to determine adherence rates to different physical activity intensities and formats over a 2 year period. The number of sessions prescribed for the month will be based on the World Health Organisation (WHO) physical activity guidelines [3]. That is, 30 min of moderate intensity physical activity, five or more days per week, a total of 20 or more sessions per month. Thirty minutes can be accumulated in 10 min bouts of physical activity per day. Moderate intensity is defined as a rating of 3 or more on the modified Borg RPE scale.

Secondary outcomes include the Active Australia Survey (AAS), accelerometry, aerobic capacity (2 min step test), quality of life (SF-12v2) and disease biomarkers, that is, waist circumference (cm), waist:hip ratio (WHR), blood pressure (mmHg) and body mass index (BMI, $kg/m^2$).

The AAS and accelerometry will be used to validate the data collected from the exercise diaries. These two continuous measures will be collected every 6 months over the 2 year study period.

The AAS has been designed to measure participation in leisure time physical activity and to assess the participant's knowledge of current public health messages about the health benefits of physical activity. It offers a short and reliable set of questions and applies to 1 week preceding the interview, including walking for transport. The AAS has been reported as reliable and of acceptable validity [30,31].

Covering the same time period as the AAS, participants will wear an Actigraph GT1M accelerometer [32] for 7 consecutive days. Accelerometers allow an objective measurement of quantity and intensity of movement and have been found to be reliable and valid [33].

The raw data collected by the accelerometer, counts, will be used to obtain the time spent in different physical activity intensities [34]. We will use the Freedson Combination energy expenditure algorithm to determine the intensity cut-points [32]. This outcome variable will be used to investigate whether participants have reached the WHO physical activity guidelines.

Assessment of aerobic capacity is essential to determine whether the completed physical activity has been intense enough to result in an improvement in cardiovascular fitness. The 2 min step test requires little space and equipment, with large studies finding it both reliable and valid [35]. The 2-minute step test protocol involves determining the number of times in 2 min that a person can step in place raising the knees to a height halfway between the patella (kneecap) and iliac crest (front hip bone), a continuous measurement. Only one successful trial will be administered.

The SF-12v2 is a general health status questionnaire which has a 12-item scale producing eight separate subscales (physical functioning, physical role functioning, emotional role functioning, social functioning, bodily pain, mental health, vitality and general health perceptions) to assess quality of life [36]. It takes the participant less than 2 min to complete the tool and is a quasi-continuous measurement.

Waist circumference and hip circumference will be measured in centimetres using a tape measure. Blood pressure levels will be obtained using a mercury sphygmomanometer on the right arm of seated subjects. Both measures will be taken twice and then the average will be recorded. BMI ($kg/m^2$) will be recorded using a portable set of scales and a stadiometer.

Sociodemographic information will also be collected with questions regarding participant's education level, relationship status, current employment status and the presence of any chronic diseases.

Qualitative data will be collected at the end of the intervention period in both the group exercise and physiotherapy-led home based physical activity programs. Telephone administered semi-structured interviews will be conducted with a sub-sample of both the group and home based interventions. Focus groups will also be conducted, with sub-samples of attendees and non-attendees for both the home based and group interventions. These approaches together with the qualitative data should provide improved data collection, guiding future physical activity programs.

### Sample size

The sample size for this study was based on the study by King [20] cited earlier, reporting a 20% difference in adherence to physical activity between a group and home based intervention at 12 months. Assuming a standard deviation of 35% based on this study and a dropout rate of 25% with a statistical power of 0.8, the sample size needed for each group is 64.

Previous community physical activity intervention studies using various recruitment methods, including utilisation of the AEC federal electoral roll, report a recruitment rate of 10-20% [20,24]. Therefore it was estimated that approximately 2000 letters need to be sent in the first mail out to recruit a suitable sample size.

### Statistical methods

Data will be analyzed according to group assignments, regardless of how many participants actually complete the study, the intent-to-treat principle. A maximum of four attempts will be made to contact participants that did not comply with the intervention protocols so outcome measures can be obtained, making the analysis more complete [37].

An intention-to-treat analysis may result in an underestimate of treatment effect, making it harder to find a significant difference [37]. Therefore data will be analyzed using both intention-to-treat and on-protocol analyses to determine if the two methods yield the same or different results. This justifies the allowance of a 25% drop-out rate.

Significance level will be set at $p < 0.05$. All analyses will be conducted using SPSS version 18.0.

### Randomised control trial

The primary analysis for the RCT will use repeated measures analysis of covariance (ANCOVA). All analyses will be adjusted for baseline values. Additional covariates to be considered include: gender, age and employment status, an ordinal measurement.

### Other analyses

A subsidiary comparison with the group exercise program will use the ANCOVA as described above, with the addition of the third intervention group.

### Cost-effectiveness analysis

Cost components for recruitment of participants and cost of the interventions will be recorded prospectively during the 2 year study period. Cost items include participant travel costs and resource use, for example, hospitalisations and GP visits, which will be collected via the 6-monthly questionnaires over the 2 year period. This data will be used in conjunction with an estimate of the health benefits, measured in terms of Disability Adjusted Life Years (DALYs), to undertake a cost-effectiveness analysis comparing the two arms of the study. Disability adjusted life years will be estimated using the method developed by Murray [38]. Health status will be measured using preference-based health status scores derived from individual SF-12 questionnaire responses [39]. The cost-effectiveness analysis will be conducted prospectively alongside the trial to compare costs per DALY change in the trial arms. Cost-effectiveness will be calculated as the ratio of the difference in costs between the home based physical activity program and usual care divided by the difference in DALYs between the two groups. The non-parametric bootstrap method (using 1000 replications) will be used to derive confidence intervals for the incremental cost-effectiveness ratio (ICER) over the follow-up period [40]. Cost-effectiveness acceptability curves [41] will be constructed from these data to provide estimates of the probability that, for a given level of the cost per DALY–the so-called 'ceiling' level, the home based physical activity program is more cost-effective than usual care.

Similar analysis will be conducted to compare cost-effectiveness between the home based interventions and the group exercise program.

## Discussion

Over a 2 year period the 'Physical Activity at Home' study will test the effectiveness, in terms of long term physical activity adherence, health benefits and cost, of a physiotherapy-led home based physical activity program. Specifically it will target middle aged adults who are less likely to adopt and maintain physical activity, as they do not access the currently available community group exercise programs. With few studies reporting on the long term adherence to physical activity post intervention and no known studies reporting on targeted physical activity interventions for those not interested in group or centre based programs, if this program is successful it could allow more individuals to increase their physical activity levels towards that needed to achieve the associated health benefits.

One of the strengths of this trial is that the inclusion criteria are broad proposing that there is some benefit from physical activity for almost everyone [42]. The recruitment method also attempts to minimize self-selection and recruitment of highly motivated volunteers by using the electoral roll, allowing a more representative sample [24]. Phone coverage is widespread in Australia therefore recruitment and providing the home based intervention via this method should also limit selection bias. All measurements will be performed by the same person and the sample size to be recruited should provide adequate statistical power to detect a significant difference in the main outcome measure.

A limitation of this study is the lack of randomisation to the group and home based interventions limiting the ability to attribute outcomes to treatment for all three groups. There is also a lack of blinding, as the principal researcher will be conducting all assessments and providing the home based intervention. Another possible limitation is the type of personnel conducting the interventions is not standardised, that is, a physiotherapist as compared to a fitness instructor.

If successful, this physiotherapy-led home based physical activity program should improve physical activity levels over the longer term, possibly in a cost-effective manner and particularly for those individuals who are not interested in, or unable to access, group exercise programs. This program could provide an alternative option for physical activity program delivery to sections of the population with various risk factors and/or diseases, a wider age range and across a number of different settings, such as rural and remote.

## Ethical approval

This trial was approved by the University of Canberra Committee for Ethics in Human Research in November 2009 (Project number 09-97).

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**Authors' contributions**

All authors contributed to the study design and development of the trial protocol. NF is the principal investigator and trial manager of the Physical Activity at Home study. NF drafted the paper and GW, WC, RD and JG contributed to subsequent drafts. All authors read and approved the final manuscript.

**Competing interests**

The authors declare that they have no competing interests.

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# 4 Physical Activity At Home First Results

## 4.1 Physiotherapist-led home-based physical activity program versus community group exercise for middle-aged adults: Quasi-experimental comparison.

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# Physiotherapist-led home-based physical activity program versus community group exercise for middle-aged adults: Quasi-experimental comparison

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## ABSTRACT

**Objectives: Program method, program deliverer and participant preference may be important factors in increasing physical activity adherence and program effectiveness. To investigate this, we compared two physical activity interventions in middle-aged adults. Methods: Using a pragmatic quasi-experimental design, sedentary community dwelling 50 - 65 year olds (n = 2105) were recruited to a non-randomized 6-month community group exercise program (n = 93) or a physiotherapist-led home-based physical activity program (n = 65). The primary outcome was physical activity adherence derived from exercise diaries. Secondary outcomes included the Active Australia Survey, aerobic capacity (step-test), quality of life (SF-12v2), blood pressure, waist circumference, waist-to-hip ratio (WHR) and body mass index. Results: Home-based participants were more likely to be younger, working full-time and not in a relationship ($p < 0.05$). Thirty-three percent of the group participants attended ≥ 70% of group exercise sessions. Ninety percent of home-based participants received ≥ 4 of the planned 6 telephone support calls. Intention-to-treat analysis found adherence to the physical activity sessions prescribed was the same for both interventions (26% ± 28% vs. 28% ± 35%). Both interventions significantly increased the number of participants achieving self-reported "sufficient" physical activity ($p \leq 0.001$) and significantly decreased waist circumference ($p < 0.001$) and WHR ($p < 0.05$). Conclusion: The physiotherapist-led home-based physical activity program, requiring few resources, appears to have increased the adoption of physical activity and adherence to physical activity program requirements for sedentary middle-aged adults. The home-based program, providing equivalent health benefits to the group exercise program, may be particularly suitable for those not interested in or unable to attend a group exercise program. Clinical Trial Registration number Australian New Zealand Clinical Trials Registry (ANZCTR), ACTRN126 1000890932.**

**Keywords:** Physiotherapy; Home-Based; Physical Activity; Adoption; Adherence; Middle-Aged

## 1. INTRODUCTION

The benefits of physical activity are well documented [1-3]. A number of health promotion strategies have been employed to increase the population's physical activity levels, including group and home-based physical activity programs [4,5]. Yet few studies have directly compared group and home-based physical activity interventions, particularly over the longer term [6,7]. Fewer studies have investigated the role the physiotherapist plays in physical activity promotion [8] and no studies appear to directly target individuals not interested in group exercise.

There is some evidence that middle-aged adults prefer not to attend group programs. Large surveys in Australia, the USA and the UK report that between 41% - 73% of middle-aged adults (50 - 65 years old) prefer not to at-

 

tend group sessions [9-11]. Booth [9] found that 73% of insufficiently active (less than 150 minutes per week of moderate-to-vigorous physical activity) Australian adults 40 - 59 years old were not interested in group exercise, increasing to more than 80% for those aged 60 - 78 years old. In contrast, as age increased, there was an increased preference for physical activity advice from a doctor or health professional, with more than 50% of 60 plus year olds preferring advice delivered in this way. A Cochrane review suggests that home-based programs may lead to better long term adherence to exercise compared with centre-based programs [6]. Therefore participant preference, program deliverer and program method are important considerations for physical activity program implementation.

Promoting exercise and physical activity for primary prevention of chronic disease is an area that appears to be under utilised by physiotherapists [8,12]. Physiotherapists are well equipped for this role, routinely prescribing individual exercise programs while taking into consideration a variety of comorbidities [13]. They have a strong background in disease pathologies and body systems, provide a thorough assessment, individually tailored exercise prescription and possess appropriate counselling skills to achieve an increase in physical activity [13,14]. A physiotherapist-led home-based physical activity program may be a suitable delivery option to increase the adoption and long term adherence to physical activity.

The aim of the Physical Activity at Home (PAAH) study was to compare a new, evidence-based model, a physiotherapist-led home-based physical activity program, to a "usual practice" community group exercise program to determine the health benefits, longer term adherence to physical activity and cost-effectiveness. Here we compare the outcomes of the two approaches after 6 months of intervention.

## 2. METHODS

### 2.1. Design

Using a pragmatic, quasi-experimental design the physiotherapist-led home-based physical activity program was compared to a non-randomised group exercise program, targeting middle-aged adults not interested in, or unable to attend, a group exercise program. This trial was approved by the University of Canberra Committee for Ethics in Human Research in November 2009 (Project number 09-97).

### 2.2. Recruitment

Between February and April 2011 two mail outs (n = 3785) were conducted and participants recruited. The Australian Electoral Commission (AEC) federal electoral roll was used to target 50 - 65 year olds in the postcode of an Australian Capital Territory (ACT) YMCA (4 suburbs). To increase the sample size, an additional two suburbs were chosen due to their geographical proximity to the local YMCA. The first letter (n = 2105) asked for expressions of interest in joining a group exercise program at the local YMCA. The second letter (n = 1680) was sent to those not interested in the group exercise program inviting them to participate in a 6 month physiotherapist-led home-based physical activity program or the completion of a number of basic health measures in their homes, "usual care". Our original study design proposed a randomised controlled trial, allocating eligible home-based participants to a physiotherapist-led home-based physical activity program or usual care [15]. Numbers recruited for the home-based option were insufficient to meet the full original design objectives and the usual care arm was excluded. The flow of participants through the trial is illustrated in **Figure 1**.

### 2.3. Participants

All individuals who responded to the mail outs were contacted by telephone by the principal researcher to determine their eligibility. Participants were between 50 - 65 years old and were sedentary, that is, did not participate in regular moderate or vigorous exercise or physical activity for 30 minutes two or more times a week for at least 6 months [16]. They had no serious medical conditions that could limit participation in moderate physical activity, such as unstable angina, uncontrolled hypertension, diagnosed or hospitalized with chest pain, heart attack or heart surgery in the past 6 months and no severe functional impairments due to multiple medical or psychiatric conditions. They were not planning to move from the area within 2 years and only one person per household was eligible. Participants were English speaking and had appropriate cognitive skills to provide informed consent and actively engage in the physical activity program. Medical clearance screening was undertaken using the Sports Medicine Australia (SMA) Pre-Exercise Screening System [17].

### 2.4. Interventions

#### 2.4.1. Physiotherapist-Led Home-Based Physical Activity Program

Assessments were conducted in participant's homes. After baseline measures were completed motivational interviewing was used to devise an individual physical activity program [18]. A physiotherapist discussed type, frequency, intensity, duration, benefits, barriers, goals, self-monitoring and progression of physical activity, aiming to achieve 30 minutes of moderate intensity

 

physical activity most days of the week. Participants were contacted by a physiotherapist via phone providing advice and support 2 weeks after the initial assessment and then monthly over a six month period, a total of approximately 6 phone calls per participant.

#### 2.4.2. Group Exercise Program

Participants attended the local YMCA for their baseline measures. Measures were taken by the same physiotherapist as the home-based interventions. Participants then had a choice of four session times during business hours for the group based exercise program. A YMCA fitness instructor conducted the program at the local YMCA once a week, for 60 minutes, over 6 months. The exercise program involved upper and lower body strengthening exercises, gross motor skill training and aerobic fitness training. The exercise specifics were at the discretion of the YMCA fitness instructor, with no involvement from the physiotherapist, aiming to mimic "usual practice". Participants were encouraged to increase their physical activity levels outside of the group sessions by the YMCA fitness instructors, aiming to achieve 30 minutes of moderate intensity physical activity most days of the week. An individual home-based exercise program was not specifically designed for this group.

Group participants were unaware that a home-based physical activity program was being conducted. No incentives were provided for either intervention to encourage compliance or adherence.

### 2.5. Outcome Measures

Physical activity adherence was measured using exercise diaries completed over the 6 month intervention period, a continuous measure. Exercise diaries have been found to be both reliable and valid [19]. Participants were encouraged to record date, type, duration and intensity, using the modified Borg rating of perceived exertion scale (RPE) [20], every time they were physically active. Participants were encouraged to return the diaries in the supplied prepaid envelope at the end of each month.

Average monthly adherence rates were calculated as follows: number of physical activity sessions reported as a percentage of physical activity sessions prescribed for the month [21]. The number of sessions prescribed for the month was based on the World Health Organisation (WHO) physical activity guidelines [3]. That is, 30 minutes of moderate intensity physical activity, five or more days per week, a total of 20 or more sessions per month. Moderate intensity was defined as a rating of 3 or more on the modified Borg RPE scale [22].

The Active Australia Survey (AAS) has been designed to measure participation in leisure time physical activity and to assess the participant's knowledge of current public health messages about the health benefits of physical activity. It applies to one week preceding the interview, including walking for transport, and has been reported as reliable and valid [23,24]. The SF-12v2 is a general health status questionnaire which has a 12-item scale producing eight separate sub-scales and two component scores, physical and mental, to assess quality of life [25]. Both the SF-12v2 and the AAS were self-administered.

The 2-minute step-test (2-MST) assesses aerobic capacity, requires little space and equipment, with large studies finding it both reliable and valid [26]. Waist circumference and hip circumference were measured in centimetres using a tape measure. Resting blood pressure levels were obtained using a mercury sphygmomanometer on the right arm of seated subjects. Waist circumference, hip circumference and blood pressure were taken twice and then the average was recorded. Body mass index ($kg/m^2$) was calculated using a portable set of scales and a stadiometer.

Sociodemographic information was also collected with questions regarding participant's education level, relationship status, current employment status and the presence of any chronic diseases.

### 2.6. Data Analysis

For data that were normally distributed, independent samples t-test (2 tailed) with a 95% confidence interval was used to assess differences between interventions at baseline. Chi-square analyses were performed to determine if there were significant differences in distribution of categorical data between interventions at baseline and 6 months. Where cells had counts of less than 5, Fishers exact test was used.

Final analyses at 6 months used an intention-to-treat approach. For missing data at 6 months, we assumed no change from baseline. A one-way repeated measures analysis of covariance (ANCOVA) with a 95% confidence interval was used to determine differences within and between interventions for data that were normally distributed, controlling for age (years), relationship and employment status. McNemar and the Wilcoxon signed-ranks test were used to determine differences within interventions for categorical data. Significance level was set at $p < 0.05$. All data were analysed using SPSS version 19.0.

## 3. RESULTS

### 3.1. Recruitment

158 participants were recruited, 93 group (G) and 65 home-based (HB). The initial mail out inviting 2105 participants to take part in a group exercise program resulted in 422 replies, a 20% (95% confidence interval (CI): 18

 

to 22%) response rate. The second mail out sent to those not interested in the group exercise program (n = 1680), invited participants to take part in the home-based program. Sixty-seven replies were received, a response rate of 4% (95% CI: 3% to 5%).

The flow of participants through the trial to date is illustrated in **Figure 1**. Attempts were made to contact all participants (n = 422) interested in the group exercise program. The majority (n = 333) were screened for eligibility. Twenty-six percent (95% CI: 21% to 31%) were unable to attend the group program due to unsuitable session times. Most of these participants were then offered the home-based program, with 53 participants expressing interest.

Some of the participants interested in the group program that were unable to be contacted during the group recruitment phase were invited to take part in the home-based program with 34 showing interest. In total, 154 participants were interested in the home-based intervention. The main reasons for exclusion for both interventions are outlined in **Figure 1**.

The recruitment rates for the physical activity programs were similar. The home-based program recruited 3.6% (95% CI: 2.8% to 4.5%) of the invited population (65/1781) compared with 4.4% (95% CI: 3.5% to 5.3%) recruited for the group exercise program (93/2105). The recruitment of 93 participants for the group exercise program may be a slight underestimate as recruitment for

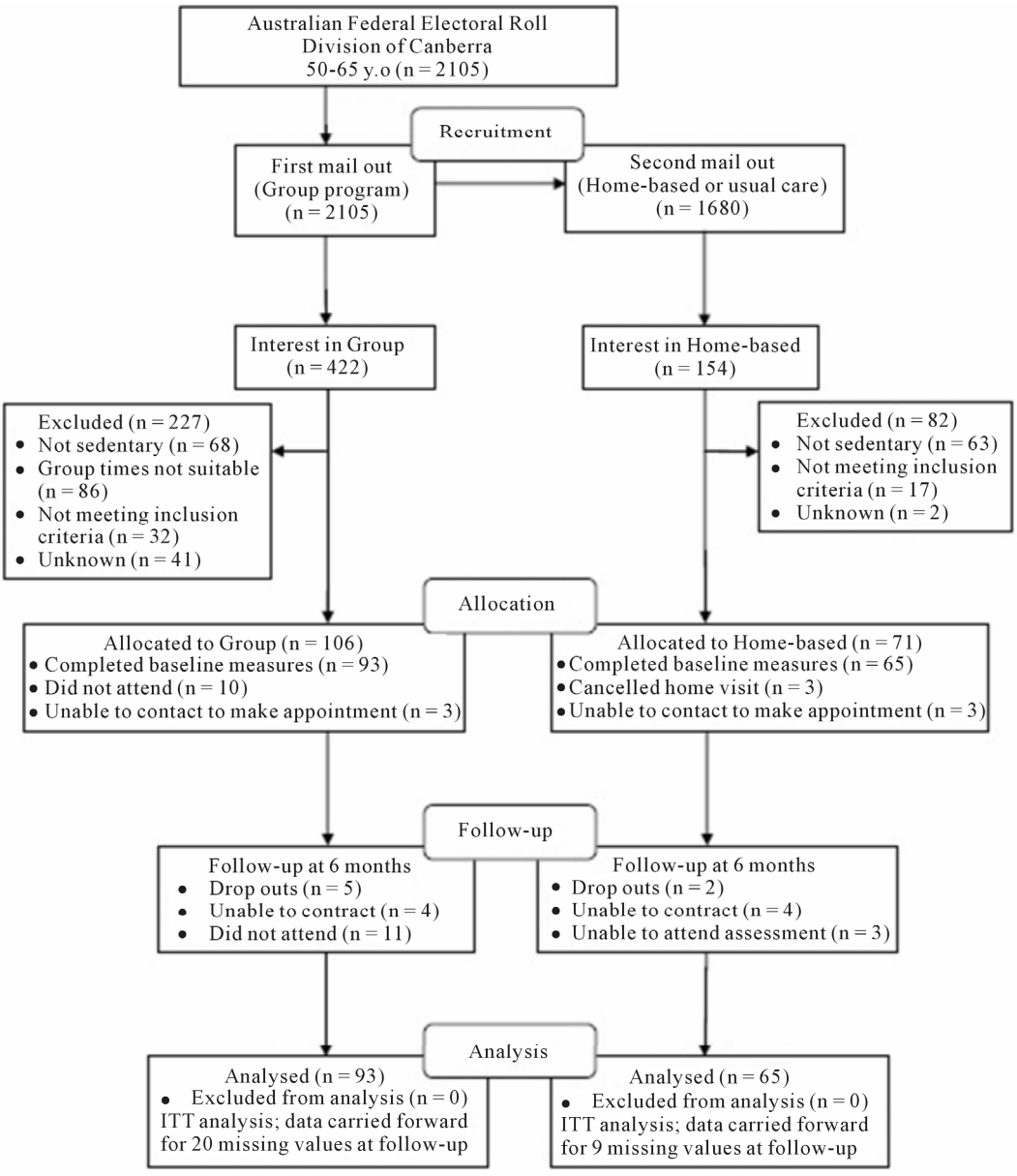


**Figure 1.** Flow of participants through the trial.

this intervention was limited by time constraints. The physiotherapist-led home-based physical activity program increased the total number of sedentary middle-aged adults recruited to a physical activity intervention by 82% (95% CI: 34% to 129%).

## 3.2. Baseline Characteristics

The home-based participants were more likely to be younger (56 vs. 59 years, $p = 0.001$, t = 3.306, 95% CI: 1.04 to 4.12), employed full-time (63% vs. 27%, $p < 0.001$, X2(2) = 21.4) and not in a relationship (41% vs. 24%, $p = 0.02$, X2(1) = 5.10). There were no other significant differences between interventions for all remaining outcome measures (**Tables 1** and **2**). The majority of participants were female (72%), tertiary educated (65%), with no history of chronic disease (73%).

## 3.3. Physical Activity Adherence

Self-reported adherence to the physical activity recommendations was limited due to the poor exercise diary

**Table 1.** Comparison of baseline and 6-month follow-up by intervention.

| | Baseline | | 6-month | |
|---|---|---|---|---|
| | Home-based | Group | Home-based | Group |
| Body Mass Index [kg/m$^2$], mean (SD) | 27.94 (5.57) | 28.42 (5.37) | 28.04 (5.69) | 28.56 (5.52) |
| Waist to Hip Ratio, mean (SD) | 0.85 (0.09) | 0.86 (0.08) | 0.84 (0.09)[a] | 0.85 (0.08)[a] |
| Waist circumference [cm], mean (SD) | 90.28 (14.34) | 92.87 (13.97) | 88.16 (14.64)[b] | 91.32 (14.62)[b] |
| BP meds, yes, n (%) | | | 14 (24.1) | 26 (35.6) |
| BP Systolic [mmHg], mean (SD) | 123.55 (12.86) | 127.76 (14.65) | 123.70 (14.37) | 128.26 (15.17) |
| BP Diastolic [mmHg], mean (SD) | 80.25 (10.67) | 81.2 (10.55) | 79.03 (10.0) | 82.16 (8.90) |
| 2-minute step test, mean (SD) | | | | |
| Number of steps | 89.22 (18.03) | 94.95 (21.12) | 94.56 (19.65)[c] | 100.01 (20.50) |
| SF-12, mean (SD) | | | | |
| Physical component score | 47.11 (10.87) | 48.26 (9.55) | 47.45 (9.54) | 46.29 (10.46) |
| Mental component score | 49.28 (7.69) | 48.48 (10.28) | 50.24 (8.66) | 50.87 (10.13) |

[a]Paired comparison repeated measures ANCOVA (baseline versus 6-month follow-up) within intervention, $p < 0.05$; [b]Paired comparison repeated measures ANCOVA (baseline versus 6-month follow-up) within intervention, $p < 0.001$; [c]6 month comparison repeated measures ANCOVA between interventions, $p < 0.05$.

**Table 2.** Physical activity characteristics at baseline and 6-month by intervention.

| Active Australia Survey [previous week] | Baseline | | 6-month | |
|---|---|---|---|---|
| | Home-based | Group | Home-based | Group |
| Physical activity "sufficient" time and sessions, n (%) | | | | |
| Sedentary (time = 0) | 11 (16.9) | 7 (7.7) | 7 (10.8) | 7 (7.5) |
| Insufficient (1 ≤ time ≤ 149mins OR ≥ 150 mins and <5 sessions) | 40 (61.5) | 64 (70.3) | 29 (44.6) | 38 (40.9) |
| Sufficient (≥150mins and ≥5 sessions) | 14 (21.5) | 20 (22.0) | 29 (44.6)[a] | 48 (51.6)[a] |
| Physical activity messages, n agree (%) | | | | |
| Taking the stairs at work or generally being more active for at least 30 minutes each day is enough to improve your health. | 53 (82.8) | 77 (86.5) | 57 (91.9) | 74 (82.2) |
| Half an hour of brisk walking on most days is enough to improve your health. | 57 (89.1) | 79 (87.8) | 59 (95.2) | 78 (86.7) |
| To improve your health it is essential for you to do vigorous exercise for at least 20 minutes each time, three times a week. | 45 (70.3) | 60 (67.4) | 44 (71.0) | 57 (62.6) |
| Exercise doesn't have to be done all at one time—blocks of 10 minutes are okay. | 35 (54.7) | 53 (59.6) | 50 (80.6)[a b] | 60 (65.9) |
| Moderate exercise that increases your heart rate slightly can improve your health. | 58 (90.6) | 84 (93.3) | 59 (96.7) | 81 (90.0) |
| Enjoyment of physical activity, n agree (%) | 38 (59.4) | 57 (63.3) | 43 (69.4) | 58 (63.7) |

[a]Paired comparison Wilcoxon signed rank test (baseline versus 6-month follow-up) within intervention, $p \leq 0.001$; [b]6-month comparison Chi-square analysis between interventions, $p < 0.05$.

return rate (**Figure 2**). Using an intention-to-treat analysis, assuming no adherence among non-responders, no significant difference was found between interventions for physical activity adherence to the sessions prescribed, $F_{(1,150)} = 0.35$, $p = 0.56$ (26% ± 28% HB vs. 28% ± 35% G), nor was there any significant difference within interventions.

Using the AAS, both the home-based and group interventions significantly increased the number of participants achieving "sufficient" physical activity over the 6 month intervention period (HB 22 vs. 45%, $Z = -3.43$, $p = 0.001$; G 22 vs. 52%, $Z = -4.91$, $p < 0.001$), although there was no difference between interventions (**Table 2**). Home-based participants also became more aware that they could accumulate physical activity in 10 minute blocks (HB 81% vs. G 66%, $X^2(1) = 3.95$, $p = 0.047$; HB $p = 0.001$) (**Table 2**).

### 3.4. Program Adherence

Ninety percent of home-based participants received ≥ 4 of the planned 6 telephone support calls, with mean call length 4.5 minutes. Approximately 2 phone call attempts (mean, 1.8 attempts) per participant per month were required before they were reached. Thirty-three percent of the group participants attended ≥70% of group exercise sessions.

### 3.5. Outcomes at 6 Months

Both interventions significantly decreased waist circumference ($F_{(1,156)} = 44.20$, $p < 0.001$) and waist-to-hip ratio (WHR) ($F_{(1,152)} = 4.53$, $p = 0.04$) over the intervention period with no difference between interventions (**Table 1**).

There was a significant difference between interventions for the 2-MST number of steps ($F_{(1,140)} = 5.52$, $p = 0.02$) with group participant's having a higher mean number of steps at baseline and 6-months (**Table 1**). Age (years) had a significant effect ($F_{(1,140)} = 10.53$, $p = 0.001$) on the number of steps completed in the 2-MST, with steps decreasing as age increased. There was no significant difference for 2-MST number of steps within both the group and home-based interventions over the 6 month period (**Table 1**).

No physical activity-related cardiac events occurred for either intervention. Physical activity noncardiac events, including strains, sprains and fractures, were very few, similar across interventions.

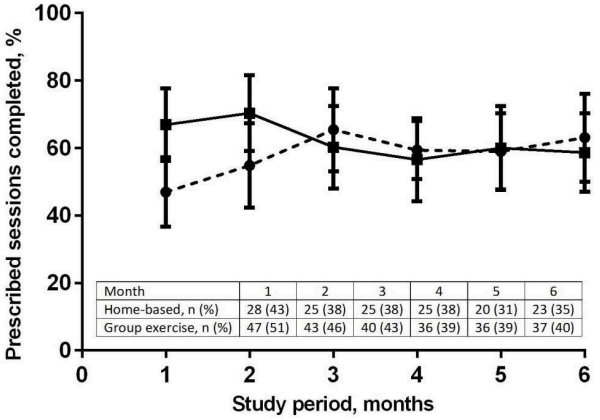


**Figure 2.** Exercise diary monthly physical activity adherence rates by intervention (mean, 95% CI); home-based (dashed line), group exercise (solid line). Inset Table shows number of diaries returned by month.

## 4. DISCUSSION

The physiotherapist-led home-based physical activity program, requiring few resources, appears to have increased the adoption of physical activity and adherence to physical activity program requirements for sedentary middle-aged adults. The home-based program, providing equivalent health outcomes to the group exercise program, may be particularly suitable for those not interested in or unable to attend a group exercise program.

There is some evidence that a large number of community dwelling middle-aged adults may not be interested in group exercise but would undertake exercise on their own if they had access to appropriate exercise information and or supports [10]. Yet, results from this study do not support this with a low response rate (≤4%) to the second mail out offering the home-based intervention. Participants in this study were not given a choice initially whether they would like to take part in a group or home-based intervention, potentially reducing numbers interested in the home-based intervention.

Once recruited, adherence to the physical activity program requirements is an important factor for physical activity adoption. The home-based intervention appears to be superior in maintaining this adherence. This agrees with two Cochrane reviews comparing home-based and centre-based programs for increasing physical activity and cardiac rehabilitation [6,27]. Similarities also exist between adherence to the group program requirements in this study and other studies, which show that approximately 35% - 50% of the general population who start an exercise program stop within the first 6 months [28,29].

Despite the differences in program adherence both interventions increased the number of participants achieving "sufficient" physical activity levels. This is valuable as there are well established links between an increase in physical activity and the health benefits [1]. The reduction in waist circumference and waist-to-hip ratio reflects this, measuring changes in central obesity, a known risk factor for chronic disease [30,31]. Importantly, it was found that the home-based program, requiring few re-

 

sources, was just as effective as the group exercise program in producing these health benefits. This requires consideration in terms of possible cost-effectiveness, for both program provision and health utilisation costs.

Increased physical activity awareness may lead to an increased adherence to the physical activity guidelines over the longer term. At the end of the intervention period, home-based participants were more aware that physical activity could be accumulated in 10 minute blocks when compared to group exercise participants. Motivational interviewing used by the physiotherapist in this study may be an important factor in increasing this awareness and possibly increasing long term physical activity adherence, requiring further investigation [9].

Using intention-to-treat analysis, adherence to the physical activity sessions prescribed during the intervention period appears to be the same for both interventions. For the actual exercise diaries returned (**Figure 2**), physical activity adherence increases and then decreases slightly over the 6 month intervention period for both interventions, showing a similar pattern for exercise adherence as reported by King [21]. On average, all participants completed 26% - 28% of the prescribed sessions, which equates to 1 - 2 sessions of ≥30 minutes MVPA per week. Data from the AAS tells us that more participants became "sufficiently" active over the intervention period, with half of all participants completing ≥ 150 minutes MVPA in ≥5 sessions by the end of the intervention period, which does not agree with the exercise diary data. There are a number of limitations to the exercise diary data, including poor return rate, potential over-reporting and the possibility that only those participants that were physically active returned their diaries. Therefore this data should be interpreted cautiously.

The participants recruited for this study were typical of participants that are recruited for studies similar to this, that is, predominantly female and well-educated, creating a gender and education bias [32]. The ACT population has a higher level of education and physical activity as compared to the national average [33,34], and this is reflected in this sample. In terms of socio-economic advantage and disadvantage within the ACT, the suburbs targeted provide a broad cross-section according to the socio-economic index for area (SEIFA). However relative to the rest of Australia, these suburbs would be considered relatively advantaged [35].

One of the strengths of this trial is that the medical and functional inclusion criteria were quite broad proposing that there is some benefit from physical activity for almost everyone. The recruitment method also attempts to minimize self-selection and recruitment of highly motivated volunteers by using the electoral roll [32]. The electoral roll allowed targeting of the suburbs within the same postcode as the community group exercise program, minimising a potential location barrier. Recruitment and providing the home-based intervention by telephone should also limit selection bias as phone coverage is widespread in Australia. Both physical activity programs were provided free of charge, potentially increasing recruitment of eligible participants.

The lack of a randomised control group, "usual care", to assess the effectiveness of the physiotherapist-led home-based physical activity intervention is a significant limitation. There is some evidence though that there is no difference in outcomes between a randomised control trial and a patient preference trial when comparing programs, in studies similar to this one. Dalal [27] found that whether patients were randomly allocated to a home-based or hospital-based cardiac rehabilitation program or they got to choose their type of program, made no difference to the clinical outcomes. The lack of blinding is also a potential cause of bias, as the principal researcher conducted all assessments and provided the home-based intervention.

In conclusion, the home-based physical activity program delivered by a physiotherapist offers potential to increase the recruitment of sedentary middle-aged adults to a physical activity intervention, particularly if they are not interested in, or unable to attend, a community group exercise program. The physiotherapist-led home-based physical activity program, requiring few resources, produced equivalent health benefits to the group exercise program and appears to have a lower attrition rate with an increased adherence to the program requirements.

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# 5 Physical Activity At Home: Barriers, enablers and preferences

## 5.1 Community group exercise versus physiotherapist-led home-based physical activity program: barriers, enablers and preferences in middle-aged adults.

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QUALITATIVE RESEARCH REPORT

# Community group exercise versus physiotherapist-led home-based physical activity program: barriers, enablers and preferences in middle-aged adults

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**Abstract**

*Background/Purpose*: Barriers and enablers of physical activity have been investigated, but it remains unclear what middle-aged adults' physical activity preferences are. Two physical activity interventions were compared to determine barriers, enablers and preferences for physical activity format in sedentary, community-dwelling 50- to 65-year-olds. *Methods*: Using mixed methods, 37 Physical Activity at Home (PAAH) participants took part in focus groups at the end of the intervention period and completed the Active Australia Survey (AAS). Participants were divided into three sub-groups: (1) group exercise attendees (GA, $n = 14$); (2) group exercise non-attendees (GNA, $n = 9$); and (3) physiotherapist-led home-based physical activity program attendees (HB, $n = 14$). Focus groups were audio-taped, transcribed, coded and analysed using an inductive thematic approach. Thirty-seven exit telephone calls with GNA were included in the analysis. *Results*: Cost, self-efficacy, work and carer commitments were major themes identified for GA and GNA. HB participants reported fewer barriers and a number of enablers, including flexibility of the program and physiotherapist instruction. HB and GNA were younger than GA ($p < 0.05$), more likely to be in paid employment and GNA participants were insufficiently active ($p \leq 0.01$). All participants preferred some home-based physical activity, although a variety of formats was indicated. *Conclusion*: The barriers, enablers and preferences indicate that the physiotherapist-led home-based physical activity program with initial face-to-face contact and telephone support may increase the adoption and maintenance of physical activity in middle-aged adults, particularly for those not interested in, or unable to attend, group exercise.

**Keywords**

Adoption, maintenance, mixed methods, physical activity, physiotherapy

**History**

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## Introduction

The benefits of physical activity are well documented, yet the majority of Australian adults are not active enough to achieve the health benefits and reduce the risk of chronic disease (Australian Bureau of Statistics, 2011). The incidence of chronic disease increases in middle-age (50–65 years old) and later years (Australian Bureau of Statistics, 2009a) and by increasing physical activity in middle-age, this could have a significant impact on future quality of life (World Health Organization, 2004). With a large number of middle-aged adults still in the work force and also caring for others (Australian Bureau of Statistics, 2009b; Australian Bureau of Statistics, 2012b), to increase physical activity levels, researchers and clinicians need to consider the demands placed upon this age group. Investigation of these and other issues is needed to guide more effective physical activity interventions.

A number of barriers and enablers of physical activity have been identified in adult populations, across chronic disease populations, economically disadvantaged and minority groups (Caperchoine, Mummery, and Joyner, 2009; Jancey et al, 2007; Mathews et al, 2010; Neubeck et al, 2011; Withall, Jago, and Fox, 2011). King et al (1992) categorised the determinants of physical activity adoption and maintenance into three factors: (1) personal; (2) program; and (3) environment. Personal factors include belief in the health benefits of physical activity, perceptions of poor health and self-efficacy (having confidence to successfully perform a specific activity or behaviour) (Bandura, 1999). Program-related factors include format, costs, time and location. Physical and social environmental factors are described as travel distance, safety and family or social support. All these factors need to be considered and addressed when designing physical activity programs to maximise physical activity adoption and maintenance in these populations.

Individual preference for physical activity program format is an issue that has received limited attention in the literature, with some evidence that middle-aged adults prefer not to attend group exercise. Wilcox, King, Brassington, and Ahn (1999) and Yardley et al (2008) report from two large surveys in the United States and UK that between 41% and 69% of middle-aged adults (50 to 64 years old) preferred not to attend group sessions. Salmon et al (2003) found from a large survey of Australian adults (18 years and over, mean age 45.4 years) that 86% of respondents reported high enjoyment of walking and only 31% reported high enjoyment of structured physical activity, such as exercise or aerobic classes, swimming, cycling and team sports. Booth, Bauman, Owen, and

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Gore (1997) surveyed a large number of insufficiently active (<150 minutes per week of moderate to vigorous activity (MVPA)) Australian adults and found that 27% of 40- to 59-year-olds and fewer than 20% of those aged 60–78 years wanted to exercise with a group; the preference for group exercise is decreasing with increasing age. In contrast, the preference for physical activity advice from a doctor or health professional increased with increasing age. Greater than 50% of 60 plus year olds wanted health professional advice, 41% of 40- to 59-year-olds and only 22% of 18- to 39-year-olds. Identifying the preference of middle-aged adults for physical activity programs, both format and deliverer, allows for the more targeted tailoring of interventions to meet the needs of these participants.

The primary aim of the Physical Activity at Home (PAAH) study was to compare a new, evidence-based model (i.e. a physiotherapist-led home-based physical activity program), to a ''usual practice'' community group exercise program to determine their effectiveness in middle-aged adults for increasing physical activity levels over the short and long term. In addition to this, PAAH was used to gather information concerning physical activity behaviours with the intention to inform future physical activity interventions, reporting on the barriers and enablers of PAAH's two interventions and the participants' preferences for physical activity format.



## Method

### Study design and theoretical perspective

The pragmatic, quasi-experimental design for PAAH, targeting sedentary, community-dwelling 50- to 65-year-olds not interested in, or unable to attend, a group exercise program, has been described elsewhere (Freene et al, 2011). Based on pragmatism, PAAH used a mixed methods approach to strengthen the data collection, focusing on the practical outcomes and ''what works'' (Onwuegbuzie and Johnson, 2004). Categorising the determinants of physical activity adoption and maintenance into King's et al (1992) three factors: (1) personal; (2) program; and (3) environment, is suited to this type of perspective, pragmatism, providing a simple framework for what can be used in practice.

The physiotherapist-led home-based physical activity program was based on practice-based evidence, utilising motivational interviewing (Rollnick, Miller, and Butler, 2008). Behavioural theories considered at the time of design were the: Social Cognitive Theory (Bandura, 1986); the Transtheoretical Model (Prochaska and DiClemente, 1984); and the Self-Determination Theory (Ryan and Deci, 2000).

### Participants

One hundred and fifty-eight sedentary, community-dwelling 50- to 65-year-olds were recruited for the PAAH study. Sixty-five participants were recruited to the physiotherapist-led home-based physical activity program, targeting those not interested in, or unable to attend, a group exercise program. The home-based program consisted of an initial home visit and approximately six phone calls using motivational interviewing to offer advice and support over the 6-month intervention period. The principal researcher provided this intervention.

Ninety-three participants commenced the group exercise program and this was run by fitness instructors at the local YMCA, once a week, for 60 minutes, for 6 months. The group exercise program was conducted during business hours to replicate similar programs in this community setting, ''usual practice''. All participants, both group and home-based, were encouraged to increase their physical activity levels during the interventions, aiming to achieve the physical activity guidelines, that is, 30 minutes of moderate intensity physical activity on most days (Freene et al, 2011; World Health Organization, 2004).

PAAH participants were categorised into three sub-groups: (1) YMCA group exercise program attendees (GA); (2) YMCA group exercise program non-attendees (GNA); and (3) the physiotherapy-led home-based physical activity program attendees (HB). Group exercise program non-attendees were defined as attending less than or equal to 50% of the group exercise sessions. This was determined via the weekly attendance list completed over the 6-month intervention by the YMCA. Fifty percent (47/93) of the YMCA group exercise participants attended less than or equal to 50% of the group exercise sessions over the 6-month intervention period. This is supported by other studies that have found that approximately 35–50% of the general population who start an exercise program stop within the first 6 months (Hong, Hughes, and Prohaska, 2008; Jancey et al, 2007).

A sub-group for the physiotherapist-led home-based physical activity program non-attendees was not formed as there were no participants in this category. Three home-based participants were lost to follow-up during the intervention period. All other home-based participants received regular motivational interviewing over the telephone during the 6 month intervention period.

### Focus groups

Six focus groups were conducted in November 2011, 4–6 weeks after the completion of the intervention arms of the study. Computer-generated random number sequences were used to select potential participants from the three PAAH sub-groups. Potential participants were invited via telephone by the principal researcher to attend a focus group. Telephone invitations continued until the required number of participants were recruited. Participant recruitment numbers were based on a minimum of two focus groups per sub-sample, with approximately six participants in each group (Krueger, 1994). Once the focus groups were completed the facilitator advised the principal researcher on whether or not additional focus groups were required. It was planned that the focus groups would continue until themes that recurred had been considered to have achieved saturation (Krueger, 1994).

Discussion questions were guided by the objectives of the study and were based on previous literature concerning physical activity and exercise behaviours of middle-aged and older adults from healthy and chronic disease samples (Jancey et al, 2006; Jancey et al, 2007; King et al, 1992; Neubeck et al, 2011). Four main themes were explored: (1) physical activity program enablers; (2) physical activity program barriers; (3) adherence to physical activity; and (4) physical activity preferences (Appendix).

Written informed consent was obtained from participants before each focus group session. Participants also completed the Active Australia Survey (Australian Institute of Health and Welfare, 2003), a physical activity questionnaire, including questions on demographics.

One of the research team for this study facilitated the focus groups. The facilitator was familiar with the study aims and methods but had not been involved in any aspect of the recruitment of participants, data collection or intervention provision. The facilitator guided the semi-structured discussion encouraging participants to share their opinions, perceptions and beliefs regarding the barriers, enablers and preferences for physical activity. The facilitator was responsible for the audio recording and provided a brief oral and written summary of the key points discussed within the focus group to the participants before they left the group and to the principal researcher immediately following the focus groups. This allowed for verification and contributed to the systematic analysis of the data (Krueger, 1994).

At the completion of the focus groups, the audio recordings were professionally transcribed. Transcripts were not returned to participants for comment. All transcribed text and audio recordings were entered into NVivo Software for Qualitative Research Version 9.2. The principal researcher read the transcripts multiple times and listened to the audio, coding and identifying potential themes using an inductive approach. NVivo coding and emerging themes were discussed with the facilitator and part of the research team until consensus was reached on final themes and categories.

The focus groups were held at the local YMCA meeting room and ran for approximately 60 minutes. For group participants, sessions were held during the day. For home-based participants, sessions were held in the evening to increase attendance. No incentives were offered to participants at any time during the study.

### Group program exit questions

The principal researcher contacted each GNA via telephone in October 2011, at the completion of the intervention period, to determine why they stopped attending the group exercise program. Up to three telephone attempts were made to contact each GNA. During the brief telephone call the principal researcher discussed, summarised and verified the main reasons for non-attendance with the participants and recorded this in a database. All recorded text was entered into NVivo Software for Qualitative Research Version 9.2, along with the focus group transcripts and audio, adding to this database to allow for triangulation (Onwuegbuzie and Johnson, 2004) in the inductive thematic analysis.

### Active Australia Survey

The Active Australia Survey (AAS) has been designed to measure participation in leisure time physical activity and to assess the participants' knowledge of current public health messages about the health benefits of physical activity. It offers a short and reliable set of questions and applies to one week preceding the interview, including walking for transport. The AAS has been reported as reliable and of acceptable validity (Brown, Burton, Marshall, and Miller, 2008; Brown et al, 2004). The AAS were self-administered and included questions on demographics, such as age, education level, relationship, and employment status, providing an indication of physical activity level and understanding of the physical activity public health messages.

All AAS data were screened initially, identifying any outliers. Analysis of Variance (ANOVA) with a 95% confidence interval was used to assess differences between focus groups for data that was normally distributed. Chi-square analyses were performed to determine if there were significant differences in distribution of categorical data between focus groups. Where cells had counts of less than 5, Fishers exact test was used. Significance level was set at $p < 0.05$. All data were analysed using SPSS version 19.0 (SPSS Inc., Chicago, IL).

### Ethics

This trial was approved by the University of Canberra Committee for Ethics in Human Research in November 2009 (Project number 09–97).

## Results

### Participant recruitment, demographics and physical activity descriptives

Overall, 37 PAAH participants took part in the focus groups (HB = 8 + 6, GA = 7 + 7, GNA = 5 + 4). Initial phone invitations resulted in 3 HB, 10 GA and 8 GNA participants unable to attend the focus groups. One GNA was not interested in attending the focus group. In total 19 HB participants agreed to attend the focus groups, 20 GA, and 17 GNA. This included 5 HB, 6 GA and 8 GNA who did not attend the focus groups, despite agreeing. The characteristics of the participants for each sub-group are presented in Table 1. Home-based and group non-attendees were significantly younger than group attendees and were more likely to be in paid employment. According to the AAS, group non-attendees were insufficiently active, that is, less than 150 minutes of moderate intensity physical activity per week, and there was a trend for them not to enjoy physical activity and to disagree with the physical activity message that 30 minutes per day is enough to improve health (Table 2). Focus group participants were predominantly female (81% (30/37)), tertiary educated (73% (27/37)) and in a relationship (65% (24/37)) (Table 1). Forty-seven PAAH participants attended ≤50% of the group exercise sessions (GNA). Exit questions via telephone were conducted with 79% (37/47) of the GNA participants (12 males, 25 females).

Table 1. Characteristics of participants by sub-group.

| Participant characteristics | Home based ($n = 14$) | Group attendees ($n = 14$) | Group non-attendees ($n = 9$) |
|---|---|---|---|
| Age range (yrs), mean (SD) | 58.5 (5.6) | 63.1 (26) | 58.5 (4.5)[a] |
| Gender, *n* females (%) | 11 (79) | 12 (86) | 7 (78) |
| Employment category, *n* (%) | | | |
| Paid labour force | 12 (86) | 3 (21) | 6 (67)[b] |
| Education level, *n* (%) | | | |
| Tertiary | 12 (86) | 8 (57) | 7 (78) |
| Relationship status, *n* Partner (%) | 7 (50) | 10 (71) | 7 (78) |

[a]Comparison between sub-groups, $p < 0.05$.
[b]Comparison between sub-groups, $p \leq 0.01$.

### Program enablers

Most PAAH participants expressed interest in a physical activity intervention as they had health concerns and they believed or had some experience that physical activity was of benefit (Figures 1 and 2). Receiving a personal invitation in the mail and taking part in research were common reasons for acting on this interest, with one female group participant stating:

> *I think it was more motivating getting a letter like that than just one from the gym.*
> (Female, GA)

No cost was a major enabler to commencing and continuing with the group exercise program. Group participants agreed that the lack of cost allowed flexibility if they were unable to attend the group exercise program, with no financial consequence if this occurred and no feelings of ''guilt'':

> *No cost. I've joined gyms and not going for one reason or another. So, the no cost, I thought, OK, I can't lose on this one.*
> (Female, GA)

Perceived improvements in physical and mental health were also key enablers for continuing with both interventions.

Flexible physical activity delivery was the major enabler for participation in the home-based program. All participants agreed that being flexible in the type of physical activity carried out,

Table 2. Physical activity characteristics by sub-group.

| Active Australia Survey [previous week] | Home based ($n = 14$) | Group attendees ($n = 14$) | Group non-attendees ($n = 9$) |
|---|---|---|---|
| Physical activity ''Sufficient'' time, *n* (%) | | | |
| Sedentary (time = 0) | 0 (0) | 0 (0) | 1 (11)[a] |
| Insufficient (1 ≤time ≤149 min) | 5 (39) | 2 (14) | 6 (67) |
| Sufficient (≥150 min) | 8 (62) | 12 (86) | 2 (22) |
| Physical activity messages*, agree *n* (%) | | | |
| Message 1 | 14 (100) | 13 (93) | 6 (67) |
| Message 2 | 14 (100) | 13 (93) | 7 (78) |
| Message 3 | 9 (69) | 8 (57) | 5 (63) |
| Message 4 | 11 (79) | 9 (64) | 7 (78) |
| Message 5 | 13 (93) | 12 (86) | 8 (89) |
| Enjoyment of physical activity, *n* agree (%) | 11 (79) | 12 (86) | 4 (44) |

*Message 1: Taking the stairs at work or generally being more active for at least 30 minutes each day is enough to improve your health.
Message 2: Half an hour of brisk walking on most days is enough to improve your health.
Message 3: To improve your health it is essential for you to do vigorous exercise for at least 20 minutes each time, three times a week.
Message 4: Exercise doesn't have to be done all at one time – blocks of 10 minutes are okay.
Message 5: Moderate exercise that increases your heart rate slightly can improve your health.
[a]Comparison between sub-groups, $p \leq 0.01$.



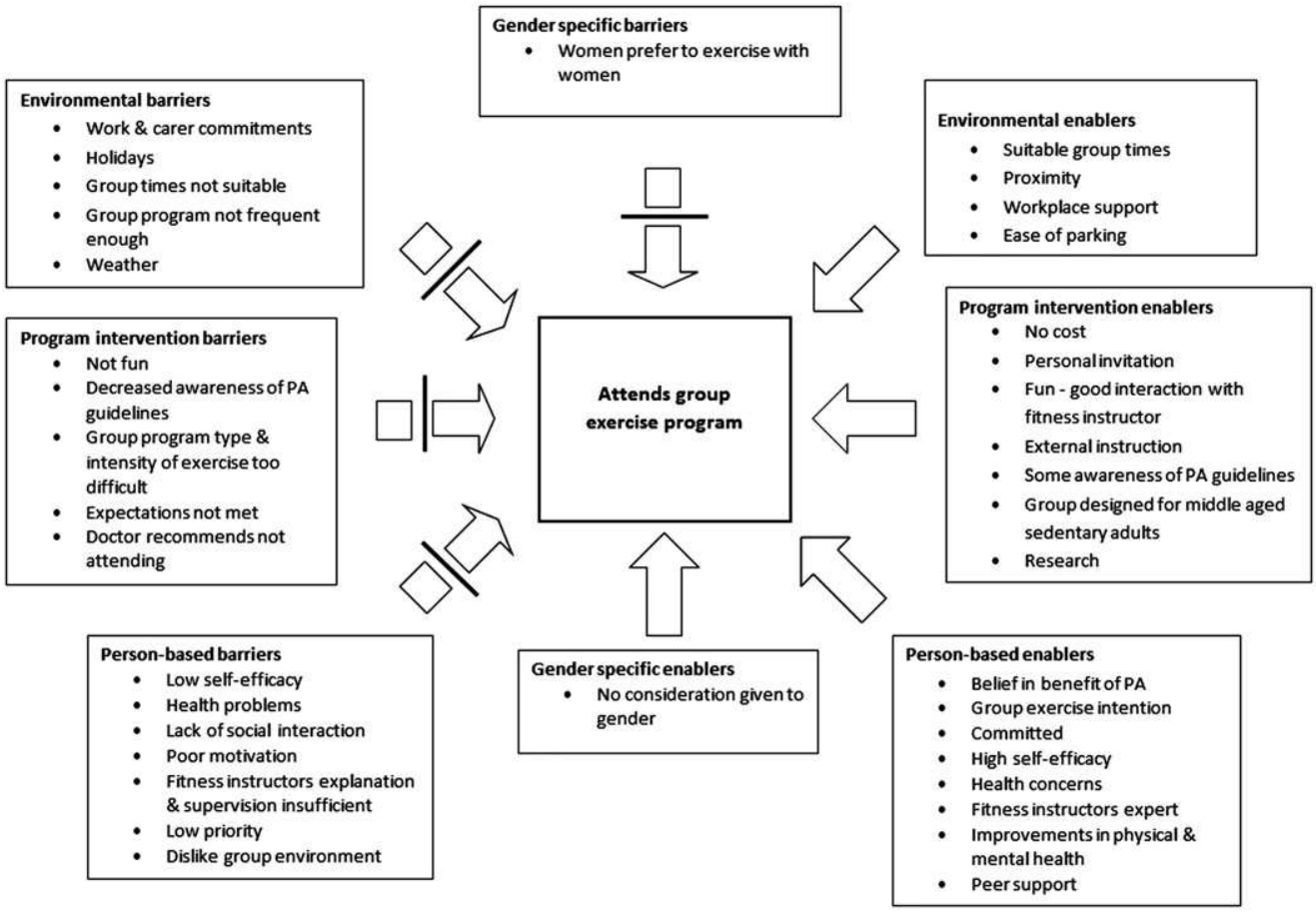


Figure 1. Group exercise program barriers and enablers (barriers indicated by the broken arrows, enablers by the solid arrows).

location, times it could be performed and the duration of the sessions were major factors for compliance:

> *You could choose to make the time and if you didn't have to fit any other schedule and if your day was really busy and you remembered, you could do it late at night or whenever.* (Male, HB)

Home-based participants also found the physical activity program ''simple''; requiring no ''radical changes'' to their lifestyle, adapting activities that they were already doing. Whereas group participants needed the group exercise program to be enjoyable, tailored and for some, have social support within the group:

> *. . .it's not exercise; it's just meeting other people.* (Female, GA)

For group participants who were still working, workplace support was also necessary.

Most participants agreed the physiotherapist was an enabling factor for the home-based intervention, although others did not think this was important. Participants reported a good interaction with the physiotherapist and felt they were expert and knowledgeable:

> *. . .she was coming from was a knowledge base of security and safety, so that any of the suggestions she made, were not going to be deleterious.* (Female, HB)

In addition to this, the manner in which the physiotherapist delivered the advice and support was well received. In contrast, for group participants to continue attending the group exercise program it was essential that they had a good relationship with the fitness instructor, perceiving them as experts and wanting instruction on how to exercise.

For home-based participants, the initial home visit was perceived as very useful. The individually tailored physical activity program discussed at this time was important but just as important was the face-to-face contact increasing feelings of commitment and accountability during the following telephone support calls:

> *I think the relationship building up that she did by actually visiting in the home helped me be more honest with myself and therefore, with her . . .* (Female, HB)

The telephone calls during the home-based program were also a key enabler providing encouragement and advice in an efficient manner. A female home-based participant described the telephone support as:

> *She wasn't constantly ringing. She wasn't in my thoughts all the time. She was there to start me off. She was there to keep me on track and give me advice when I asked her questions when she phoned . . .* (Female, HB)

The telephone calls received by home-based participants contributed to an improved self-efficacy and placing a higher priority on completing physical activity.

> *This ten minute lot thing was a revelation. I mean, it was good.* (Female, HB)

This was a common sentiment expressed by home-based participants who found this simple physical activity guideline a major enabler for participation.

Self-efficacy was also an important enabler for group attendees. In particular, the confidence to return and exercise in front of others after a period of absence, despite possibly starting at a lower level:

> *I came back a little bit overweight and I thought get back to getting fit again.*
> (Female, GA)

Group attendees also had an increased level of commitment. Once they had started the group exercise program, they intended to finish it.

### Program barriers

Environmental factors were the major barriers to attending the group exercise program (Figure 1). A number of group participants reported holidays, work commitments and caring for others made it difficult to attend the program on a regular basis. The varying life stages of participants in this sample of middle-aged adults were emphasized by who they were caring for. Some group participants reported caring for grandchildren:

> *I think I'm busier with grandchildren than I ever was with children to be quite honest.*
> (Female, GNA)

While others in this age group were still caring for their children:

> *. . . I work three days a week, and I've got a nine year old. . .it just got harder and harder for me as the time went on.* (Female, GNA)

Health problems were also a barrier to attendance. Some participants had been advised by Doctors not to attend the group exercise program. Regardless of why participants were not able to attend, low self-efficacy was a key barrier to commencing or not returning to the group exercise program.

> *I was aware of not having exercised for a long time, formally exercised, and probably thinking that I didn't want to do it with other people. . . Actually it's not wanting to be confronted either by your own limitations. . .* (Female, GNA)

This was further highlighted by the exit questions via telephone which revealed that a number of group non-attendees were ''embarrassed'' or self-conscious about returning to the group exercise program after missing some sessions.

Some participants found that the group exercise program was not fun, was too difficult and was not social enough. Others lacked motivation and placed little importance on attending, making it a low priority:

> *. . .other things came up, other excuses.* (Female, GNA)

The perception of fitness instructors was also important for group attendance, with poor supervision and insufficient explanation of activities cited as reasons why participants did not continue with the group exercise sessions.

Several group non-attendees felt that the group exercise program was too infrequent to be of benefit and did not meet expectations:

> *The reason why I stopped coming when I was better was because once a week in the afternoon was not enough.* (Male, GNA)

There was also a prevalent feeling among group participants that incidental or unstructured physical activity, for example, walking, was not enough to gain the health benefits:

> *Oh I do go for walks, but as __ said that's not enough.* (Female, GNA)

Similar to the group exercise program, work and carer commitments and poor health were found to be barriers for the home-based participants (Figure 2). These factors created a lower self-efficacy and placed a lower priority on completing physical activity. The difference for home-based participants was that these barriers were not seen as insurmountable. Home-based participants were able to return to physical activity with the regular

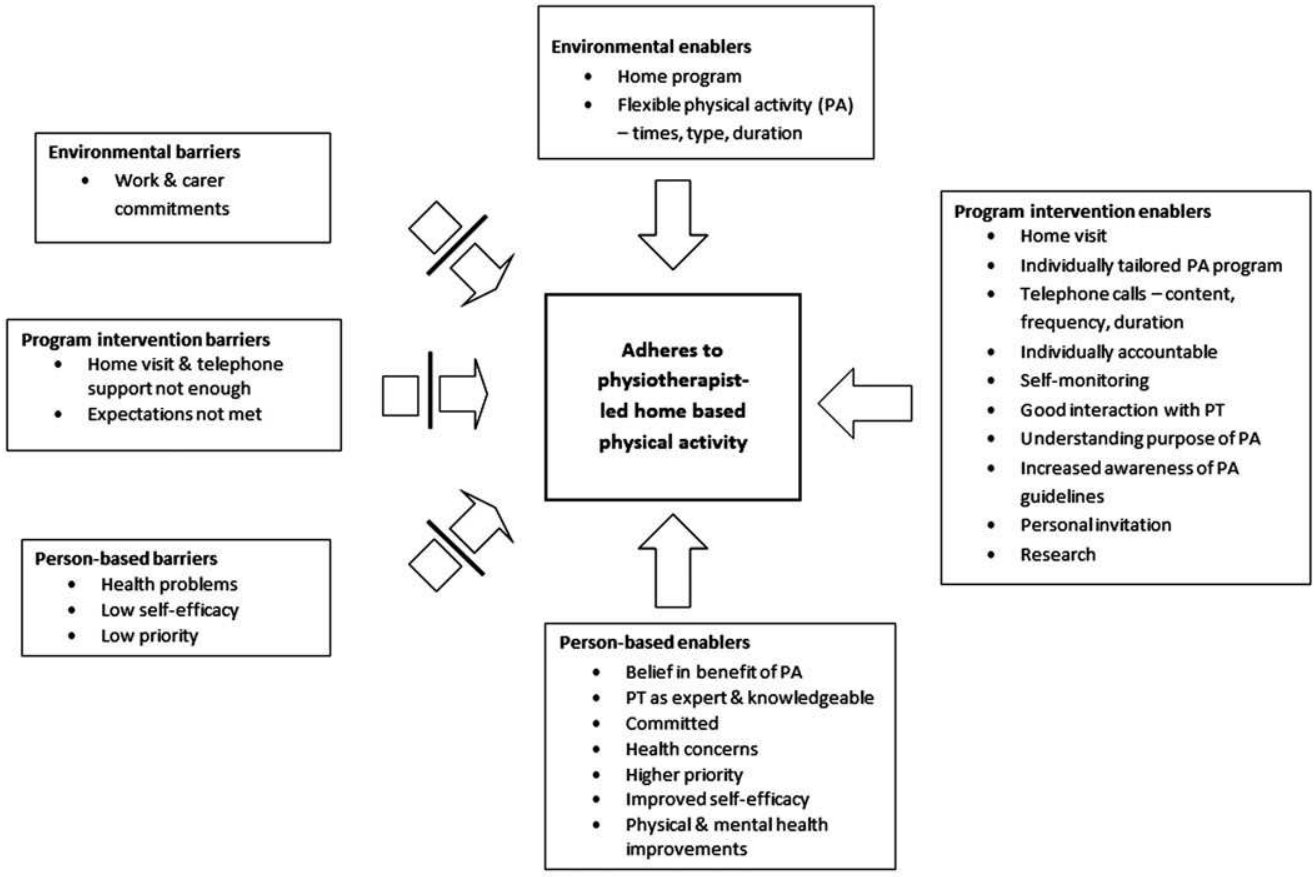


Figure 2. Physiotherapist-led home-based physical activity program barriers and enablers (barriers indicated by the broken arrows, enablers by the solid arrows).



telephone advice and support, with one female home-based participant stating:

> *I would never have gone back to it* [if the telephone support was not provided].
> (Female, HB)

While another female home-based participant reported:

> *I think I would have, but it would have been harder. It was, sort of, like ''It's OK that you've had this time off''. That's normal; just, I know you'll get back into it again and you know what you need to do and you're doing really well when you're not sick.* (Female, HB)

A very small number of home-based participants reported that the home visit and telephone support was not enough, and that their expectations of the program were not met, with a male home-based participant describing:

> *. . .it was basically left to me.* (Male, HB)

## Physical activity preferences

No single preference was clearly identified for the format of physical activity in middle-aged adults. Participants who preferred groups perceived they needed the motivation of a group, although cost and convenience remained as major barriers. Even those who had continued to attend the group exercise program after the completion of the program only joined for the short term, with expressions of uncertainty about what would happen in the future. Some participants required flexibility, having the option of not attending the group exercise sessions some weeks:

> *. . .sometimes you travel, sometimes you do other things, I want to go in and go out when I want to, I don't want to be set to something that would seem to be ridiculous at my age.* (Female, GA)

While others appeared more concerned about changes in health and functional status:

> *I'm not prepared to commit long term like that because I have had serious falls and things and there's a point where it may not suit me.* (Female, GA)

Some participants preferred individual or home-based physical activity. These participants, both group and home-based, wanted their physical activity program to be flexible, fitting into their everyday lives.

> *No, I've decided that there's no point committing to any organised group, or paying money to go to a gym, for the next few years. So all I do now, because of how things are, I just fit it in when I can.* (Female, GNA)

Overall, most participants preferred a mix of activities, group and home-based or individual, with all participants reporting involvement in individual or unstructured activity, such as walking or attending the gym for individual exercise.

The following quote from a male group attendee captures the over-riding feeling expressed by participants in all focus groups:

> *I think variety is the spice of life and some things you do with a friend, some things you do on your own, some things you do in a group...* (Male, GA)

## Discussion

A number of barriers and enablers for physical activity adoption and maintenance identified by the home-based and group participants in this study have been well documented (Jancey et al, 2007; King et al, 1992; Neubeck et al, 2011; Withall, Jago, and Fox, 2011). There appears to be no studies though, that directly compare group and home-based physical activity interventions in sedentary middle-aged adults. Physical activity strategies that are age-appropriate are necessary (McNaughton, Crawford, Ball, and Salmon, 2012), particularly when a large number of middle-aged adults are still in the workforce and/or caring for others (Australian Bureau of Statistics, 2009b; Australian Bureau of Statistics, 2012b). The home-based program may be a suitable strategy with less barriers reported and indications that self-efficacy levels, a major determinant of physical activity behaviour (Trost et al, 2002), were higher. The flexibility and convenience of the home-based program were also major enablers, with all participants preferring a variety of physical activity experiences.

Work and carer commitments were environmental barriers reported by participants in both interventions (Figures 1 and 2). According to the demographic data, both home-based participants and group non-attendees were much more likely to be in paid employment (Table 1). Despite this, home-based participants were more likely to return to physical activity after a period of non-compliance. The flexibility of the home-based program allowed participants to work around their commitments and incorporate physical activity into their lifestyle. Evidence of this was found via the AAS, with home-based and group participants ''sufficiently'' active, that is, greater than 150 minutes of MVPA per week, while group non-attendees were found to be ''insufficiently'' active (Table 2).

Another major barrier was the lack of confidence to take part in physical activity, a low self-efficacy. This was particularly relevant to group participants, with a high self-efficacy resulting in group attendance and those with a low self-efficacy resulting in group non-attendance and insufficient physical activity levels (Table 2). Motivational interviewing (Rollnick, Miller, and Butler, 2008) used by the physiotherapist during the home-based program home visit and subsequent phone calls appears to have been effective in increasing self-efficacy levels. In particular the face-to-face contact in their own environment created a sense of commitment and the value of this and the impact of the physiotherapist needs to be further explored. Booth, Bauman, Owen, and Gore (1997) found that nearly half or more of those older than 40 years, who were insufficiently active, preferred exercise advice from a health professional. Physiotherapists are effective communicators, establishing rapport, gaining trust, supporting and empowering an individual (Mueller, 2010). These skills, along with a possible preference for physical activity advice from a health professional, indicate that physiotherapists may have an important role to play in increasing middle-aged adults physical activity levels (Frerichs, Kaltenbacher, Johannes Peter, and Dean, 2012).

The importance of being physically active was understood by most participants, with all initially willing to increase their physical activity levels by taking part in the study. Yet the AAS indicated that group participants had a lower awareness of the physical activity guidelines compared to home-based participants (Table 2). Particularly the group non-attendees, who tended to disagree with this public health message, were insufficiently active (Table 2). The one-to-one contact the home-based participants received may have resulted in this increased awareness. This is important, with any activity better than none, particularly for sedentary individuals who have the most to gain (Warburton, Nicol, and Bredin, 2006).

### Preferences

Various types of physical activity were preferred by most participants in this study, with all doing some form of home-based or unstructured physical activity. Even participants who preferred to exercise in a group setting recognised the barriers to participation, such as lack of flexibility, convenience and possibly in the future, lack of suitability, and they were unwilling to commit long term. In the longer term, safety to exercise due to a decline in physical functioning may be the concern or it may be that a group exercise program is not the most appropriate format and this was not further explored.

There is some evidence that middle-age and older adults prefer home-based or unstructured physical activity as opposed to group or structured physical activity (Booth, Bauman, Owen, and Gore, 1997; Salmon et al, 2003; Wilcox, King, Brassington, and Ahn, 1999). This disagrees with the common perception that group exercise is favoured by adults. Social support has been found to be an important determinant of physical activity (Trost et al, 2002) and thought to be the reason why middle-aged and older adults prefer groups. Interestingly, most PAAH participants reported that peer and family support, or social support, was not an important factor for physical activity participation (Figure 1).

### Theoretical model

PAAH is not based on a particular theory of behaviour. Rather the home-based program is based on practice-based evidence, utilising motivational interviewing (MI) which has been based on a similar approach (Miller and Rollnick, 2012). The findings do indicate that the Self Determination Theory (SDT) (Ryan and Deci, 2000) may be a suitable theoretical framework for physical activity adoption and maintenance in this population. SDT relies on three psychological needs to self-determine behaviour: (1) competence; (2) autonomy; and (3) relatedness, and this has similar characteristics to MI (Miller and Rollnick, 2012). MI used in the home-based program addressed all three needs of SDT and the qualitative and quantitative data show that this has been effective in this study and in others (Thompson et al, 2011). The group program was able to address these psychological needs required for behaviour change in half of the participants, while the other half were not satisfied, and stopped attending. Group non-attendees reported a poorer relationship with the fitness instructor and a lack of social interaction (Figure 1) and this lack of ''relatedness'' may have contributed to them ceasing the program and decreasing their self-confidence (Ryan and Deci, 2000). Pragmatism or ''what works'' (Onwuegbuzie and Johnson, 2004) has been of interest here but there has been some discussion in the literature that successful physical activity interventions need to be theory-based and SDT may be a suitable theory (King et al, 2007).

## Implications for practice

Future physical activity interventions for middle-aged adults need to consider participants' lifestyles, including work and carer commitments, along with participant preference, particularly their interest in various physical activity formats and an indication that

they may prefer physical activity advice from a health professional (Booth, Bauman, Owen, and Gore, 1997). For group exercise programs, short-term programs at low or no cost, which are fun and social, based on different fitness levels, with fitness instructors giving more instruction on why exercises are performed and offering groups out of business hours may be suitable options. Using motivational interviewing, both in a group and individual settings, to increase self-efficacy and physical activity guidelines awareness may be a valuable component. Home-based programs with face-to-face contact and telephone support and physical activity programs delivered by health professionals, such as a physiotherapist, may also be possible solutions. Evidence from this study shows that when referring sedentary individuals to a suitable physical activity intervention an individualised approach is indicated, giving consideration to their current level of self-efficacy and physical activity and their preference for physical activity format.

## Limitations and strengths

A number of factors limit the interpretation of this study. The small number of males participating in the focus groups is a limitation, providing a potentially poor representation of their views. The sample of participants may not necessarily represent the perceptions of all middle-aged adults as it was drawn from those participating in the PAAH study, previously self-reported sedentary middle-aged adults who were willing to increase their physical activity levels. The sample size is small, increasing the chance of sampling error for the quantitative data and therefore should be interpreted cautiously. Investigator bias is also possible as the analysis was primarily conducted by the principal researcher who provided the home-based intervention. The ethnic makeup of this sample limits generalisability, with the majority of participants being Caucasian, with Australian or English ancestry (Australian Bureau of Statistics, 2012a).

A mixed method approach allowed a more in depth understanding of the complex nature of the factors influencing choice of physical activity in this group. Random sampling used to select focus group participants limited selection bias for the quantitative data. Random sampling is, however, not an ideal strategy for qualitative methods such as focus groups and this is also a limitation of this study. Member checking also took place within the focus groups by the facilitator and during the exit questions via telephone by the principal researcher, increasing validity and limiting researcher bias.

## Conclusion

There appears to be no single solution for the most effective format of physical activity program in middle-aged adults. The home-based program with physiotherapist support and motivational interviewing increased physical activity self-efficacy levels and met the need for flexibility. Considering this, the adoption and maintenance of physical activity in sedentary middle-aged adults may be increased with the physiotherapist-led home-based physical activity program and it could be particularly suitable for those not interested in, or unable to attend, a group exercise program.

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## Declaration of interest

The authors report no declarations of interest.

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## Appendix

### Focus group themes and suggested questions

### Program Enablers

- *''What did you like about the [group exercise program/home-based physical activity program]?''*
- *''What were some of the reasons for [attending/adhering to]?''*

### Program Barriers

- *''What didn't you like about the program?''*
- *''What were some of the reasons for not [attending/adhering to]?''*

### Physical Activity Adherence

- *''What is the likelihood of you continuing to do exercise or be physically active in the longer term?''*

### Physical Activity Preferences

- *''Which is more appealing to you, exercising in a group with an exercise leader or exercising on your own, with some instruction from a physiotherapist?''*

# 6 Validating self-reported physical activity measures in Physical Activity At Home

## 6.1 Validating two self-report physical activity measures in middle-aged adults completing a group exercise or home-based physical activity program.

Manuscript submitted for publication and under review in the *Journal of Science and Medicine in Sport* as:

**Freene N**, Waddington G, Chesworth W, Davey R, Cochrane T (submitted 17 May 2013) Validating two self-report physical activity measures in middle-aged adults completing a group exercise or home-based physical activity program. Journal of Science and Medicine in Sport.

The manuscript is presented here in the format required by the *Journal of Science and Medicine in Sport.*

## 6.3 Paper submitted for publication


### Abstract

#### Objectives

To compare self-reported physical activity recorded in physical activity diaries or the Active Australia Survey with objectively measured physical activity using accelerometry in sedentary middle-aged adults completing two physical activity interventions.

#### Design

Cross-sectional study.

#### Methods

Sedentary 50-65 year olds were recruited to a non-randomized 6-month community group exercise program (G) or a physiotherapist-led home-based physical activity program (HB). Over 7-days, 76 participants (HB 39, G 37) wore an ActiGraph GT1M accelerometer (5 second epochs), completed the Active Australia Survey (AAS) and a daily physical activity diary. Data were analyzed using descriptive statistics and Spearman rank-order correlations.

#### Results

The two interventions had similar demographic and physical activity characteristics except that home-based participants were younger ($p<0.01$), more likely to be employed full time ($p\leq0.001$) and reported less moderate-to-vigorous physical activity in the physical activity diaries compared to group exercise participants (HB 29±21 $min.d^{-1}$ vs. G 57±35 $min.d^{-1}$, $p\leq0.001$). Home-based participants had fair-to-good agreement between the physical activity diaries and AAS or ActiGraph data ($r=0.39$-$0.68$, $p<0.05$). Group exercise physical activity diary data did not correlate significantly with either the AAS or ActiGraph data. In contrast, group exercise AAS data had good correlations with ActiGraph data ($r=0.49$-$0.64$, $p\leq 0.001$).

#### Conclusions

Physical activity diaries should be interpreted cautiously unless intervention participants have an adequate understanding of physical activity intensity. The AAS is the preferred self-report measure in middle-aged adults independent of intervention.



#### Keywords

physical activity, diary, questionnaire, accelerometer, intervention study, validation study.

## Introduction

To test the effectiveness of physical activity interventions, physical activity (PA) levels need to be accurately evaluated. Subjective measures, such as PA diaries and questionnaires, are commonly employed as outcome measures due to their low cost and ease of use in the clinical setting (Kwak et al. 2007). However, these measures do have some limitations (Troiano et al. 2008; Sternfeld and Goldman-Rosas 2012) and their value within an intervention study or in the clinical setting needs to be determined.

PA diaries have been shown to be reliable and valid (Duncan and Pozehl 2002) although numerous studies indicate issues with over-reporting (Duncan et al. 2001). The detail obtained from PA diaries is high but they are labor intensive for participants (Sternfeld and Goldman-Rosas 2012). In a long-term study in the USA, King et al (1995) used PA diaries to determine PA adherence to sessions prescribed, comparing group and home-based programs of varying intensities. The findings from this study rated highly in a Cochrane review (Ashworth et al. 2005) comparing centre and home-based PA programs, concluding that there was some evidence that home-based programs provide better long-term adherence to PA. Therefore the accuracy of PA diaries is important, guiding future PA program implementation.

Similarly, PA questionnaires (PAQs) have been found to be reliable, valid and practical to use (Brown et al. 2004). Although PAQs provide a lower level of detail and are subject to recall bias (Duncan et al. 2001), they are considered a less cumbersome self-report measure of PA, for both participants and researchers / clinicians, than PA diaries (Lagerros and Lagiou 2007). The use of accelerometers to objectively measure PA are in turn considered a more accurate reflection of PA levels than subjective measures, eliminating issues such as over-reporting and recall bias (Lagerros and Lagiou 2007; Gabriel et al. 2009; Matthews et al. 2012) and having a stronger association with physiological and anthropometric biomarkers (Atienza et al. 2011). Accelerometers too, are not without their limitations. They provide no information on the type of activity performed (Matthews et al. 2012), do not adequately measure some activities (Haskell 2012; Matthews et al. 2012), such as cycling, and variations continue between study protocols, such as site placement (Trost et al. 2005; Ridgers and Fairclough 2011; Matthews et al. 2012), epoch length (Trost et al. 2005; Ridgers and Fairclough 2011; Matthews et al. 2012), cut-point thresholds (Troiano et al. 2008; Ridgers and Fairclough 2011; Matthews et al. 2012), make and model differences (Trost et al. 2005; Ridgers and Fairclough 2011), making it difficult to compare results. Numerous studies have compared

PAQs and accelerometer outputs with fair-to-good correlations being reported (Kwak et al. 2007; Troiano et al. 2008; Gabriel et al. 2009). Few studies have compared PA diaries or logs to accelerometer data though (Timperio et al. 2004; Kwak et al. 2007; Jovanovic et al. 2011), particularly in middle-aged adults, and there are no known studies where these measures have been compared when evaluating different physical activity interventions.

The main purpose of this study was to determine whether self-reported duration of perceived moderate and vigorous intensity PA via PA diaries matched potentially more accurate measures of PA, the Active Australia Survey and accelerometer data, for two PA interventions.

**Methods**

Community-dwelling 50-65 year olds were recruited to a non-randomised 6-month community group exercise program (G) or a physiotherapist-led home-based PA program (HB) (Freene et al. 2011). Two mail outs were conducted in the Australian Capital Territory (ACT) using the Australian Electoral Commission (AEC) federal electoral roll. The first letter (n=2105) asked for expressions of interest in joining a group exercise program at a local YMCA. The second letter (n=1680) was sent to those not interested in the group exercise program, inviting them to participate in the physiotherapist-led home-based physical activity program. All individuals who responded to the mail outs were contacted by telephone by the principal researcher to determine their eligibility. Participants were sedentary, had no serious medical conditions that could limit participation in moderate physical activity, and no severe functional impairments due to multiple medical or psychiatric conditions. Medical clearance screening was undertaken using the Sports Medicine Australia (SMA) Pre-Exercise Screening System (Sports Medicine Australia 2005).

The physiotherapist-led home-based physical activity program targeted those not interested in, or unable to attend, a group exercise program. The home-based program consisted of an initial physiotherapy home visit. This was followed by approximately six phone calls using motivational interviewing (Rollnick et al. 2008) to offer advice and support over the 6-month intervention period. Fitness instructors conducted the group exercise program at the local YMCA, once a week, for 60 minutes, for 6-months. All participants, both group and home-based, were encouraged to increase their physical activity levels during the interventions, aiming to achieve public health PA guidelines, that is, 30 minutes of moderate intensity physical activity on most days (World Health Organization 2004; Freene et al. 2011). A

convenience sample of group-attendees and home-based participants were invited to take part in the validation study, with forty group-attendees and fifty-six home-based participants providing consent (figure 6.1).

Accelerometers were distributed to group-attendees within an exercise session at the YMCA. Instructions and demonstration of the accelerometer placement were provided during the exercise session by the principal researcher. Accelerometer instructions for home-based participants were provided by phone. The accelerometers and the self-report measures were then delivered to the participants' homes by the principal researcher. All participants were instructed to wear the accelerometer for 7-consecutive days within the next 10 day period, completing the PA diary during the 7-days and the self-administered Active Australia Survey (AAS) at the end of the 7-days. Written instructions were provided to all participants. Group-attendees were asked to return the accelerometer and the self-report measures the following week during their next exercise session or as soon as possible thereafter. Home-based participants were advised to return the accelerometer and the self-report measures in the reply-paid padded post-pak at the end of the 7-day wear period.

Both group-attendees and home-based participants wore the accelerometers over the same week to minimise seasonal differences. No incentives were offered to participants to increase compliance or adherence in wearing the accelerometer and completing the self-report data.

Participants were encouraged to record date, type, duration and intensity, using the modified Borg rating of perceived exertion scale (RPE) (Borg 1982), every time they were physically active over the 7-day period in the PA diary (Duncan and Pozehl 2002). Total moderate PA (MPA), vigorous PA (VPA) and moderate-to-vigorous PA (MVPA) minutes were calculated for the week and divided by 7 to give minutes per day. Moderate intensity was defined as a rating of 3 to 5 on the modified Borg RPE scale, vigorous intensity as 6 to 10, and moderate-to-vigorous intensity as 3 to 10 (Norton et al. 2010). Only 10 minutes or more of PA was included in the calculations (Egger et al. 1999; Department of Health and Ageing 2005).

Sufficient PA was based on the World Health Organisation PA guidelines (World Health Organization 2004). 'Sufficient time' was calculated as greater than or equal to 150 minutes of MVPA per week. 'Sufficient time and sessions' was calculated as greater than or equal to 150 minutes MVPA in 5 or more sessions per week (Australian Institute of Health and Welfare 2003). Thirty minutes could be accumulated in 10 minute bouts of PA per day (Egger

et al. 1999; Department of Health and Ageing 2005). For sufficient PA, VPA was weighted by 2 to account for its greater intensity and health benefits (Timperio et al. 2004) and the total weekly data was used.

The AAS has been designed to measure participation in leisure time PA and to assess the participant's knowledge of current public health messages about the health benefits of PA (Australian Institute of Health and Welfare 2003). It consists of nine questions and applies to one week preceding the interview. For each activity type (walking, gardening, vigorous PA, other moderate PA) there are two questions: the number of sessions, and the time completed in minutes or hours in the last week, using a continuous scale. The last question assesses participants' knowledge on the public health messages and includes five sub-questions, using the Likert scale. The AAS has been reported as reliable and of acceptable validity (Australian Institute of Health and Welfare 2003; Brown et al. 2004; Gabriel et al. 2009).

To calculate the total amount of time spent in MPA during the previous week using the AAS, walk time and moderate activity time in minutes were added. To estimate VPA for the week, vigorous time in minutes was used. These values were divided by 7 to give minutes per day MPA, VPA and MVPA.

'Sufficient time' was calculated by adding walk time, moderate activity time and vigorous activity time weighted by 2. 'Sufficient time and sessions' was calculated by adding the number of walking, moderate activity and vigorous sessions for the week, in addition to the MVPA time calculation (Australian Institute of Health and Welfare 2003). To avoid over-reporting the total time in all activities was limited to 1680 minutes, or 840 minutes for a single activity type (Australian Institute of Health and Welfare 2003).

Sociodemographic information was also collected in the AAS with questions regarding participant's education level, relationship status, current employment status and the presence of any chronic diseases. Measures of body composition, body mass index ($kg/m^2$), waist and hip circumference, were collected at the end of the intervention period.

The criterion measure used in this study was the ActiGraph GT1M accelerometer (Pensacola, FL)(Actigraph 2011). The ActiGraph GT1M accelerometer is a match-box sized, uniaxial piezoelectric accelerometer, which is designed to measure and record accelerations in the vertical plane. Detected accelerations are filtered, converted to a number (counts) and summed over a specific period (epoch) (Ridgers and Fairclough 2011). Accelerometers allow

an objective measurement of quantity and intensity of movement and have been found to be reliable and valid (Abel et al. 2008).

The accelerometers where charged and initialised the day before delivery, setting an epoch length of 5 seconds. Participants wore the accelerometer around the waist using an elastic belt, held snugly against the body (Actigraph 2011), on the right hip (Trost et al. 2005; Ridgers and Fairclough 2011), recording the start and finish of the 7-day period in the PA diary. Participants were instructed not to wear the accelerometer to bed or wear it in water.

Accelerometer data was downloaded and screened, excluding data if any of the following criteria were met (Troiano et al. 2008): less than 10 hours.day$^{-1}$ wear time (Ridgers and Fairclough 2011) (non-wear time is defined as greater than 60 consecutive minutes where there is zero activity, allowing for 1-2 minutes (5%) of counts between 0-100 (Troiano et al. 2008)); less than 4 days of valid data (Troiano et al. 2008); if data was recorded on days when it was not worn comparing ActiGraph data to PA diaries; if there were unusually low counts (all counts less than 1952) or unusually high counts (all counts greater than 5724).

To determine time spent in moderate and vigorous intensity PA, accelerometer counts were used (Ridgers and Fairclough 2011). Using the ActiGraph cut-point default settings (Actigraph 2011), the cut-points for MPA were 1953-5724 counts and 5725$^{+}$ for VPA based on research by Freedson et al (Freedson et al. 1998). A number of studies using the ActiGraph to measure PA intensity levels in adults have utilised the Freedson cut-points with small variations (Abel et al. 2008; Jovanovic et al. 2011). Bout data used a minimum bout length set at 10 minutes. The minimum count to be considered a bout was 1953, with a tolerance of 2 minutes (Troiano et al. 2008). Estimating time spent in each intensity level per day (MPA, VPA and MVPA min.d$^{-1}$) were calculated by dividing the total time spent (minutes) in each threshold by the number of valid days (Banda et al. 2010).

Estimates of time spent in PA according to count threshold cut-point data and adherence to the PA recommendations were calculated for 5 second epoch data and 10 minute bout data, where appropriate. Adherence to the PA recommendations was calculated for ‘sufficient time’ and ‘sufficient time and sessions’. Calculations were based on estimates of minutes per day in MVPA, weighting VPA by 2 (Timperio et al. 2004), and multiplying by 7 to estimate a week. This was done as not all participants had 7-days of valid data, although 86% of all participants

had 6 or more days of valid data. Only 10 minute bout data were used to calculate adherence to sufficient time and sessions (Troiano et al. 2008).

For parametric data, t-tests were used and for non-parametric data, independent samples Mann-Whitney U test with a 95% confidence interval were used to assess differences between interventions. Chi-square analyses were performed to determine if there were significant differences in distribution of categorical data between interventions. The Spearman rank-order correlation statistic was used to assess the degree of agreement between MPA, VPA and MVPA min.day$^{-1}$ recorded by the PA diaries, AAS and accelerometer for each intervention. A sensitivity analysis was conducted where correlations were high between subjective and objective measures, excluding walking from the AAS. The Phi ($\varphi$) coefficient was used to measure agreement between paired samples for dichotomous variables (sufficient/insufficient PA) for each outcome measure, for each intervention. Significance level was set at $p<0.05$. All data were analysed using SPSS version 19.0.

This trial was approved by the University of Canberra Committee for Ethics in Human Research in November 2009 (Project number 09-97).

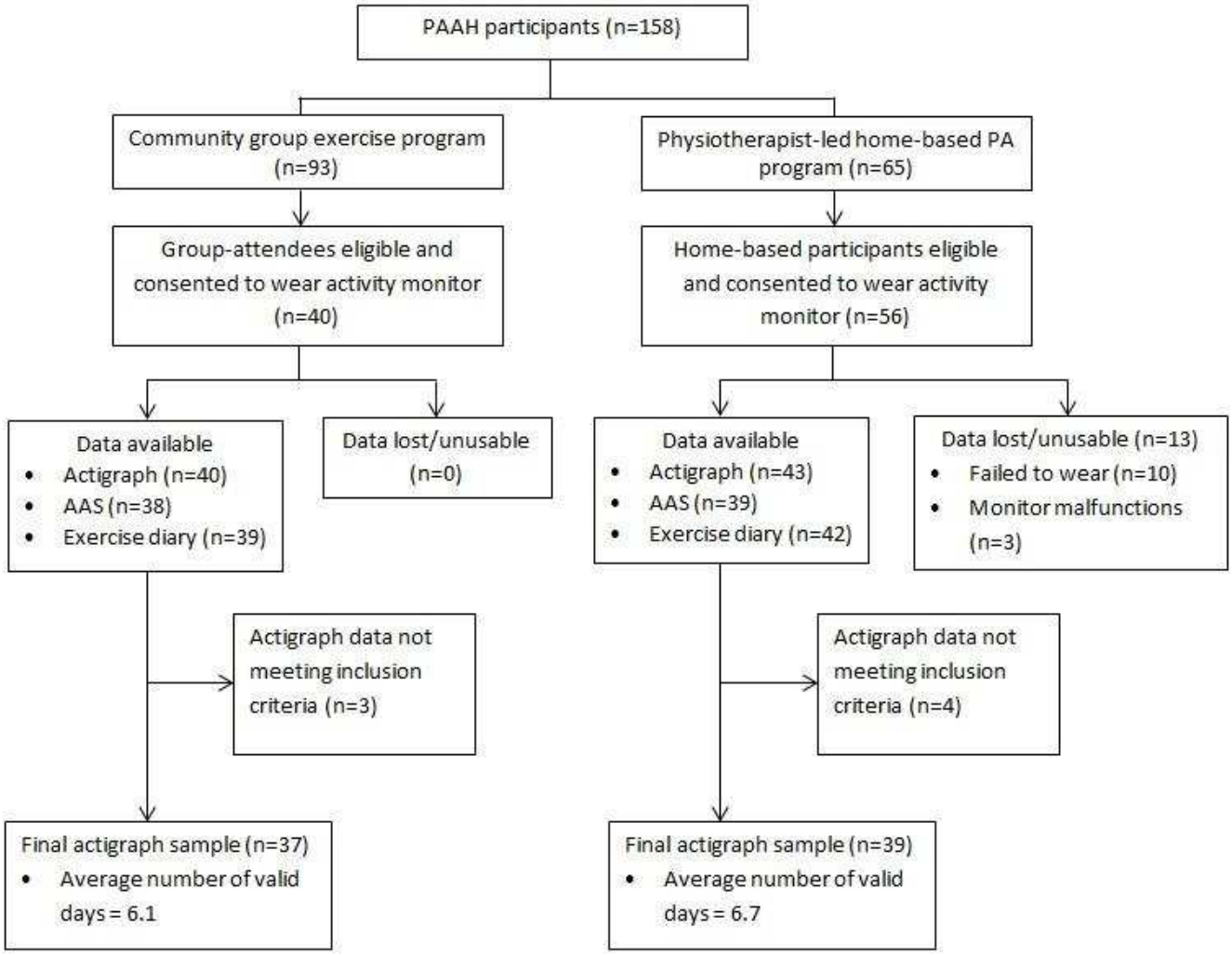


**Figure 6.1.** Flow of physical activity measures.

**Results**

Fifty-six home-based participants and forty group-attendees agreed to take part in the validation study. Figure 6.1 provides an overview of the PA measures collected (Matthews et al. 2012). The characteristics of participants were similar across interventions, with all participants being predominately female, overweight or obese, with no history of chronic disease, tertiary educated and in a relationship (table 6.1). Home-based participants were younger and more likely to be employed full-time (table 6.1). Preliminary analysis found that the potential confounders, age (years) and employment status, did not effect the outcomes of each physical activity measure.

**Table 6.1.** Characteristics of participants.

| Participant Characteristics | Home-based (n = 37) | Group (n = 37) |
|---|---|---|
| Age *(yrs)*, mean (SD) | 56.7 (4.7)[a] | 59.9 (5.1) |
| Gender, n females (%) | 29 (78.4) | 26 (70.3) |
| Waist circumference *(cm)*, mean (SD) | 83.5 (13.9) | 88.4 (12.7) |
| Waist-to-hip ratio, mean (SD) | 0.80 (0.83) | 0.82 (0.08) |
| Body Mass Index *($kg/m^2$)*, mean (SD) | 26.9 (5.1) | 28.1 (4.7) |
| Body Mass Index *($kg/m^2$)*, n (%) | | |
| Underweight *(<18.5)* | 2 (5.9) | 0 |
| Normal *(18.5-24.9)* | 9 (26.5) | 11 (32.4) |
| Overweight *(25-29.9)* | 15 (44.1) | 12 (35.3) |
| Obese *(≥ 30)* | 8 (23.5) | 11 (32.4) |
| Employment category, n (%) | | |
| Full time | 26 (72.2)[b] | 7 (20) |
| Part time | 5 (13.9) | 7 (20) |
| Not in paid labour force | 5 (13.9) | 21 (60) |
| Education level, n (%) | | |
| Secondary or less | 11 (31.4) | 12 (34.3) |
| Tertiary | 24 (68.6) | 23 (65.7) |
| Relationship status, n Partner (%) | 24 (68.6) | 29 (82.9) |
| Chronic diseases, n (%) | | |
| 0 | 27 (79.4) | 23 (71.9) |
| 1 | 6 (17.6) | 8 (25) |
| ≥ 2 | 1 (2.9) | 1 (3.1) |

[a] Independent t-test between interventions, $p<0.01$

[b] Chi-square analysis between interventions, $p<0.001$

**Table 6.2.** Physical activity descriptives of the home-based (HB, n=39) and group-exercise (G, n=37) participants.

| | X diary | | AAS | | ActiGraph 5s | | ActiGraph 10 min bout | |
|---|---|---|---|---|---|---|---|---|
| | HB | G | HB | G | HB | G | HB | G |
| MPA mins.d$^{-1}$ (mean, SD) | 25.7[a] (20.8) | 53.1 (37.8) | 29.9 (20.6) | 44.9 (33.3) | 47.4 (18.1) | 49 (20.7) | 14.9 (11.3) | 18.8 (16.3) |
| VPA mins.d$^{-1}$ (mean, SD) | 3 (9.5) | 3.8 (11.2) | 7.6 (10.9) | 10.8 (11.7) | 2.7 (4.5) | 1.8 (2.2) | 0.7 (2.1) | 0.1 (0.8) |
| Total MVPA mins.d$^{-1}$ (mean, SD) | 28.6[a] (20.5) | 56.9 (35.1) | 38 (26.8) | 54.9 (39.3) | 50.1 (19.6) | 50.8 (21.7) | 15.6 (11.6) | 19 (16.3) |
| Sufficient$_t$[#] (%) (≥150mins.w$^{-1}$)[*] | 63.2[b] | 86.1 | 70 | 84.4 | 92.3 | 91.9 | 35.9 | 40.5 |
| Sufficient$_{ts}$[^] (%) (≥150 mins.w$^{-1}$ and ≥5 sessions.w$^{-1}$)[*] | 39.5[c] | 69.4 | 65.5 | 81.3 | - | - | 33.3 | 40.5 |

MPA (moderate physical activity), MVPA (moderate-to-vigorous physical activity), VPA (vigorous physical activity) min.d$^{-1}$.
*VPA weighted by 2.
[#] Sufficient$_t$ is sufficient MVPA time.
[^] Sufficient$_{ts}$ is sufficient MVPA time and sessions.
[a] Mann-Whitney U test between interventions, $p \leq 0.001$.
[b] Chi square analysis between interventions, $p < 0.05$, [c] $p \leq 0.01$.

According to the PA diary, group participants self-reported more MPA and MVPA min.$d^{-1}$ ($p \leq 0.001$) and more group participants were found to be 'sufficiently' physically activity ($p < 0.05$, table 6.2). There was no difference between interventions for the AAS and ActiGraph data (table 6.2), including ActiGraph counts per day (G 276251, 95% confidence interval (CI) 245416 - 307086 vs. HB 267358, 95 CI% 239041 - 295675).

HB participants had fair-to-good agreement between PA diaries and the AAS ($r = 0.39 - 0.68$, $p < 0.05$, table 6.3). There was a fair-to-good correlation between the PA diaries and the ActiGraph 10 minute bout data for all measures except VPA ($p < 0.05$). The PA diaries did not correlate significantly with any of the 5 second epoch ActiGraph data (table 6.3). The HB AAS had fair-to-good agreement with the 5 second epoch and 10 minute bout ActiGraph data (table 6.3).

Group PA diary data did not correlate with either the AAS or the ActiGraph data for any measure, except with the AAS 'sufficient time', where there was a fair relationship between data ($\varphi = 0.45$, $p \leq 0.01$, table 6.3). There was a negative correlation between 5 second ActiGraph VPA and PA diary VPA ($r = -0.44$, $p \leq 0.01$). In contrast, Group AAS data had good correlations with the ActiGraph 5 second epoch and 10 minute MPA and MVPA data, $r = 0.49$-$0.64$ ($p < 0.05$). The sensitivity analysis found that the good correlations between the AAS and accelerometer data were dependent on the addition of walking to the MPA and the MVPA calculations using the AAS.

Walking was the most common type of exercise reported in the PA diaries (G 40%, HB 51%). Swimming was not reported by any of the group participants and only accounted for 4% of the PA sessions for HB participants. Cycling was also found to be a less common type of exercise utilised by participants (G 2%, HB 8%). Due to the high number of ambulatory types of PA reported by participants it can be assumed that the ActiGraph results would provide a reasonable estimate of the MVPA completed over the 7-day trial period.

**Table 6.3.** Correlations between physical activity measures in Home-based (HB) and Group-exercise (G) participants for moderate, vigorous and sufficient physical activity.

| | AAS | | | | | ActiGraph 5s | | | | ActiGraph 10min bout | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MPA | VPA | MVPA | #$Suff_t$ | ^$Suff_{ts}$ | MPA | VPA | MVPA | #$Suff_t$ | MPA | VPA | MVPA | #$Suff_t$ | ^$Suff_{ts}$ |
| X diary | | | | | | | | | | | | | | |
| HB | 0.45[a] | 0.39[c] | 0.68[b] | 0.46[d] | 0.32 | 0.28 | 0.02 | 0.27 | -0.22 | 0.39[c] | 0.09 | 0.40[a] | 0.58[e] | 0.44[d] |
| G | 0.28 | 0.08 | 0.33 | 0.45[d] | 0.09 | 0.22 | -0.44[a] | 0.18 | 0.17 | 0.29 | -0.07 | 0.24 | 0.32 | 0.28 |
| AAS | | | | | | | | | | | | | | |
| HB | - | - | - | - | - | 0.56[b] | 0.33 | 0.56[b] | 0.41[f] | 0.63[b] | 0.17 | 0.56[b] | 0.47[d] | 0.46[d] |
| G | - | - | - | - | - | 0.55[b] | -0.08 | 0.49[a] | 0.16 | 0.64[b] | - | 0.64[b] | 0.21 | 0.26 |
| ActiGraph 5s | | | | | | | | | | | | | | |
| HB | | | | | | - | - | - | - | 0.68[b] | 0.62[b] | 0.71[b] | 0.22 | - |
| G | | | | | | - | - | - | - | 0.73[b] | 0.28 | 0.76[b] | 0.25 | - |

MPA (moderate physical activity), MVPA (moderate-to-vigorous physical activity), VPA (vigorous physical activity) $min.d^{-1}$.

[#] $Suff_t$ is sufficient MVPA time ($\geq$150 $min.w^{-1}$).

[^] $Suff_{ts}$ is sufficient MVPA time and sessions ($\geq$150 $min.w^{-1}$ and $\geq$5 $sessions.w^{-1}$).

[a] Spearman Rank-Order correlations (rho) within intervention, $p \leq 0.01$, [b] $p \leq 0.001$, [c] $p < 0.05$.

[d] Phi-coefficient correlations ($\varphi$) within intervention, $p \leq 0.01$, [e] $p \leq 0.001$, [f] $p < 0.05$.

**Discussion**

Participants in the physiotherapist-led home-based PA program had a better agreement between subjective and objective measurement of PA compared to participants completing the community group exercise program. Group exercise participants, who received some education on PA guidelines, tended to over report PA using PA diaries. Accurately assessing the effectiveness of interventions is vital in guiding future PA programs. Different interventions may influence the accuracy of self-reporting methods and this is an important implication when considering outcome measures for participant PA levels.

Choosing an appropriate measurement tool, which is both reliable and valid, while taking into account cost and time is not always straight-forward for researchers and clinicians. Self-report measures have been favoured in large or free-living studies as they are relatively easy to administer, low cost and have been found to be reliable and valid (Duncan et al. 2001; Brown et al. 2004; Kwak et al. 2007). Comparing self-report measures and accelerometer data, fair-to-good correlations for MVPA have been reported, varying between r=0.21-0.60 in middle-aged adults (Gabriel et al. 2009; Banda et al. 2010). This study supports these findings, particularly when utilizing the AAS with correlations ranging from 0.39 to 0.64 (table 6.3). The AAS was found to be the better self-report measure for all participants and this may be due to the way the survey is structured, implemented and analysed, with methods utilized to limit over-reporting (Australian Institute of Health and Welfare 2003). No method was used to limit over-reporting in the PA diaries and as such, large differences were found between group and home-based self-reported MVPA.

The classification of intensity is a complex issue, particularly in older participants where there is a general decline in cardiorespiratory fitness with age (Norton et al. 2010), increasing relative intensity. Classification of intensity using accelerometer cut-points determined from calibration studies, generally using young, healthy participants, may not be appropriate for middle-aged adults (Troiano et al. 2008; Miller et al. 2010). Miller et al (2010) suggests that for moderate absolute intensity, there was a strong similarity with accelerometry ranges, irrespective of age. In contrast, Miller et al (2010) also reports there were large differences in accelerometer cut-points when considering relative intensity with increasing age. Despite this limitation, there is some value in continuing with these commonly used cut-points, such as those derived by Freedson, as it allows comparison between studies and different interventions.

Participants' understanding of intensity, perceived intensity, appears to be an important component for accurate assessment. HB participants appear to have a better understanding of intensity with a better agreement between self-report and objective measures, compared to G participants. Jovanovic et al (2011) compared endometrial cancer survivors 40 to 79 years old to a control group of age-matched healthy adults, both completing a PA program, and found a high agreement between PA diaries and accelerometry data for both groups. This may be due to the method that they used, where they only considered accelerometry data for intentional PA rather than total PA. It may also be due to an increased focus on the understanding of intensity, which is possibly why the physiotherapist-led HB participants had a higher agreement between subjective and objective measures. In order to increase physical activity levels, interventions need to increase their focus on participants' understanding of intensity and appropriate methods, such as motivational interviewing, may be suitable to increase this understanding.

There are a number of limitations that need to be considered when interpreting the results. The participants were a convenience sample from a non-randomized intervention study. The sample size was small (figure 6.1) and participants were predominantly Caucasian (Australian Bureau of Statistics 2012), highly educated females from a relatively advantaged socio-economic area (Australian Bureau of Statistics 2008), limiting the generalizability of the results. There is also a dilution effect for the accelerometer data, due to the averaging of several days (Matthews et al. 2012) and the calculation of 'sufficient' PA is an estimation as not all participants provided 7-days of valid acclerometry data. The cut-points used may also have been inappropriate for middle-aged adults, possibly under-classifying the amount of MVPA completed by participants.

One of the strengths of the study is that there are no known studies that compare PA diaries and accelerometry in healthy, previously sedentary, middle-aged adults completing two different PA interventions. Comparison of self-report measures to accelerometry occurred over the same time period preventing seasonal differences. The majority of participants also performed ambulatory types of physical activity, making the accelerometer results representative of total MVPA.

**Conclusion**

Home-based participants had a better agreement between subjective and objective measures which may indicate a better understanding of intensity. Unless intervention participants have

an adequate understanding of intensity, PA diaries should be interpreted cautiously, with the AAS the preferred self-report measure in middle-aged adults completing an intervention study. Interventions increasing the understanding of intensity, such as the physiotherapist-led home-based PA program, may lead to a greater increase in PA, with this understanding being a vital component for subjective evaluation of PA levels.

**Practical implications**

- To allow comparison between interventions, the AAS is the recommended self-report measure of PA in middle-aged adults.
- Participants need to have an adequate understanding of intensity to accurately self-report PA levels.
- PA interventions need to increase their focus on participants' understanding of intensity. The physiotherapist and motivational interviewing may be valuable components in increasing this understanding.

**Acknowledgements**

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# 7 Physical Activity At Home Final Results

## 7.1 Longitudinal comparison of a physiotherapist-led home-based and group-based program for increasing physical activity in community-dwelling middle-aged adults.

Manuscript accepted for publication in the *Australian Journal of Primary Health* as:

**Freene N**, Waddington G, Davey R, Cochrane T (accepted 30 October 2013) Longitudinal comparison of a physiotherapist-led home-based and group-based program for increasing physical activity in community-dwelling middle-aged adults. Australian Journal of Primary Health.

The manuscript is presented here in the format required by the *Australian Journal of Primary Health.*

## 7.3 Paper accepted for publication


### Abstract

Few studies have compared the longer-term effects of physical activity interventions. Here we compare a 6-month physiotherapist-led home-based physical activity program to a community group exercise program over 2-years. Healthy, sedentary community-dwelling 50-65 year olds were recruited to a non-randomized community group exercise program (G, n=93) or a physiotherapist-led home-based physical activity program (HB, n=65). Outcomes included 'sufficient' physical activity (Active Australia Survey), minutes of moderate-vigorous physical activity (ActiGraph GT1M), aerobic capacity (2-minute step-test), quality of life (SF-12v2), blood pressure, waist circumference, waist-to-hip ratio and body mass index. Outcome measures were collected at baseline, 6, 12, 18 and 24-months. Using intention-to-treat analysis, both interventions resulted in significant and sustainable increases in the number of participants achieving 'sufficient' physical activity (HB 22 vs. 41%, G 22 vs. 47%, $p \leq 0.001$) and decreases in waist circumference (HB 90 vs. 89cm, G 93 vs. 91cm, $p < 0.001$) over 2-years. The home-based program was less costly (HB AUS$47 vs. G $84 per participant) but less effective in achieving the benefits at 2-years. The physiotherapist-led home-based physical activity program may be a low cost alternative to increase physical activity levels for those not interested in, or unable to attend, a group exercise program.

Clinical Trial Registration number Australian New Zealand Clinical Trials Registry (ANZCTR), ACTRN12611000890932.



### Additional keywords

adherence; cost evaluation; exercise.

**Summary statement**

What is known about the topic?

- Few studies have directly compared group and home-based physical activity interventions. There is some indication that home-based programs provide better long-term adherence to physical activity, with limited reporting of costs.

What does this paper add?

- The physiotherapist-led home-based physical activity program provided similar increases in physical activity levels and reductions in waist circumference as the group exercise program over the longer-term, at lower marginal cost.

## Introduction

Physical inactivity is a major risk factor for numerous chronic diseases (Warburton et al. 2006). Both group and home-based physical activity (PA) programs have been investigated to increase PA levels in adults for the primary prevention of chronic disease. Some of these programs have been evaluated over the longer-term, with a small number of studies directly comparing group and home-based formats (King et al. 1995; Dunn et al. 1999; Cox et al. 2003; Wilcox et al. 2009; Opdenacker et al. 2011). Whether one format provides a more lasting benefit to participants than the other is worth considering, and outcomes of such comparison studies will better inform clinical practice.

There is some evidence that home-based programs provide better longer-term adherence to PA than group-based programs in middle-aged and older adults (King et al. 1995; Ashworth et al. 2005; Opdenacker et al. 2008; Wilcox et al. 2009). However, others have found no difference in PA measures between interventions over the longer-term (Dunn et al. 1999) or conversely, group participants have shown higher long-term exercise adherence when compared to home-based participants (Cox et al. 2003). Thus, it remains unclear which format, group or home-based, encourages better long-term adherence to PA in middle-aged adults.

Few studies report on the cost-effectiveness of PA interventions, with only one study identified comparing a group and home-based intervention (Sevick et al. 2000). This trial found that the home-based (lifestyle) intervention was more cost-effective than the group (structured) intervention (Sevick et al. 2000). To our knowledge, other trials comparing group and home-based interventions have not reported costs. Cost is an important factor when comparing group and home-based PA interventions in healthy middle-aged adults, particularly when studies report similar health benefits over the short and long-term (King et al. 1995; Dunn et al. 1999; Wilcox et al. 2009; Opdenacker et al. 2011).

Therefore, the aim of Physical Activity at Home (PAAH) was to determine whether a 6-month physiotherapist-led home-based PA intervention, for sedentary community-dwelling middle-aged adults, was as effective as a community group exercise program, considering PA adherence, health benefits and cost over a 2-year period.

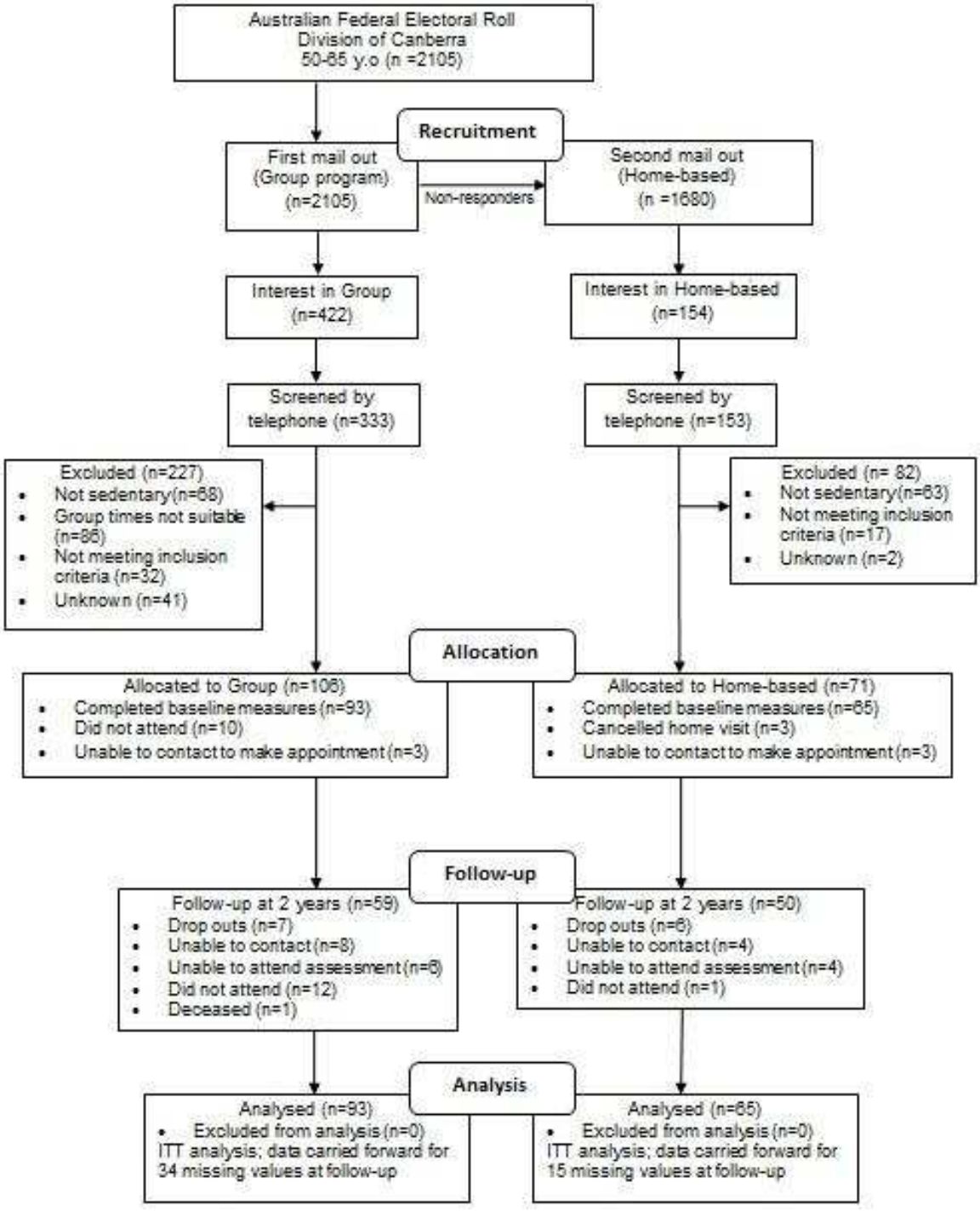


**Figure 7.1.** Flow of participants through the 2-year trial.

## Methods

Using a pragmatic, quasi-experimental design, sedentary community-dwelling 50-65 year olds were recruited to a non-randomized 6-month community group exercise program (G) or a physiotherapist-led home-based PA program (HB) (Freene et al. 2011). Participants were recruited from the Australian Capital Territory (ACT) in 2011 using the Australian federal electoral roll and had no serious medical conditions or functional impairments. The design and 6-month results of PAAH have been described previously (Freene et al. 2011; Freene et al. 2013). This trial was approved by the University of Canberra Committee for Ethics in Human Research in November 2009 (Project number 09-97). Participant flow is shown in Figure 7.1.

The physiotherapist-led home-based physical activity program targeted those not interested in, or unable to attend, a group exercise program. The home-based program consisted of an initial physiotherapy home visit. This was followed by approximately six phone calls using motivational interviewing to offer advice and support over the 6-month intervention period. Fitness instructors conducted the group exercise program at the local YMCA, once a week, for 60 minutes, for 6-months. All participants, both group and home-based, were encouraged to increase their physical activity levels during and following the interventions, aiming to achieve the public health PA guidelines, that is, 30 minutes of moderate intensity physical activity on most days (World Health Organization 2004). During the 18-month follow-up period, no support was provided. No incentives were provided for either intervention to encourage compliance or adherence.

## Outcome measures

PA adherence was defined as achieving the public health PA guidelines (World Health Organization 2004). This was measured using the Active Australia Survey (AAS), designed to measure participation in leisure time physical activity in the preceding week. 'Sufficient PA' was calculated by adding moderate-to-vigorous PA (MVPA) time to MVPA sessions (Australian Institute of Health and Welfare 2003). Originally it was proposed that physical activity diaries would be used to measure adherence but due to a low return rate and issues with over-reporting, identified using the accelerometry data, the AAS was the preferred self-report measure.

Secondary outcomes included an objective measurement of PA assessed using the ActiGraph GT1M accelerometer (5 second epochs), Pensacola, FL (Actigraph 2011); waist and hip

circumference, resting blood pressure and body mass index ($kg/m^2$). Aerobic capacity was measured using the 2-minute step-test (2-MST) (Rikli and Jones 1999). Quality of life was determined using the SF-12v2 (Ware et al. 1996). Outcome measures were assessed at baseline, 6, 12, 18 and 24-months. Sociodemographic characteristics, usage of health services and the presence of any chronic diseases were collected at each assessment.

Direct program costs (marginal costs of delivering the programs) were recorded prospectively. This included travel costs for group participants. Indirect costs, such as costs of health care utilization and lost productivity, were not considered. Both interventions were provided free of charge to participants. Ancillary costs such as purchase of sports shoes, gym memberships and exercise equipment were not included and were assumed to be the same between interventions.

**Data analysis**

An intention-to-treat analysis was used. For missing data at follow-up assessments, no change from baseline was assumed, except for accelerometry data where the last value was brought forward as no baseline data was collected. A one-way repeated measures analysis of covariance (ANCOVA) was used to test for differences (with a 95% confidence interval (CI)) within and between interventions for data that were normally distributed, controlling for age (years), relationship and employment status. Chi-square analyses and the Friedman test were used to determine significant differences in distribution of categorical data between and within interventions at follow-up assessments. Significance level was set at $p<0.05$. All data were analysed using SPSS version 21.0.

**Cost**

The non-parametric bootstrap method (1000 replications) was used for direct intervention costs, net change in the proportion of participants achieving sufficient physical activity, change in MVPA minutes per week and waist circumference (cm) at 6 and 24-months for both interventions (Efron and Tibshirani 1993). Cost and effect (benefit) differences between interventions were plotted in the cost-effectiveness plane. Mean differences in costs and effects (with 95% confidence intervals) were calculated at 6 and 24-months.

**Results**

At 2-years 69% (109/158) of participants completed follow-up assessments (Figure 7.1). The retention rates were not significantly different across the study arms (HB 50/65 (77%) vs. G

59/93 (63%), *p*>0.05). At baseline home-based participants were more likely to be younger (56 vs. 59 years, p = 0.001, t = 3.306, 95% CI: 1.04 to 4.12), employed full-time (63% vs. 27%, p < 0.001, $X^2(2) = 21.4$) and not in a relationship (41% vs. 24%, p = 0.02, $X^2(1) = 5.10$). There were no other significant differences between interventions for all remaining baseline outcome measures (Tables 7.1 and 7.2). The majority of participants were female (72%), tertiary educated (65%), born in Australia (70%), not of Aboriginal or Torres Strait Islander origin (98%), with no history of chronic disease (73%).

Using the AAS at 2-years, both the home-based and group interventions significantly increased the number of participants achieving 'sufficient' physical activity (HB 22 vs. 41%, $X^2(4) = 19.68$, p = 0.001; G 22 vs. 47%, $X^2(4) = 24.60$, p < 0.001), there was no difference between interventions (Table 7.2). These changes occurred within the intervention period for both programs and were maintained over the following 18 months (Figure 7.2). Both interventions significantly decreased waist circumference (F (4,620) = 14.91, p < 0.001) over the 2-year period with no difference between interventions (Table 7.1). There was no significant difference for any other outcome measure.

**Costs**

Table 7.3 includes the marginal direct cost components of each intervention. The cost of the group program per participant remained the same regardless of whether or not they attended. The mean number of phone calls received by home-based participants was 5, with an average of 11 attempts. The approximate phone call length was 5 minutes. The cost of each intervention and the benefits at 6 and 24-months are presented in table 7.4. Health utilisation costs were not recorded although reported usage of these services remained low during the 2-year period with no difference between interventions. Within a 6-month period approximately 80% of all participants attended the GP once or more, 40% attended a medical specialist, 14% had a same day hospital visit and 5% had an overnight hospital visit.

The direct costs of the home-based program were less than the group program, with the mean difference AUS$36.80 (95% CI: $36.85 to $36.76) less per participant (Table 7.4, Figure 7.3). The home-based program was less effective in increasing the number of participant's sufficiently active and increasing MVPA minutes/week at 6 and 24-months (Table 7.4, Figure 7.3A-D). At 6-months the home-based program was more effective than the group program in reducing waist circumference (Figure 7.3E), reversing to less effective at 24-months (Table 7.4, Figure 7.2B & 7.3F).

**Table 7.1.** Comparison of baseline, 6, 12, 18 and 24-month measures by intervention[a].

| | Baseline | | 6-months | | 12-months | | 18-months | | 24-months | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Home-based | Group | Home-based | Group | Home-based | Group | Home-based | Group | Home-based | Group |
| **Body Mass Index [kg/m$^2$], mean (SD)** | 27.94 (5.57) | 28.42 (5.37) | 28.04 (5.69) | 28.56 (5.52) | 27.89 (5.63) | 28.53 (5.56) | 27.95 (5.55) | 28.35 (5.43) | 28.00 (5.69) | 28.12 (5.00) |
| **Waist to Hip Ratio, mean (SD)** | 0.85 (0.09) | 0.86 (0.08) | 0.84 (0.09)[b] | 0.85 (0.08)[b] | 0.84 (0.09) | 0.85 (0.08) | 0.84 (0.09) | 0.85 (0.08) | 0.84 (0.09) | 0.85 (0.08) |
| **Waist circumference [cm], mean (SD)** | 90.28 (14.34) | 92.87 (13.97) | 88.16 (14.64)[c] | 91.32 (14.62)[c] | 88.41 (14.65) | 91.0 (14.68) | 88.62 (14.72) | 90.58 (14.22) | 89.12 (14.49)[d] | 91.04 (13.66)[d] |
| **BP meds, yes, n (%)** | - | - | 14 (24.1) | 26 (35.6) | 13 (30.2) | 22 (40.7) | 11 (30.6) | 22 (38.6) | 8 (22.2) | 21 (39.6) |
| **BP Systolic [mmHg], mean (SD)** | 123.55 (12.86) | 127.76 (14.65) | 123.70 (14.37) | 128.26 (15.17) | 125.71 (15.69) | 130.03 (15.06) | 126.78 (14.57) | 130.09 (15.48) | 127.22 (15.24) | 128.76 (14.90) |
| **BP Diastolic [mmHg], mean (SD)** | 80.25 (10.67) | 81.2 (10.55) | 79.03 (10.0) | 82.16 (8.90) | 81.83 (10.06) | 83.33 (8.92) | 82.00 (8.67) | 82.91 (9.25) | 82.58 (10.4) | 82.23 (8.82) |
| **2-minute step test, mean (SD)** | | | | | | | | | | |
| **Number of steps** | 89.22 (18.03) | 94.95 (21.12) | 94.56 (19.65)[e] | 100.01 (20.50) | 95.22 (21.00) | 97.65 (20.72) | 95.43 (19.66) | 96.92 (21.32) | 93.75 (19.73) | 95.41 (20.62) |
| **SF-12, mean (SD)** | | | | | | | | | | |
| **Physical component score** | 47.11 (10.87) | 48.26 (9.55) | 47.45 (9.54) | 46.29 (10.46) | 47.55 (11.55) | 47.91 (9.69) | 48.09 (9.61) | 45.75 (11.36) | 48.26 (9.28) | 47.14 (9.75) |
| **Mental component score** | 49.28 (7.69) | 48.48 (10.28) | 50.24 (8.66) | 50.87 (10.13) | 48.72 (9.76) | 49.36 (9.64) | 49.09 (7.54) | 49.76 (11.05) | 49.88 (9.12) | 48.17 (9.78) |

[a] All comparisons were non-significant unless otherwise indicated.
[b] Paired comparison repeated measures ANCOVA (baseline to 6-months) within intervention, $p<0.05$.
[c] Paired comparison repeated measures ANCOVA (baseline to 6-months) within intervention, $p<0.001$.
[d] Paired comparison repeated measures ANCOVA (baseline to 24-months) within intervention, $p<0.001$.
[e] 6-month comparison repeated measures ANCOVA between interventions, $p<0.05$.

**Table 7.2.** Physical activity characteristics at baseline, 6, 12, 18 and 24-months by intervention[a].

| | Baseline | | 6-months | | 12-months | | 18-months | | 24-momths | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Home-based | Group | Home-based | Group | Home-based | Group | Home-based | Group | Home-based | Group |
| **ActiGraph[5s] MVPA mins.day$^{-1}$, mean (SD)** | - | - | 50.1 (19.6) | 50.8 (21.7) | 45.0 (18.0) | 47.6 (18.6) | 45.6 (18.7) | 46.0 (18.4) | 42.5 (17.9) | 45.9 (19.6) |
| **Active Australia Survey, n (%)** | | | | | | | | | | |
| **Sedentary (MVPA time=0)** | 11(16.9) | 7 (7.7) | 7 (10.8) | 7 (7.5) | 6 (10.2) | 6 (7.4) | 6 (9.7) | 6 (7.4) | 6 (9.4) | 5 (5.7) |
| **Insufficient physical activity (1 ≤ MVPA time ≤ 149mins OR ≥ 150 mins and <5 sessions)** | 40 (61.5) | 64 (70.3) | 29 (44.6) | 38 (40.9) | 28 (47.5) | 33 (40.7) | 29 (46.8) | 42 (51.9) | 32 (50.0) | 42 (47.7) |
| **Sufficient physical activity (≥ 150mins MVPA and ≥ 5 sessions)** | 14 (21.5) | 20 (22.0) | 29 (44.6)[b] | 48 (51.6)[b] | 25 (42.4) | 42 (51.9) | 27 (43.5) | 33 (40.7) | 26 (40.6)[c] | 41 (46.6)[c] |

[a] All comparisons were non-significant unless otherwise indicated.
[b] Paired comparison Wilcoxon signed rank test (baseline versus 6-months) within intervention, p≤0.001.
[c] Paired comparison Friedman test (baseline to 24-months) within intervention, p≤0.001.

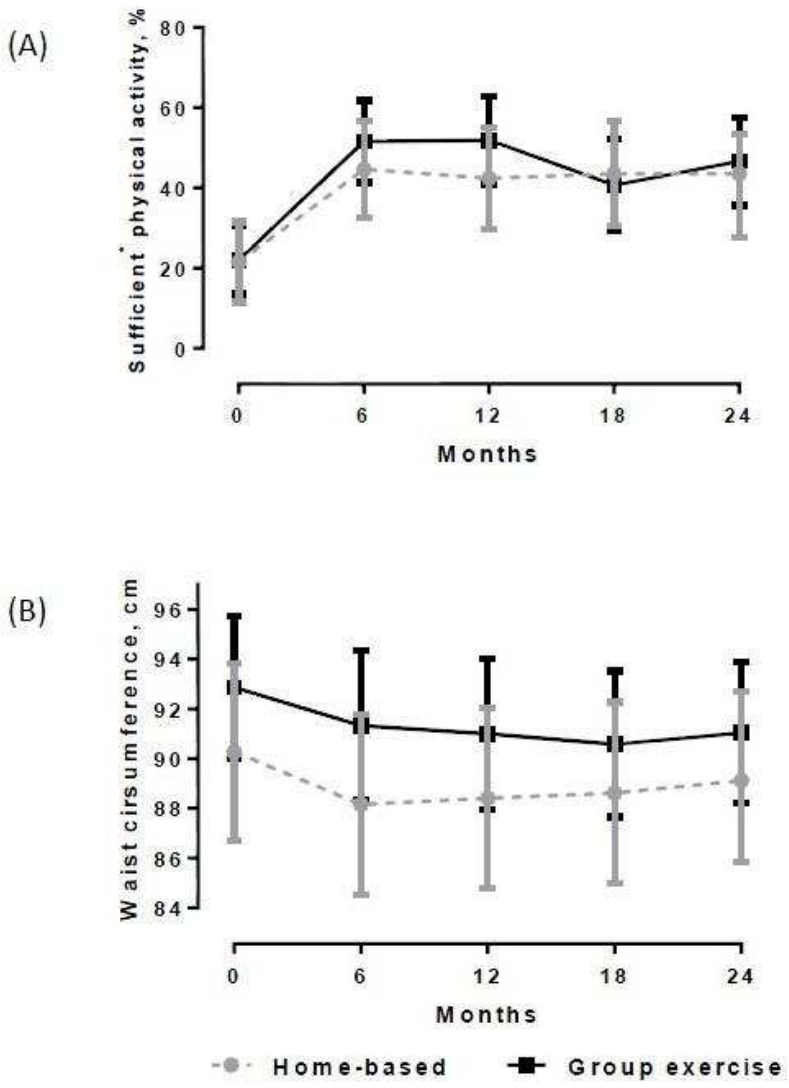


**Figure 7.2.** Changes over time in (A) 'sufficient' physical activity (≥150 mins MVPA and ≥5 sessions per week) and (B) waist circumference (mean, 95% CI) by intervention.

**Table 7.3.** Components of the intervention costs by intervention.

| | Group | Home-based |
|---|---|---|
| YMCA costs per participant for the intervention period including instructor, administration and facility use | $81.29 | - |
| Travel costs for participants[#] | $0.74/km | - |
| Physiotherapy home visit (20 mins) including travel costs[*#] | - | $16.00 |
| Single phone contact cost (physio time[*] + call cost[^]) | - | $4.63 |
| Single phone attempt cost (physio time[*]) | - | $0.73 |

* A weighting of 1.25 has been included to account for physiotherapy hours conducted out of business hours. National Physiotherapy Service Descriptors recommends a multiplier of 1.5 for treatments conducted out of business hours. Approximately half of the home visits and phone calls were conducted out of business hours therefore a multiplier of 1.25 was used for the physiotherapy pay rates. Physiotherapy pay rate used is the average of the mean Australian private practice physiotherapy hourly rate and the ACT Health Allied Health Classification HP3 level 1 hourly rate 2011=$34.87.

[#] ATO work related car expenses for a medium car 2011 have been used (0.74c/km) to calculate travel costs for physiotherapist and G participants.

^call costs based on actual costs encountered during the trial using a mobile phone on a $49/month plan.

**Table 7.4.** Mean direct cost and health benefit differences with 95% confidence intervals (CI) estimated using bootstrap sampling at 6 and 24-months by intervention.

| | Baseline to 6-months | | | Baseline to 24-months | | |
|---|---|---|---|---|---|---|
| | **Home-based (HB)** | **Group (G)** | **HB minus G Mean Difference (95%CI)** | **Home-based (HB)** | **Group (G)** | **HB minus G Mean Difference (95%CI)** |
| **Direct cost of program per participant, mean (AUS$)** | $47.06 | $83.86 | -$36.80 (-$36.85 to -$36.76) | $47.06 | $83.86 | -$36.80 (-$36.85 to -$36.76) |
| **Net proportion of participants achieving 'sufficient' PA (AAS)** | 0.23 | 0.30 | -0.07 (-0.08 to -0.07) | 0.18 | 0.25 | -0.07 (-0.08 to -0.07) |
| **Increase in MVPA/week (AAS, mins)** | 87 | 106 | -19 (-21 to -17) | 53 | 96 | -43 (-45 to -42) |
| **Reduction in waist circumference (cm)** | -2.12 | -1.51 | -0.61 (-0.64 to -0.58) | -1.16 | -1.67 | 0.51 (0.47 to 0.55) |

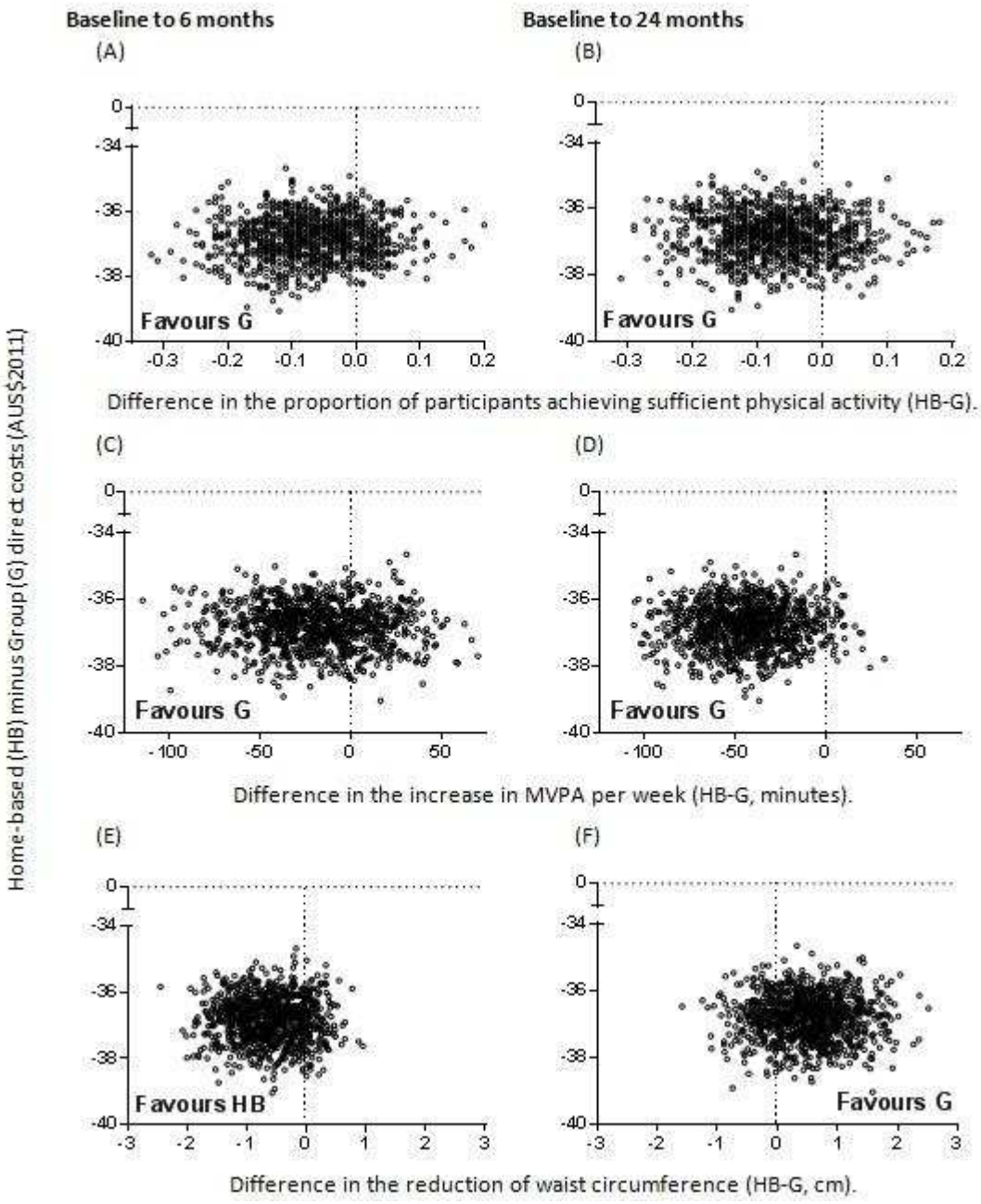


**Figure 7.3.** Differences in costs and main effects between the home-based and group interventions at 6 and 24-months (bootstrap samples).

**Discussion**

Few studies have directly compared home-based and group PA programs post-intervention over the longer-term. The physiotherapist-led home-based PA program, specifically targeting those not interested in, or unable to attend a group program, produced similar increases in PA levels and decreases in waist circumference as the group exercise program, and was less costly. Importantly, these benefits for both interventions were able to be maintained over the longer-term with no support.

The long-term adherence to PA post intervention is an important consideration for clinicians and public health providers. The literature comparing home-based and group formats over the long-term does not provide a clear indication of which format is better in improving this outcome. Increasing the difficulty in interpreting these results, are the varied methods for calculating PA adherence rates and the different levels of support during the follow-up period, both within and between studies. Cox et al (2003) and King et al (1995) used differing methods to calculate home-based and group PA adherence. Exercise logs were used for home-based participants, while attendance lists were used for group program adherence. Some form of intervention was provided in both studies during the follow-up period. Interestingly, these studies found opposing results. In PAAH, the same method for assessing PA adherence was used for both interventions, the number of participants meeting the public health PA guidelines using the AAS. These results indicate that the adherence was similarly improved and maintained for both interventions (Figure 7.2A), disagreeing with both studies mentioned above.

The direct cost of the home-based program was AUS$47 per participant, approximately 50% of the group program. Elley et al (2010) reports a similar home-based intervention in New Zealand using primary healthcare nurses and exercise specialists. The cost was NZ$94 per participant, resulting in similar increases in PA. Directly contrasting the costs of PAAH's two interventions shows that the home-based program costs less than the group program, supporting the result of Sevick et al (2000). However, it should also be noted that both PAAH interventions were relatively low cost.

The long-term health benefits received, increases in physical activity and decreases in waist circumference, were found to be similar between interventions in PAAH (Tables 7.1 & 7.2), and this agrees with other comparison studies (Dunn et al. 1999). The reduction in waist circumference is unlikely to be of clinical significance, as the difference in measures is less

than the measurement error (Dhaliwal and Welborn 2009). Yet, this result is not unexpected as other comparison studies report no significant changes in body composition for either intervention (King et al. 1995; Opdenacker et al. 2011). Further comparing the benefits of PAAH's two interventions, the home-based program was found to be less effective than the group program (Table 7.4). It is worth highlighting though, that both programs increased the number of sufficiently active participants by 20% or more. Cadilhac et al (2011) has found that a 10% increase in PA would result in substantial health benefits and opportunity cost savings in the Australian adult population.

**Limitations and strengths**

The lack of a randomised control group to assess the effectiveness of the physiotherapist-led home-based physical activity intervention is a significant limitation. The generalizability of the results is limited as the sample size was small and participants were predominantly Caucasian, highly educated females from a relatively advantaged socio-economic area (Australian Bureau of Statistics 2008). The lack of observer blinding is a potential cause of bias, as the principal researcher conducted all assessments and provided the home-based intervention. The cost analysis also did not include indirect cost data or a sensitivity analysis and there was a wide within group variation in outcome measures.

One of the strengths of the study is the long-term no-intervention follow-up. Few physical activity studies include this, with only one study found comparing a home-based and group intervention (Opdenacker et al. 2008). The inclusion of marginal cost data and bootstrap sampling of cost and effect differences also adds value to the analysis. The no-intervention follow-up allows the sustainability of the interventions to be identified, which is an important aspect when considering cost (Cobiac et al. 2009). Using physical activity outcomes also allows comparison between physical activity interventions (Wu et al. 2011).

**Conclusion**

The physiotherapist-led home-based physical activity program produced similar long-term physical activity adherence and health benefits to the group exercise program, costing less to implement. The physiotherapist-led home-based physical activity program may be a viable and relatively low cost alternative for those not interested in, or unable to attend, a group exercise program, and may be suitable for a number of conditions and settings, such as rural and remote.

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# 8 Conclusions, Contribution and Future Directions

The evidence from the Physical Activity At Home (PAAH) trial has shown that the physiotherapist-led home-based physical activity program (HB) is an effective alternative to a 'usual practice' community group exercise program (G) over 2-years, and costs less to implement. The novel pragmatic study design, targeting those not interested in, or unable to attend, a community group exercise program, found that a proportion of sedentary middle-aged adults would commence physical activity if a completely home-based program was offered. The physiotherapist-led home-based physical activity program appeared to have less barriers and a number of enablers. The findings from PAAH indicate that sub-groups of middle-aged adults may be particularly suited to the home-based format, such as those that are younger, and in the paid work force.

Uniquely, subjective measures of physical activity were compared in middle-aged adults completing the group or home-based physical activity program. Participants completing the home-based program appeared to have a better understanding of intensity, with stronger correlations between subjective and objective measures. The limited body of literature comparing the two physical activity formats indicate that home-based programs provide better long-term adherence to physical activity (King et al. 1995; Opdenacker et al. 2011). PAAH found that both physical activity formats were equally effective in increasing physical activity levels, and receiving the health benefits, over the short and long-term. Thus, cost is an important consideration. PAAH appears to be the only study that directly compares a group and home-based physical activity program in terms of direct costs and effectiveness. Results show that the home-based program costs less, but is slightly less effective.

Within this chapter, the findings from the PAAH trial will be further integrated, meeting the aim of the study by extending the current level of evidence on which physical activity format, group or home-based, is more effective, in terms of health benefits, long-term physical activity adherence and cost. The original contribution of the studies will be further discussed, practical implications will be suggested and future directions will be identified. Finally, the overall effectiveness of the physiotherapist-led home-based physical activity program will be determined.

## 8.1 Contribution to knowledge

### 8.1.1 Sedentary middle-aged adults prefer a variety of physical activity formats, but preference may not predict adherence

Few studies have investigated middle-aged adults' preferences for physical activity format (Booth et al. 1997; Wilcox et al. 1999; Salmon et al. 2003; Beauchamp et al. 2007). The available evidence suggests that the majority of middle-aged adults may have a preference for home-based physical activity (Booth et al. 1997; Wilcox et al. 1999). Utilising PAAHs mixed methods study design, there appears to be no single solution for physical activity program delivery, with middle-aged adults preferring a variety of experiences, despite some indication that certain sub-groups of middle-aged adults are better suited to the home-based format.

**Response and recruitment rates**

When considering participant preference, it is useful to discuss the trials response and recruitment rates. Similar recruitment rates were found in PAAH (G 4.4% vs. HB 3.6%, Chapter 4), although the response rate (number of participants that replied to the mail-out) was much higher for the group exercise program (20%), compared with the home-based program (4%). This does not support the results from Wilcox et al (1999), who suggest that the majority of middle-aged adults prefer not to attend group programs. Three things must be considered here:

(i) participants that responded to the group exercise program invitation were unaware that a home-based program was being offered (Chapter 3),

(ii) the main reason group participants were ineligible for the group program was unsuitable group times (38% (86/227), Figure 1, Chapter 4), and

(iii) two-thirds of group participants were unable to attend 70% or more of the group exercise program (Chapter 4).

According to the response rates for the group and home-based interventions, there does seem to be a preference for group exercise. The three factors outlined above may further indicate that middle-aged adults perceive that group exercise may be the best option to increase their physical activity levels, but in reality it is difficult to attend.

**Preference Trial**

PAAH is a preference trial, subsequently the differences found at baseline between interventions, provides an indication of the types of participants who prefer each physical activity format. Participants in the home-based intervention were found to be younger middle-

aged, employed full-time and not in relationship, compared with group exercise participants ($p<0.05$, Chapter 4). Jancey et al (2007) found the main reasons that older participants (65-74 years old) were unable to continue with a 6-month community group physical activity intervention were work commitments and group times being unsuitable. A number of participants were ineligible for the group program in PAAH due to these reasons, and may explain why the home-based intervention consisted of participants that were more likely to be working full-time. The sub-groups analysed in the focus groups (group attendees, group non-attendees, home-based) further supports the view that participants who are working are less likely to complete a group exercise program, with home-based and group non-attendees significantly more likely to be younger middle-aged and in the paid labour force compared with group attendees (Table 1, Chapter 5). Therefore, without a clear indictor of preference, there does seem to be a clear indicator of the types of participants who are better suited to a home-based physical activity program, such as those that are younger middle-aged and in the paid labour force.

**Barriers and enablers**

The focus groups conducted in Chapter 5 found that work and carer commitments were major barriers to program adherence. Although these barriers were similar for both interventions, they were not seen as insurmountable in the home-based program. In contrast, the group participants found it difficult to return to the group sessions after a period of non-compliance, reporting low self-efficacy levels (Chapter 5). Physical activity strategies need to be age-appropriate. Group physical activity programs may not be the most appropriate format for physical activity adoption and maintenance in middle-aged adults, particularly with a large number still in the work force and/or caring for others (Australian Bureau of Statistics 2009; Australian Bureau of Statistics 2012).

**Participant preference and adherence**

The relationship of initial participant preference for physical activity format and how well participants do with different physical activity interventions has been discussed by King and Wilcox (2008). They report that anecdotally participants in their comparison study preferred to attend the group program. Yet, results found that home-based participants had better adherence to physical activity in the long-term (King et al. 1991). King and Wilcox (2008) suggest that initial participant preference may have limited use in predicting physical activity behaviour change when participants have limited experience with one or more of the interventions under investigation. This may apply to PAAH, with seemingly increased

preference for the group program, yet a low program adherence rate, and both interventions resulting in similar increases in physical activity (Chapters 4 & 7).

**Physical activity preference**

PAAH participants indicated that a variety of physical activity formats was important (Chapter 5). Some participants preferred group exercise, but also realised the barriers of cost and convenience, and the need for flexibility. Some participants expressed a preference for home-based activity. Importantly, all participants reported involvement in home-based activity, such as walking. This was further highlighted in the validation paper, with walking the most common type of physical activity completed by the sub-groups of home-based participants and group attendees (Chapter 6), agreeing with surveys conducted by Booth et al (1997) and Salmon et al (2003) in Australian adults.

**Conclusion**

There is no strong indication of preference, although the evidence from the entire PAAH trial, particularly the focus groups, suggests that a large number of community-dwelling middle-aged adults do prefer a variety of physical activity formats, with all doing some form of home-based activity (Chapter 5). The differences at baseline, between subgroups and in program adherence rates, indicate that middle-aged adults who work full-time, or are in paid employment, are less likely to attend a group program. The response rate reveals that even though middle-aged adults are faced with a number of barriers to group physical activity participation, they are initially unable to identify these, with a large number of participants showing interest in the group exercise program. However, results show that group participants are unlikely to attend a group program in the long-term (Chapter 4). In particular, this study has shown that the physiotherapist-led home-based physical activity program may be suitable for younger middle-aged adults, in paid employment, regardless of whether or not they have a preference for home-based physical activity.

### 8.1.2 Equivalent health benefits found in the community group exercise and physiotherapist-led home-based physical activity program

As outlined in Chapter 2, previous comparison studies in sedentary middle-aged adults have reported no or small health benefits, excluding changes in physical activity, and were similar in both group and home-based physical activity programs. The results from PAAH confirm these results, with equivalent health benefits, decreases in waist circumference and waist-to-

hip ratio (WHR), found in both the group exercise and physiotherapist-led home-based physical activity program, despite the home-based program requiring less resources.

Changes in waist circumference were found at the end of the intervention period in PAAH, which were able to be maintained during the no-intervention 18-month follow-up period, with no difference between interventions (Chapters 4 & 7). As discussed in Chapter 7, although the long-term change in waist circumference in PAAH was statistically significant, it is unlikely to be clinically significant, as the difference in measures was less than the measurement error (Dhaliwal and Welborn 2009). Conversely, the decrease in waist circumference at 6-months for the home-based program is likely to be clinically significant, as the measurement difference is greater than the measurement error (table 4, Chapter 7). Therefore, the only 'clinically significant' change in waist circumference was found in the home-based program at the end of the 6-month intervention period. In addition to this, the home-based program was able to achieve this result with minimal physical activity advice and support, not specifically targeting other lifestyle behaviours, such as diet. Regardless of whether waist circumference decreased in terms of clinical or statistical significance, the lack of an increase in waist circumference in this population over 2-years is a positive result. As data from the Australian Health Survey 2011-12 shows, waist circumference generally increases over time in adults aged 50-65 years old and this did not happen for either intervention in PAAH (Australian Bureau of Statistics 2012). Other comparison studies found no changes in waist circumference, in either intervention, over a 2-year period (King et al. 1995; Opdenacker et al. 2011).

Within the PAAH trial, no other changes in measures of disease risk, such as blood pressure and quality of life, were found. No long-term change found in blood pressure, for either intervention, agrees with the studies conducted by Opdenacker et al (2011) and King et al (1995), although Dunn et al (1999) did find decreases in systolic (SBP) and diastolic blood (DBP) pressure over 2-years for both interventions, with no difference between interventions. These decreases in blood pressure were small, approximately 3.5 mmHg for SBP and 5.3 mmHg for DBP, and are unlikely to be clinically significant in an Australian population (Dhaliwal and Welborn 2009).

The lack of change on the SF-12 physical and mental component scores is also not unexpected, consistent with the literature on evidence-based physical activity programs, with only small improvements noted (Chapter 7). Wilcox et al (2006) found that there was a

moderate improvement in physical activity-related quality of life, and only small improvements in the mental health domains at the end of the intervention period in both the group and home-based interventions. The authors suggest a possible explanation is the types of participants who volunteer for research studies have low level depressive symptoms and perceived stress, subjecting these measures to a floor effect.

**Conclusion**

Regardless of whether or not a difference was found in the above health measures, it is clear that both the group and home-based physical activity programs provide similar results. This highlights the need for cost evaluations of the two physical activity formats, group and home-based. If home-based physical activity programs are found to be consistently as effective as, and less costly than group interventions, it may change the way a number of different settings conduct physical activity programs.

### 8.1.3 The physiotherapist-led home-based physical activity program can result in long-term physical activity adherence in middle-aged adults

In the literature there is some indication that home-based physical activity programs provide better long-term adherence to physical activity when compared to group or centre-based programs (King et al. 1995; Ashworth et al. 2005). The heterogeneity of the physical activity interventions, physical activity and adherence outcome measures and follow-up support, both within and between studies, makes it difficult to form a strong conclusion on which format, group or home-based, provides better long-term adherence to physical activity (Chapter 2). The novel study design employed by PAAH, using the same outcome measures for long-term physical activity adherence and no follow-up support for either intervention, found that both group and home-based physical activity programs were equally able to improve physical activity levels at the end of the intervention period, and maintain this improvement over the following 18-months (Chapters 4 & 7).

**Physical activity adherence**

The sub-group analysis completed in Chapter 5 found that group non-attendees were less likely to be 'sufficiently' active. Despite this, using intention-to-treat analysis (ITT), equivalent long-term physical activity gains were found in both PAAH interventions, even though adherence to the group program requirements was low (Table 2, Chapter 7; Chapter 4). The value of ITT may be argued at this point. It is relevant though, as it is reflective of routine clinical situations, where some participants will be non-compliant (Portney and

Watkins 2009). We must also keep in mind the role of contamination and measurement alone (Davey et al. 2010; Opdenacker et al. 2011). Contamination occurs when some participants in the intervention group (home-based program) may not comply with the intervention, while some participants in the control group (group-based program) may access some components of the intervention of interest (Davey et al. 2010). There is also some evidence that control groups may increase their physical activity levels over time, with a possible stimulating effect from simply measuring physical activity (Eakin et al. 2009; Opdenacker et al. 2011). Ultimately, how group participants in PAAH changed their physical activity levels is not completely known. What is known is the group exercise sessions cost the same to deliver, whether or not group participants attended the group exercise sessions, emphasizing once again the importance of the cost and effectiveness analysis.

**Physical activity maintenance**

The maintenance of physical activity gains in both the home-based and group interventions, with no support provided during the follow-up period appears to be unique in PAAH. Chapter 2 discusses the evidence for long-term physical adherence in both group and home-based programs, finding some indication that measures of physical activity and aerobic fitness are more likely to decline in group participants compared to home-based participants in the follow-up period, with no return to baseline levels. Figure 2, Chapter 7 shows there is a trend for group participants to decrease physical activity during follow-up, whereas the percentage of home-based participants remaining sufficiently active appears constant. This trend, with no significant changes found, is similar to findings of other comparison studies where no follow-up support was provided, reporting significant decreases in physical activity and cardiorespiratory fitness in group participants during the follow-up period (Wilcox et al. 2009; Opdenacker et al. 2011).

A decline in the group participants' aerobic fitness during the 18-month follow-up period is also indicated in PAAH. Chapter 4 reported that there was a significant difference between interventions for the number of steps completed in the 2-minute step-test (2-MST) at baseline and 6-months ($p=0.02$). Group participants had a higher mean number of steps (baseline steps: G 95 vs. HB 89, 6-month steps: G 100 vs. HB 95, table 1, Chapter 4), with age a significant covariate ($p=0.001$). There was no significant difference for the number of steps completed in the 2-MST within both interventions over the 6-month period.

At 2-years, the significant difference in the number of steps completed in the 2-MST between interventions was not found (2-year steps: G 95 vs. HB 94, Table 1, Chapter 7). There was also no significant difference within interventions for the number of steps completed in the 2-MST over the 2-year period. Thus, there is some support for a decline in aerobic fitness in group participants during the 18-month follow-up period, with no significant difference between the number of steps completed in the 2-MST in both interventions at 2-years, despite a significant difference at baseline and 6-months.

The trend for a decrease in physical activity and aerobic fitness in group participants during the no-intervention follow-up period suggests that the group participants were unable to maintain their physical activity routine as effectively as home-based participants. As suggested by Opdenacker et al (2008), the most obvious way for group participants to continue their exercise routine would be to join a commercial fitness centre and continue with a group exercise program. The findings from the focus groups reported in Chapter 5 show that cost and convenience may be barriers to continuing with instructor-led group exercise programs. These findings from PAAH suggest that the home-based physical activity program may be easier for participants to adhere to in the long-term.

**Subjective versus objective long-term physical activity measures**

Chapter 6 investigated the subjective and objective measurement of physical activity in both PAAH interventions, with no studies comparing these measures while completing different interventions. Initially physical activity diaries were proposed as the main outcome measure for long-term physical activity adherence (Chapter 3). Due to a low return rate of physical activity diaries and issues with over-reporting, the AAS became the preferred self-report measure for long-term physical activity adherence (Figure 2, Chapter 4; Chapters 6 & 7). Chapter 6 highlighted the tendency for group participants to over-report moderate-to-vigorous physical activity (MVPA). An improved correlation between the home-based participants' subjective and objective measures of physical activity found in Chapter 6 may be due to the physiotherapist and the use of motivational interviewing (MI), increasing participants understanding of intensity (Rubak et al. 2009). Therefore, although the long-term adherence to physical activity appears to be equivalent in PAAHs two interventions, there is some evidence that group participants may have over-reported MVPA. Home-based participants may have had a better understanding of physical activity, resulting in more accurate self-reporting of their physical activity levels, and this may be due to the physiotherapist and the use of MI.

**Physiotherapy and long-term physical activity**

To increase the populations' physical activity levels over the longer term, an adequate understanding of the public health physical activity guidelines by the public is necessary. Considering the above, physiotherapy may play a vital role in improving long-term physical activity adherence. The focus group study reported in Chapter 5 found that the physiotherapy intervention was well received, improving physical activity self-efficacy levels and allowing flexibility. Participants perceived the physiotherapist as expert and knowledgeable, with the home-visit increasing feelings of commitment, and the telephone calls providing timely and efficient support. These results support the survey by Booth et al (1997) where middle-aged and older adults preferred exercise support via medical advice. Physiotherapists do perceive the provision of physical activity advice as part of their role, and there is some evidence that physiotherapists can counsel effectively for physical activity behaviour change (Sheedy et al. 2000; Taylor et al. 2009; Shirley et al. 2010).

**Conclusion**

PAAH has expanded the limited level of knowledge on the value of physiotherapy in the physical activity field, demonstrating that physiotherapists using behavioural techniques can increase long-term physical activity adherence in middle-aged adults not interested in, or unable to attend a group exercise program. According to PAAH, the long-term improvement in physical activity levels for the physiotherapist-led home-based physical activity program is equivalent to a community group exercise program. Additional findings indicate that group participants may have over-reported MVPA, and had a tendency to decrease physical activity and aerobic fitness over the 18-month follow-up period. Therefore, the effectiveness of the physiotherapist-led home-based physical activity program may be under-estimated, and results should not be over-interpreted.

### 8.1.4 The physiotherapist-led home-based physical activity program requires less cost and time to implement

Regardless of whether participants commenced a group or home-based physical activity program, the long-term adherence to physical activity appears to be the same, according to the PAAH trial and others (Dunn et al. 1999; Wilcox et al. 2009; Opdenacker et al. 2011). The question for clinicians and public health providers may then be which program requires less time and is less costly to implement. To date, no studies in the literature appear to directly compare the costs of these two formats.

The group exercise program conducted by the YMCA represents a common format for physical activity programs delivered in the community. This type of program operates the same time and place, requiring the same amount of staff input every week, regardless of how many participants attend. In PAAH, one hour every week was required for instructing this program, plus additional time for session preparation (Chapter 3). An estimation of instructor time for a 6-month period is 26 hours, not including preparation time. As reported in Chapter 4, four group exercise sessions were conducted in PAAH, therefore the total instructor time required was 104 hours for 93 participants. The approximate instructor time per participant can be calculated as 67 minutes (104x60 minutes/93 participants). The mean direct cost per participant, whether or not they attended, was calculated as $83.86, including participant travel costs (Table 4, Chapter 7).

The physiotherapist-led home-based physical activity program did require less time and was less costly when compared to the group exercise program. The total time for the physiotherapist to implement this program can be estimated as 58 hours (home visits 65 x 20 minutes, phone attempts 65 x 11 minutes (average 11 attempts per participant, 1 minute per attempt), phone contacts 65 x 22.5 minutes (mean calls received by participants= 5, mean length of phone call = 4.5 minutes), Chapters 4 & 7). According to this, the approximate physiotherapist time allocated to each participant was 54 minutes (58x60 minutes/ 65 participants). The mean direct cost per participant was calculated as $47.06 (Table 4, Chapter 7).

Despite the home-based program being less time consuming to implement and less costly, Chapter 7 discusses its decreased effectiveness when compared to the group exercise program using bootstrap sampling. For every 100 people, 7 less would be made ‘sufficiently’ active if the home-based program was utilised compared to the group exercise program, in the short and long-term (Table 4, Chapter 7). Additionally, participants completing the group program were more likely to have greater increases in their minutes of MVPA per week at 2-years (Figure 3 & Table 4, Chapter 7). As previously mentioned, it is worth considering, that this is self-reported physical activity data using the AAS. The validation study in Chapter 6 highlights that the group exercise participants tended to over-report physical activity. The AAS MVPA data did correlate well with the 5s ActiGraph MVPA data in group participants where methods were used to limit over-reporting, although home-based participants had a better correlation between this subjective and objective data (HB $r=0.56$, $p\leq0.001$, G $r=0.49$, $p\leq0.01$, table 2, Chapter 6). There was no significant difference found between group and

home-based AAS MVPA in the validation study, despite the group participants recording a greater number of mean minutes of MVPA per day (G 55 vs. HB 38 minutes MVPA per day, Table 1, Chapter 6). Using accelerometry, there was also no difference found in mean number of minutes of MVPA per day completed by group and home-based participants. The difference though, between number of minutes of MVPA recorded using 5s epochs, was much less between the two interventions (G 50.8 versus HB 50.1 minutes MVPA per day, Table 1, Chapter 6), when comparing it to the AAS data as mentioned above. Hence, it does appear that group participants tend to over-report MVPA even when using the AAS, and therefore the cost and effectiveness (benefit) analysis of the interventions considering self-reported physical activity data reported in Chapter 7 should not be over interpreted. Supporting this view, Wu et al (2011) conducted a systematic review of effective physical activity interventions, calculating cost-effectiveness ratios for each of the eligible interventions. Wu et al (2011) found that interventions using subjective measures appeared more effective than those using objective measures. The authors suggested this was probably due to imprecise measurement tools, social desirability, recall problems, and definition/interpretation problems.

**Conclusion**

The results of PAAH agree with the cost-effectiveness results of the only other study identified comparing group and home-based physical activity programs, finding the home-based program costs less to deliver (Sevick et al. 2000). The study completed by Sevick et al (2000) though, bases effectiveness on changes from baseline level within each intervention arm (Müller-Riemenschneider 2009). In contrast, PAAH directly compared the group and home-based interventions, calculating effectiveness as the difference in improvement in physical activity and waist circumference measures between the two interventions (home-based minus group, Figure 3 & Table 4, Chapter 7). Thus PAAH is novel, seeming to be the only comparison study to directly compare the home-based and group interventions in terms of cost and effectiveness. PAAH clearly identifies that the home-based program costs less to deliver and is less time consuming, yet appears to be less effective in increasing physical activity levels and decreasing waist circumference over the longer term (Chapter 7).

## 8.2 Implications for practice

As discussed in Chapter 5, there appears to be no single solution for the most effective format of physical activity program in middle-aged adults. A variety of physical activity alternatives are indicated, both group and home-based, with PAAH participants reporting no particular

preference. Chapter 4 and 7 report that regardless of which format participants commenced, the health benefits were the same, increasing physical activity levels and decreasing waist circumference, in the short and long-term. The only difference between interventions appears to be cost, with the home-based program costing less to implement (Chapter 7).

Participants and clinicians/public health providers need to consider the barriers and enablers for physical activity adoption. In particular in middle-aged adults, participants and clinicians/public health providers need to consider the clearly identified barriers, work and carer commitments, for group program attendance. Physical activity self-efficacy levels should also be measured initially, possibly indicating those participants who may require additional support. Clinicians should also ask participants if they have a preference for physical format and deliverer. Do you like attending group sessions? Would you prefer physical advice from a physiotherapist or a fitness instructor? This may determine which format is more suitable for the participant and result in greater long-term physical activity increases.

PAAH has shown that participants may not necessarily know which physical activity format will work for them. To encourage attendance at group programs, the group program should be short-term, it should be no or low cost, and offered out of hours for some. If the group program is delivered by fitness instructors, they should provide clear instruction on what exercises are being performed, and the program should cater for different fitness levels. MI may also be suitable, and could be used in a group situation, collaborating with participants, activating their motivation and allowing some autonomy. Occasional telephone support of short duration through the course of a group exercise program, similar to that provided in the home-based intervention, may also increase program adherence and further increase physical activity levels. Additionally, clinicians/public health providers should not be overly concerned if participants do not attend all of the group sessions. As PAAH has shown, despite a low attendance at the group sessions, overall group participants did increase their physical activity levels and decrease their waist circumference. Attending some of the group exercise sessions, rather than all of them, may be enough to increase physical activity levels.

The physiotherapist-led home-based program has been shown to be a viable, low cost alternative and may be suitable for a number of conditions and settings, where attendance at a centre may be difficult. All participants reported completing some home-based physical activity, therefore there is potential to take advantage of these physical activity opportunities

(Chapter 5). The face-to-face home visit and the one-on-one telephone support calls using motivational interviewing, also appear to be valuable components, with participants reporting increased feelings of commitment and showing an increased level of understanding of the public health physical activity guidelines (Chapters 4-6). The home-based program may be particularly suitable for those in paid employment.

Straker (2012) suggests that physiotherapists could play a major role in preventive health. PAAH has demonstrated that physiotherapists can be effective in increasing physical activity levels in sedentary, healthy, middle-aged adults, requiring less time and costs than a community group exercise program, and resulting in the same health benefits. Brief physical activity advice could be incorporated into individual treatment sessions, in both private and public health settings, and physiotherapists perceive this is a possibility (Shirley et al. 2010).

### 8.3 Recommendations for future research

Each study has outlined its strengths, limitations and areas for further study. In particular, the need has been recognised for a randomised control study (RCT) comparing group, home-based and usual care (control) arms, to determine the effectiveness of the physiotherapist-led home-based physical activity program. RCTs are considered the 'gold standard' of study designs (Portney and Watkins 2009). Yet, as found in PAAH, despite best intentions to recruit participants for randomisation, not enough participants could be recruited within available resources and time-frame to the home-based arm to allow randomisation to the control group.

Physical activity studies are characterised by primarily recruiting white, well-educated females, including PAAH. Methods to increase recruitment of other populations are indicated, to increase the generalizability of the study results. In turn, improved reporting of the recruitment methods, recruitment rates and recruitment costs are recommended, to guide implementation of effective interventions.

Further investigation of sedentary middle-aged adults' physical activity preferences is suggested. Future studies should incorporate mixed methods research, using quantitative and qualitative methods, to increase the depth of understanding of what determines physical activity behaviour. Preference trials within the physical activity field are indicated, with some evidence that preference trials compared to RCTs, make no difference to the outcomes (Dalal et al. 2007). Dalal et al (2007) found that whether patients were randomly allocated to a home-based or hospital-based cardiac rehabilitation program or they got to choose their type of program, made no difference to the clinical outcomes. Further research, directly comparing

the use of random allocation and patient preference for physical activity format, will determine the value of this approach. Additionally, the context of the varying physical activity formats needs to be more specifically investigated. Do middle-aged adults prefer unsupervised (structural domain) home-based physical activity, completed alone or with others (social domain)?

The literature review completed in Chapter 2 identified the heterogeneity amongst physical activity adherence measures, within and between studies. Adherence measures need to be clearly defined, defining terms and contexts to reduce ambiguity. Physical activity adherence should also be measured using both subjective and objective measures at all-time points. A limitation of the current study was that objective measurement of physical activity using accelerometry was not completed at baseline. 'Research that combines the strengths of both self-report and objective measures has the potential to provide new insights into the benefits of physical activity and how to implement successful interventions' (Haskell 2012). In addition, by using both objective and subjective measures, as highlighted in the validation study in Chapter 6, an intervention may alter the participants' understanding of the physical activity guidelines, in particular, intensity, potentially changing the amount of self-reported MVPA. It is recognised though, that the statistical methods used in this validation study, the correlation coefficient, does have some limitations as it only measures the degree of association between measures and does not quantify the level of agreement.

Group exercise programs typically have a low-moderate recruitment and attendance rate (Jancey et al. 2007; Hong et al. 2008; Holland and Hill 2011; Neubeck et al. 2011). Further sub-group analyses of those participants who do not commence or drop-out of group exercise programs is required to determine if these participants were 'sufficiently' active in the long-term. The PAAH trial identified that group non-attendees were more likely to be working full-time, or in paid employment, and were less likely to be sufficiently active (Chapter 5). Further sub-group analyses would potentially identify other characteristics of these participants, enabling greater tailoring of group and home-based physical activity programs.

The value of simply measuring physical activity alone is worthy of further investigation. Physical activity studies have found that control groups have increased physical activity levels, particularly over the longer term (Eakin et al. 2009; Opdenacker et al. 2011). By not recruiting enough participants to the home-based arm of the PAAH study to allow randomisation to a control group, the effectiveness of the physiotherapist-led home-based

physical activity program was not fully determined. The effect of simply measurement alone may be enough to increase middle-aged adults' physical activity levels and future research should determine if adults only need to be measured at regular intervals to encourage increased physical activity.

Further investigating reasons for equivalent or better adherence to exercise in home-based programs is also indicated (Ashworth et al. 2005). PAAH suggested a theoretical model that may explain a similar or better adherence to physical activity with less input and fewer resources required, the Self Determination Theory (Ryan and Deci 2000). Successful physical activity interventions need to understand why they are successful. Future physical activity studies should increase attention to the determinants of physical activity behaviour and utilise suitable behavioural theories. Where motivational interviewing is used, the level of training received by the provider, including duration and competency, should also be clearly stated as well as variations in the use of the behavioural technique. This was not included in the PAAH study.

With limited reporting of cost-effectiveness when comparing group and home-based formats, further evidence is required to guide clinicians and public health providers, capturing all costs (Ashworth et al. 2005). PAAH did not include indirect costs, such as health care utilisation and lost productivity, and did not estimate health benefits measured in terms of Disability Adjusted Life Years (DALYs) as originally proposed in the study protocol for the cost-effectiveness analysis, for a number of reasons. PAAH was unable to provide a control group, there was a limited sample size and therefore power to detect differences and cover cost variations adequately, and there were ethical and resource issues with capturing clinical data and full cost data therefore a full cost-effectiveness evaluation was not completed. PAAH did not include ancillary costs, such as gym membership, sports shoes and exercise equipment. Nor was a sensitivity analysis performed, altering certain costs. Thus, further research is indicated to determine the cost-effectiveness of both the interventions compared with 'usual care' including all costs, utilising both subjective and objective measures of physical activity, to better inform practice.

The role of physiotherapy in preventive health and physical activity is new. An RCT comparing the physiotherapist-led home-based physical activity program to a control group would be useful to establish the program's effectiveness. Further research to identify the value of the physiotherapist alone may compare the physiotherapist-led home-based physical

activity program to home-based programs delivered by other health professionals, such as exercise physiologists, nurses or medical practitioners.

Other areas that may be improved in future comparison studies are increased use of observer blinding, larger samples, and prospective registration of clinical trials to allow greater efficiency by preventing duplication of research studies and improving available evidence to inform health care professionals and clients. A particular focus for future comparison studies should be targeting those least likely to increase physical activity levels, for example, those not interested in groups or have a low physical activity self-efficacy.

### 8.4 Summary

Maybe groups aren't the panacea we think they are, but possibly due to contamination and the potential value of measurement alone, group participants performed better than expected, despite poor program adherence. Nevertheless, the low group attendance rate highlights the need for a number of flexible physical activity formats in this age group. The physiotherapist-led home-based physical activity program appears to be a possible solution.

PAAH has investigated the effectiveness of the physiotherapist-led home-based physical activity program, comparing it to a community group exercise program in sedentary middle-aged adults. Uniquely, participants who were not interested in, or unable to attend, a group exercise program were targeted for this intervention, attempting to capture sedentary participants who may not otherwise increase their physical activity levels. The study design is also reflective of reality, utilising pragmatism as its theoretical perspective.

Equivalent health benefits or no change in health status, for both physical activity formats has been demonstrated by PAAH, excluding physical activity. This agrees with other comparison studies, and adds further strength to the conclusion that one format is not more effective than the other in improving health outcomes other than changes in physical activity (King et al. 1995; Dunn et al. 1999; Wilcox et al. 2009; Opdenacker et al. 2011). No comparison studies, comparing group and home-based physical activity programs, appear to have investigated and compared the barriers, enablers and participant preferences for these two formats. PAAH has found that the home-based program had less barriers and a number of enablers, increasing levels of physical activity self-efficacy, compared to the group exercise program, and being particularly suitable for those in paid employment. Previously sedentary middle-aged adults appeared to have no preference for one physical activity format over the other, preferring a variety of activities. All participants though, were performing some form of home-based

activity, with only some participants taking part in instructor-led group exercise intermittently.

Accurately assessing changes in physical activity levels is important to determine the effectiveness of interventions. PAAH compared subjective (physical activity diaries, Active Australia Survey (AAS)) and objective (accelerometry) measures in participants completing two different interventions, with no other known studies comparing these measures while completing different physical activity formats. Results indicated that group participants tended to over-report moderate-to-vigorous physical activity, emphasizing the need for participants to have an adequate understanding of intensity for accurate self-reporting. The AAS was recommended as the preferred self-report tool.

The no-intervention long-term follow-up in PAAH allowed the sustainability of the formats to be identified, with only one other comparison study identified including no support during the follow-up period (Opdenacker et al. 2011). Both physical activity formats were found to be effective, having similar increases in physical activity at the end of the 6-month intervention period, which were able to be maintained over the following 18-months. There is some indication that physical activity and aerobic fitness levels may have decreased slightly in group participants in the no-intervention follow-up period, but this does not appear to be significant, resulting in similar physical activity and fitness levels as home-based participants at 2-years. The inclusion of the cost evaluation completed in PAAH also seems to be novel, with no other comparison studies directly comparing the costs and effectiveness (benefits) of the two formats. The home-based program was shown to cost less, although was slightly (non-significantly) less effective in increasing physical activity levels according to the self-report data.

Finally, with limited research in this area, the value of physiotherapy in preventive health, aiming to increase physical activity levels, has been determined. The physiotherapist was able to effectively implement behavioural techniques, requiring minimal time and cost, to improve sedentary middle-aged adults' physical activity levels in a home-based setting. The physiotherapist-led home-based physical activity program is an effective low cost alternative option for physical activity program delivery, and may be suitable for a number of different conditions and settings, such as rural and remote.

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## Appendix 1: Initial invitation letters


### *Evaluating a group-based aerobic exercise program*

### Calling for Volunteers

Ms Nicole Freene, PhD Candidate, University of Canberra, is commencing a project aiming to provide primary prevention of chronic disease by increasing levels of physical activity and aerobic fitness.

The health benefits of physical activity are widely recognised, with physical inactivity being an important health risk factor for chronic disease.

Not being active enough:

- increases all causes of death,
- doubles the risk of cardiovascular disease, type 2 diabetes and obesity,
- increases the risk of colon and breast cancer, high blood pressure, lipid disorders, osteoporosis, depression and anxiety.

This project will evaluate the effectiveness of an exercise program in terms of its health benefits, cost and providing long-term adherence to exercise.

You are being invited to attend the Chifley YMCA for approximately one hour, once a week for a Group Exercise program over a period of six months. The program will consist of a variety of upper and lower body strengthening and coordination exercises and fitness training (eg: walking, stationary bike, treadmill), aiming to increase your overall fitness. Participants will be encouraged to gradually increase their level of physical activity outside of the group, eventually aiming to achieve 30 minutes of moderate intensity exercise most days of the week. There is no cost for the group exercise program. The day and time of the group will be determined by participant's preference and availability.

In order to evaluate how effective this exercise program is a number of measures will be taken at the beginning and end of the program and at 6, 12 and 18-months following the completion of the exercise program. All assessments will take place at the Chifley YMCA.

Data collection will involve:

- the completion of a questionnaire describing your physical activity over the last 7 days,

- a 2 minute step test determining the number of times you can step in place in 2 minutes,
- completion of a quality of life questionnaire,
- blood pressure measurements,
- waist and hip measurements,
- height and weight measurements,
- completion of individual exercise diaries.

If you are interested in participating in this Group Exercise Program or would like to find out more information about this project, please complete the information below and return it in the replied paid envelope by 23 February 2011 and I will contact you by telephone to discuss the program further.

If you would like further information on other exercise options but you are not interested in participating in the Group Exercise Program, can you also please complete the information below and return it in the replied paid envelope by 23 February 2011. I will be in contact with you via mail in the near future.

If you do not wish to participate in this study, please do not reply to this letter.

Thank you for your time and I look forward to hearing from you,

Nicole Freene
PhD Candidate
Physiotherapist.

---

☐ I am interested in attending the Group Exercise Program at the Chifley YMCA, OR

☐ I am interested in receiving further information on exercise options via mail but I am NOT interested in attending the Group Exercise Program at the Chifley YMCA.

Name _____

Address _____

Telephone contact number _____

Convenient time to be contacted by phone_____

UNIVERSITY OF CANBERRA
AUSTRALIA'S CAPITAL UNIVERSITY

## *Evaluating a home-based aerobic exercise program*

## Calling for Volunteers

Ms Nicole Freene, PhD Candidate, University of Canberra, is commencing a project aiming to provide primary prevention of chronic disease by increasing levels of physical activity and aerobic fitness.

The health benefits of physical activity are widely recognised, with physical inactivity being an important health risk factor for chronic disease.

Not being active enough:

- increases all causes of death,
- doubles the risk of cardiovascular disease, type 2 diabetes and obesity,
- increases the risk of colon and breast cancer, high blood pressure, lipid disorders, osteoporosis, depression and anxiety.

This project will evaluate the effectiveness of an exercise program in terms of its health benefits, cost and providing long-term adherence to exercise.

You are being invited to participate in this health project that will consist of either a 6 month **home-based** physical activity program with telephone support or the completion of a number of basic health measures **in your home** giving you an indication of your fitness and health status. In order to assess the effectiveness of the programs we will randomise you to either group.

To evaluate how effective the exercise program is a number of measures will be taken at the beginning and end of the program and at 6, 12 and 18-months following the completion of the exercise program. **All assessments will take place in your home at a time that suits you**.

Data collection will involve:

- the completion of a questionnaire describing your physical activity over the last 7 days,
- a 2 minute step test determining the number of times you can step in place in 2 minutes,
- completion of a quality of life questionnaire,
- blood pressure measurements,
- waist and hip measurements,

- height and weight measurements,
- completion of individual exercise diaries.

If you are interested in participating in this home exercise health project or would like to find out more information about this project, please complete the information below and return it by the 14 March 2011 in the replied paid envelope and I will contact you by telephone to discuss the program further.

If you do not wish to participate in this study, please do not reply to this letter.

Thank you for your time and I look forward to hearing from you,

Nicole Freene
PhD Candidate
Physiotherapist.

---

☐ I am interested in participating in the Home Exercise Health Project.

Name _____

Address _____

Telephone contact number _____

Convenient time to be contacted by phone_____

Please note:
The Australian Electoral Commission (AEC) has supplied name, address, gender and age-range information for this medical research study in conformity with Item 2 of subsection 90B(4) of the *Commonwealth Electoral Act 1918* and subregulation 9(a) of the *Electoral and Referendum Regulation 1940.* The information has been provided by the AEC on a confidential basis and will not be forwarded on or sold or otherwise disclosed or used for any purpose other than to contact participants for this medical research project.

**Appendix 2: Medical screening: Sports Medicine Australia pre-exercise screening system (Sports Medicine Australia 2005)**

## Pre-exercise screening system 2005

### Sports Medicine Australia (SMA) - Stage 1 questionnaire

| | | | |
|---|---|---|---|
| Name | Age | Gender | M F |
| Address | Phone | Date | |

| | | | |
|---|---|---|---|
| 1 | Have you ever had a heart attack, coronary revascularisation surgery or a stroke ? | No | Yes |
| 2 | Has your doctor ever told you that you have heart trouble or vascular disease ? | No | Yes |
| 3 | Has your doctor ever told you that you have a heart murmur ? | No | Yes |
| 4 | Do you ever suffer from pains in your chest, especially with exercise ? | No | Yes |
| 5 | Do you ever get pains in your calves, buttocks or at the back of your legs during exercise which are not due to soreness or stiffness ? | No | Yes |
| 6 | Do you ever feel faint or have spells of severe dizziness, particularly with exercise ? | No | Yes |
| 7 | Do you experience swelling or accumulation of fluid about the ankles ? | No | Yes |
| 8 | Do you ever get the feeling that your heart is suddenly beating faster, racing or skipping beats, either at rest or during exercise ? | No | Yes |
| 9 | Do you have chronic obstructive pulmonary disease, interstitial lung disease, or cystic fibrosis? | No | Yes |
| 10 | Have you ever had an attack of shortness of breath that developed when you were not doing anything strenuous, at any time in the last 12 months ? | No | Yes |
| 11 | Have you ever had an attack of shortness of breath that developed after you stopped exercising, at any time in the last 12 months ? | No | Yes |
| 12 | Have you ever been woken at night by an attack of shortness of breath, at any time in the last 12 months ? | No | Yes |
| 13 | Do you have diabetes [IDDM or NIDDM] ? If so, do you have trouble controlling your diabetes? | No | Yes |
| 14 | Do you have any ulcerated wounds or cuts on your feet that do not seem to heal? | No | Yes |
| 15 | Do you have any liver, kidney or thyroid disorders? | No | Yes |
| 16 | Do you experience unusual fatigue or shortness of breath with usual activities? | No | Yes |
| 17 | Is there any other physical reason or medical condition, or are you taking any medication(s) which could prevent you from undertaking an exercise program, or that you are concerned about? # | No | Yes |

NOTES

# Some of these conditions might include a history of blood clotting, osteoporosis, bone fractures or serious musculoskeletal disorders, or if they have recently lost a large amount of body mass without trying to. Other types of conditions might include psychiatric disorders, later-stage pregnancy or those with a history of health problems during pregnancy. Those people taking medication(s) for medical conditions listed may also need medical clearance.

Also, if any one or more of the risk factors (below) are extreme then the health and fitness professional should use professional judgement as to whether medical clearance may be required.

**Appendix 3: Medical Officer Information and Clearance forms**


# Medical Officer Information Form

## Project Title

***Evaluating a group-based aerobic exercise program.***

## Researchers

Ms Nicole Freene, Physiotherapist, PhD Candidate, University of Canberra.

Supervisors:

Prof Gordon Waddington PhD, Faculty of Health, University of Canberra;
Dr Wendy Chesworth PhD, Faculty of Health, University of Canberra; and
Prof Rachel Davey PhD, Faculty of Health, University of Canberra.

## Project Aim

The aim of this study is to increase the adoption and maintenance of physical activity in community-dwelling sedentary middle-aged individuals for the primary prevention of chronic disease.

## Benefits of the Project

The health benefits of physical activity are widely recognised, with physical inactivity being an important health risk factor for chronic disease. Physical inactivity increases all causes of mortality, doubles the risk of cardiovascular disease, type 2 diabetes and obesity, and increases the risk of colon and breast cancer, high blood pressure, lipid disorders, osteoporosis, depression and anxiety.

This project will evaluate the effectiveness of an exercise program in terms of health benefits, cost and providing long-term adherence to exercise.

## General Outline of the Project

Individuals 50-65 years old living in the community will be invited by letter to participate in a Group Exercise session at the Chifley YMCA once a week, for a period of six months. Potential participants will be contacted via telephone to determine if they are sedentary, have no serious medical conditions that could limit participation in the exercise program and are not planning to move from the area within 2-years.

Eligible participants will be required to attend the Chifley YMCA for an initial assessment prior to commencing the Group Exercise program and obtain medical clearance from their Medical Practitioner, if indicated. Assessments will also be completed at the end of

the intervention and then at 6, 12 and 18-months post intervention. All assessments will take place at the Chifley YMCA.

## Participant Involvement

Participants will attend the Chifley YMCA for approximately 1 hour, once a week, for 6-months for a Group Exercise program. The program will consist of a variety of upper and lower body strengthening and coordination exercises, and aerobic fitness training (eg: walking, stationary bike, treadmill), aiming to increase their overall fitness. Participants will be encouraged to gradually increase their level of physical activity outside of the group, eventually aiming to achieve 30 minutes of moderate intensity exercise most days of the week.

The principal researcher will collect all data at the assessments. Data collection will involve a questionnaire describing the participants physical activity over the last 7 days, a 2 minute step test determining the number of times a person can step in place in 2 minutes, completion of a quality of life questionnaire, blood pressure measured via a sphygmomanometer, waist and hip measurements using a tape measure, height and weight measurements and completion of individual exercise diaries. These measures will be taken at the start and finish of the intervention and then at 6, 12 and 18-months post intervention. Data gathered from these interventions will be used to determine the health benefits, cost effectiveness and long-term adherence to exercise of this approach.

## Medical Officer Involvement

As the participants Medical Officer it would be very much appreciated if you could assess the participant's medical eligibility to be included in the study. Prior to visiting you, participants will be pre-screened using the Sports Medicine Australia Pre-Exercise Screening and will only be requested to receive medical clearance from you if indicated. The medical clearance form must be signed by you, the medical officer, and sighted by the principal researcher before inclusion in the study and exercise can commence. The inclusion and exclusion criteria for this study are listed below.

Inclusion criteria:

1. 50-65 years old.
2. sedentary – no participation in regular moderate or vigorous exercise for 30 minutes 2 or more times a week for at least 6-months.
3. no serious medical conditions that could limit participation in moderate physical activity (unstable angina, uncontrolled hypertension, type I diabetes or diagnosed or hospitalised with chest pain, heart attack or heart surgery in past 6-months.
4. no severe functional impairment due to multiple medical or psychiatric diseases.
5. not planning to move from area within 2-years.
6. appropriate language skills (English speaking only) and other cognitive skills to be able to provide informed consent and actively engage in the exercise program.
7. Only one person per household is eligible.

Exclusion criteria:

1. resting SBP > 200mmHg, DBP > 100mmHg, resting HR > 100bpm

Considering the highlighted areas in the above inclusion and exclusion criteria, could you please complete the attached Medical Clearance Form, if appropriate. Once this form is signed could it please be returned to the participant for them to provide to the principal researcher at their initial assessment.

## Confidentiality

No one but the nominated researchers will have access to the material provided by the participants.

## Anonymity

For data analysis all data will be non-identifiable and all data recording sheets will not contain the name, nor allow the identification, of any participant.

## Data Storage

Only the researchers will have access to the original data. Paper records will be stored under lock and key and electronic data will be stored on a password-protected computer. All data will be stored at the University of Canberra for five years when the project is complete and at the end of this period the data will be deleted or shredded.

## Ethics Committee Clearance

This project has been approved by the University of Canberra Committee for Ethics in Human Research.

## Queries and Concerns

Medical Officers can raise queries on the project by contacting the principal researcher.

| | |
|---|---|
| Ms Nicole Freene | 0400 502 902 |
| Prof Gordon Waddington | 6201 2737 |

UNIVERSITY OF CANBERRA
AUSTRALIA'S CAPITAL UNIVERSITY

# Medical Officer Information Form

## Project Title

***Evaluating a home-based aerobic exercise program.***

## Researchers

Ms Nicole Freene, Physiotherapist, PhD Candidate, University of Canberra.

Supervisors:

Prof Gordon Waddington PhD, Faculty of Health, University of Canberra;
Dr Wendy Chesworth PhD, Faculty of Health, University of Canberra; and
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## Project Aim

The aim of this study is to increase the adoption and maintenance of physical activity in community-dwelling sedentary middle-aged individuals for the primary prevention of chronic disease.

## Benefits of the Project

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This project will evaluate the effectiveness of an exercise program in terms of health benefits, cost and providing long-term adherence to exercise.

## General Outline of the Project

Individuals 50-65 years old living in the community will be invited by letter to participate in a Group Exercise Program or Home-based Exercise Program for a period of six months. Potential participants will be contacted by telephone to determine if they are sedentary, have no serious medical conditions that could limit participation in the exercise program and are not planning to move from the area within 2-years.

Eligible participants will be visited in their homes for an initial assessment. The participants will receive a 6 month individually tailored home-based physical activity program with telephone. Medical clearance from their Medical Practitioner, if indicated, will be required before commencement of the exercise program. Assessments will also be

completed at the end of the intervention and then at 6, 12 and 18-months post intervention. All assessments will take place in the participant's home.

## Participant Involvement

An individual graded physical activity program, for example a walking program, utilising the participant's home environment and surrounding areas will be prescribed at the initial assessment. Instruction will be given on how to monitor the intensity of the program which is important to receive the associated health benefits. Google maps will be used to map out suitable walking routes and distances in the participants' local neighbourhood, if relevant. Participants will be encouraged to start slowly and progress gradually. The aim will be to achieve 30 minutes of moderate intensity exercise most days of the week. Following the initial home visit participants will then be contacted by phone for advice and support 2 weeks after the initial assessment and then at the end of every month until the end of the intervention. Participants will be exercising in an unsupervised environment.

The principal researcher will collect all data at the assessment sessions. Data collection will involve a questionnaire describing the participants physical activity over the last 7 days, a 2 minute step test determining the number of times a person can step in place in 2 minutes, completion of a quality of life questionnaire, blood pressure measured via a sphygmomanometer, waist and hip measurements using a tape measure, height and weight measures and completion of individual exercise diaries. These measures will be taken at the start and finish of the intervention and then at 6, 12 and 18-months post intervention. Data gathered from these interventions will be used to determine the health benefits, cost effectiveness and long-term adherence to exercise of this approach.

## Medical Officer Involvement

As the participants Medical Officer it would be very much appreciated if you could assess the participant and their medical eligibility to be included in the study. Prior to visiting you, participants will be pre-screened via the Sports Medicine Australia Pre-Exercise Screening and will only be requested to receive medical clearance from you if indicated. The medical clearance form must be signed by you, the medical officer, and sighted by the principal researcher before
inclusion in the study and exercise can commence. The inclusion and exclusion criteria for this study are listed below.

Inclusion criteria:

1. 50-65 years old.
2. sedentary – no participation in regular moderate or vigorous exercise for 30 minutes 2 or more times a week for at least 6-months.
3. no serious medical conditions that could limit participation in moderate physical activity (unstable angina, uncontrolled hypertension, type I diabetes or diagnosed or hospitalised with chest pain, heart attack or heart surgery in past 6-months).
4. no severe functional impairment due to multiple medical or psychiatric diseases.
5. not planning to move from area within 2-years.

6. appropriate language skills (English speaking only) and other cognitive skills to be able to provide informed consent and actively engage in the exercise program.
7. Only one person per household is eligible.

Exclusion criteria:

1. resting SBP > 200mmHg, DBP > 100mmHg, resting HR > 100bpm.

Considering the highlighted areas in the above inclusion and exclusion criteria, could you please complete the attached Medical Clearance Form, if appropriate. Once this form is signed could it please be returned to the participant for them to provide to the principal researcher at their initial assessment.

## Confidentiality

No one but the nominated researchers will have access to the material provided by the participants.

## Anonymity

For data analysis all data will be non-identifiable and all data recording sheets will not contain the name, nor allow the identification, of any participant.

## Data Storage

Only the researchers will have access to the original data. Paper records will be stored under lock and key and electronic data will be stored on a password-protected computer. All data will be stored at the University of Canberra for five years when the project is complete and at the end of this period the data will be deleted or shredded.

## Ethics Committee Clearance

This project has been approved by the University of Canberra Committee for Ethics in Human Research.

## Queries and Concerns

Medical Officers can raise queries on the project by contacting the principal researcher.
Ms Nicole Freene 0400 502 902
Prof Gordon Waddington 6201 2737

UNIVERSITY OF CANBERRA
AUSTRALIA'S CAPITAL UNIVERSITY

## Project Title

***Evaluating an aerobic exercise program.***

# MEDICAL CLEARANCE FORM

Participant Name _____
Address _____
_____
_____

Date of birth _____

_____ is safe to participate in a moderate intensity aerobic exercise program. There are no serious medical conditions that could limit participation in moderate physical activity such as unstable angina, uncontrolled hypertension, type I diabetes or diagnosed or hospitalised with chest pain, heart attack or heart surgery in the past 6-months. There are no severe functional impairments due to multiple medical or psychiatric diseases. He/she has appropriate language skills (English only) and capacity to understand what is involved in this study.

Signed _____
Medical Officer
Name _____
Date _____
Contact address _____
_____
Phone number _____

**Appendix 4: Participant Information and Consent forms**

**Main Intervention Study**


# Participant Information Form

## Project Title

***Evaluating a group-based aerobic exercise program.***

## Researchers

Ms Nicole Freene, Physiotherapist, PhD Candidate, University of Canberra.

Supervisors:

Prof Gordon Waddington PhD, Faculty of Health, University of Canberra;
Dr Wendy Chesworth PhD, Faculty of Health, University of Canberra; and
Prof Rachel Davey PhD, Faculty of Health, University of Canberra.

## Project Aim

The aim of this study is to increase physical activity in middle-aged insufficiently active individuals to prevent chronic disease.

## Benefits of the Project

It is well documented that aerobic fitness / physical activity protects individuals from a variety of chronic health problems, such as,

- cardiovascular disease,
- type 2 diabetes,
- obesity,
- colon and breast cancer,
- high blood pressure,
- lipid disorders,
- osteoporosis,
- depression and anxiety
- falls.

This project will evaluate the effectiveness of an exercise program in terms of health benefits, cost and providing long-term adherence to exercise.

## General Outline of the Project

Individuals 50-65 years old living in the community were invited by letter to participate in a Group Exercise session at the Chifley YMCA once a week, for a period of six months.

Potential participants were then contacted via phone to determine if they were insufficiently active, had no serious medical conditions that could limit participation in the exercise program and were not planning to move from the area within 2-years.

Eligible participants were then requested to attend the Chifley YMCA for an initial assessment prior to commencing the Group Exercise program and obtain medical clearance, if indicated, from their Medical Practitioner. Assessments will also be completed at the end of the intervention and then at 6, 12 and 18-months post intervention. All assessments will take place at the Chifley YMCA.

## Participant Involvement

Initially you will attend the Chifley YMCA for an initial assessment. Following this you will commence the Group Exercise Program.

The Group Exercise Program at the Chifley YMCA will run for approximately 1 hour, once a week, for 6-months. The program will consist of a variety of upper and lower body strengthening and coordination exercises, and aerobic fitness training (eg: walking, stationary bike, treadmill), aiming to increase your overall fitness. You will be encouraged to gradually increase your level of physical activity outside of the group, eventually aiming to achieve 30 minutes of moderate intensity exercise most days of the week.

The principal researcher will collect all data at the assessments. Data collection will involve:

- a questionnaire describing your physical activity over the last 7 days,
- a 2 minute step test determining the number of times you can step in place in 2 minutes,
- completion of a quality of life questionnaire,
- blood pressure measured via a sphygmomanometer,
- waist and hip measurements using a tape measure
- height and weight measures
- and a request to complete a daily exercise diary, to be returned to the principal researcher at the end of each month.

These measures will be taken at the start and finish of the intervention and then at 6, 12 and 18-months post intervention. Data gathered from these interventions will be used to determine the health benefits, cost effectiveness and long-term adherence to exercise of this approach.

The health risks associated with physical inactivity are now recognised as being substantially greater than those associated with participating in exercise or physical activity. Initially you may experience mild muscular soreness or fatigue when you begin the Group Exercise Program. If symptoms do not improve we advise you to discuss this with the YMCA Fitness Instructor or contact the principal researcher and visit your local medical officer. If you experience chest pain, dizziness, excessive sweatiness,

palpitations, extreme shortness of breath and feeling generally unwell STOP exercising. If symptoms do not ease after 5 minutes do not recommence exercise. In the case of an emergency please dial '000' and call an ambulance.

You will be closely monitored while attending the Group Exercise Program by a YMCA Fitness Instructor and they will provide appropriate advice if this situation arises. If you are exercising at home, in the case of an emergency, please dial '000' and call an ambulance.

The benefits and risks of exercise will be discussed in further detail with you at the initial assessment and any further concerns throughout the exercise program can be addressed by discussing them with the YMCA Fitness Instructor or by contacting the principal researcher via phone.

## Confidentiality

No one but the nominated researchers will have access to the material provided by the participants.

## Anonymity

For data analysis all data will be non-identifiable and all data recording sheets will not contain the name, nor allow the identification, of any participant.

## Data Storage

Only the researchers will have access to the original data. Paper records will be stored under lock and key and electronic data will be stored on a password-protected computer. All data will be stored at the University of Canberra for five years when the project is complete and at the end of this period the data will be deleted or shredded.

## Ethics Committee Clearance

This project has been approved by the University of Canberra Committee for Ethics in Human Research.

## Queries and Concerns

Participants can raise queries on the project by contacting the principal researcher.

| | |
|---|---|
| Ms Nicole Freene | 0400 502 902 |
| Prof Gordon Waddington | 6201 2737 |
| Lifeline telephone counselling service | 13 11 14 |

Lifeline Counsellors will listen, support and assist you to clarify options and choices for yourself. Counsellors may also provide you with information about community services, or other Lifeline Services which you may find useful.


# Informed Consent Form

## Project Title

## Evaluating a group-based aerobic exercise program.

## Consent Statement

I have read and understood the information about the research. I am not aware of any condition that would prevent my participation, and I agree to participate in this project. I have had the opportunity to ask questions about my participation in the research. All questions I have asked have been answered to my satisfaction. I am aware that I can withdraw from this project at any time.

Name…….…… Signature……..…….
Date …….

A summary of the research report can be forwarded to you when published. If you would like to receive a copy of the report, please include your mailing address below.

Name……..…….
Address…….……..
……..……

UNIVERSITY OF CANBERRA
AUSTRALIA'S CAPITAL UNIVERSITY

# Participant Information Form

## Project Title

***Evaluating a home-based aerobic exercise program.***

## Researchers

Ms Nicole Freene, Physiotherapist, PhD Candidate, University of Canberra.

Supervisors:

Prof Gordon Waddington PhD, Faculty of Health, University of Canberra;
Dr Wendy Chesworth PhD, Faculty of Health, University of Canberra; and
Prof Rachel Davey PhD, Faculty of Health, University of Canberra.

## Project Aim

The aim of this study is to increase physical activity in middle-aged insufficiently active individuals to prevent chronic disease.

## Benefits of the Project

It is well documented that aerobic fitness / physical activity protects individuals from a variety of chronic health problems, such as,

- cardiovascular disease,
- type 2 diabetes,
- obesity,
- colon and breast cancer,
- high blood pressure,
- lipid disorders,
- osteoporosis,
- depression and anxiety
- falls.

This project will evaluate the effectiveness of an exercise program in terms of health benefits, cost and providing long-term adherence to exercise.

## General Outline of the Project

Individuals 50-65 years old living in the community were invited by letter to participate in a Group Exercise Program or Home-based Exercise Program. Potential participants were contacted by telephone to determine if they were insufficiently active, had no serious medical conditions that could limit participation in the exercise program and were not planning to move from the area within 2-years.

Eligible participants for the Home-based program were then visited in their homes for an initial assessment. Medical clearance from their Medical Practitioner was required, if indicated, before commencement of the exercise program. Assessments will also be completed at the end of the intervention and then at 6, 12 and 18-months post intervention. All assessments will take place in the participant's home.

## Participant Involvement

At the initial assessment an individualised graded walking program utilising your home environment and surrounding areas will be prescribed. Instruction will be given on how to monitor the intensity of your walking program which is important to receive the associated health benefits. Google maps will be used to map out suitable walking routes and distances. You will be encouraged to start slowly and progress gradually. The aim will be to achieve 30 minutes of moderate intensity exercise most days of the week. Following the initial home visit you will then be contacted by phone for advice and support after 2 weeks and then at the end of each month until the end of the 6 month walking program.

The principal researcher will collect all data at the assessments in your home. Data collection will involve:

- a questionnaire describing your physical activity over the last 7 days,
- a 2 minute step test determining the number of times you can step in place in 2 minutes,
- completion of a quality of life questionnaire,
- blood pressure measured via a sphygmomanometer,
- waist and hip measurements using a tape measure
- height and weight measures
- and you will be requested to complete a daily exercise diary, to be returned to the principal researcher at the end of every month.

These measures will be taken at the start and finish of the intervention and then at 6, 12 and 18-months post intervention. Data gathered from these interventions will be used to determine the health benefits, cost effectiveness and long-term adherence to exercise of this approach.

The health risks associated with physical inactivity are now recognised as being substantially greater than those associated with participating in exercise or physical activity. Initially you may experience mild muscular soreness or fatigue when you begin your walking program but this is quite normal after a period of being insufficiently active. If symptoms do not improve we advise you to contact the principal researcher and visit your local medical officer. If you experience chest pain, dizziness, excessive sweatiness, palpitations, extreme shortness of breath and feeling generally unwell STOP exercising. If symptoms do not ease after 5 minutes do not recommence exercise. In the case of an emergency please dial '000' and call an ambulance.

The benefits and risks of exercise will be discussed in further detail with you at the initial assessment and any further concerns throughout the exercise program can be addressed by contacting the principal researcher via phone (see below).

## Confidentiality

No one but the nominated researchers will have access to the material provided by the participants.

## Anonymity

For data analysis all data will be non-identifiable and all data recording sheets will not contain the name, nor allow the identification, of any participant.

## Data Storage

Only the researchers will have access to the original data. Paper records will be stored under lock and key and electronic data will be stored on a password-protected computer. All data will be stored at the University of Canberra for five years when the project is complete and at the end of this period the data will be deleted or shredded.

## Ethics Committee Clearance

This project has been approved by the University of Canberra Committee for Ethics in Human Research.

## Queries and Concerns

Participants can raise queries on the project by contacting the principal researcher.

| | |
|---|---|
| Ms Nicole Freene | 0400 502 902 |
| Prof Gordon Waddington | 6201 2737 |
| Lifeline telephone counselling service | 13 11 14 |

Lifeline Counsellors will listen, support and assist you to clarify options and choices for yourself. Counsellors may also provide you with information about community services, or other Lifeline Services which you may find useful.


# Informed Consent Form

## Project Title

## Evaluating a home-based aerobic exercise program.

## Consent Statement

I have read and understood the information about the research. I am not aware of any condition that would prevent my participation, and I agree to participate in this project. I have had the opportunity to ask questions about my participation in the research. All questions I have asked have been answered to my satisfaction. I am aware that I can withdraw from this project at any time.

Name…….…… Signature……..…….
Date …….

A summary of the research report can be forwarded to you when published. If you would like to receive a copy of the report, please include your mailing address below.

Name……..…….
Address…….……..
……..……


# Participant Information Form

## Project Title

***Evaluating a group-based aerobic exercise program.***

***Focus Group***

## Researchers

Ms Nicole Freene, Physiotherapist, PhD Candidate, University of Canberra.

Supervisors:

Prof Gordon Waddington PhD, Faculty of Health, University of Canberra;

Dr Wendy Chesworth PhD, Faculty of Health, University of Canberra; and

Prof Rachel Davey PhD, Faculty of Health, University of Canberra.

## Project Aim

The aim of this study is to increase physical activity in middle-aged insufficiently active individuals to prevent chronic disease.

Barriers and enablers for increasing physical activity using a Group Exercise program will be explored via Focus Groups.

## Benefits of the Project

It is well documented that physical activity protects individuals from a variety of chronic health problems, such as,

- cardiovascular disease,
- type 2 diabetes,
- obesity,
- colon and breast cancer,
- high blood pressure,
- lipid disorders,
- osteoporosis,
- depression and anxiety
- falls.

This project will evaluate the effectiveness of a Group Exercise program in terms of health benefits, cost and providing long-term adherence to exercise.

## General Outline of the Project

Insufficiently active 50-65 years old living in the community that were eligible for this study were invited to take part in a Group Exercise program at the Chifley YMCA once a week, for a period of six months.

Approximately 50% of eligible participants completed less than half of the group exercise sessions over the 6 month period.

In order to gain a better understanding of the barriers and enablers of attending a community Group Exercise program, in insufficiently active middle-aged community-dwelling adult's, focus groups will be conducted. There will be a number of focus groups, consisting of those that attended the Group Exercise program and those that did not. Non-attendees will consist of participants attending less than 50% of the total Group Exercise sessions. Potential participants, attendees and non-attendees, will be randomly selected and invited via telephone to attend the focus groups. The focus groups will be held at the Chifley YMCA.

## Participant Involvement

You have been invited to attend the Chifley YMCA to take part in a focus group. You will be required to complete a written informed consent and the Active Australia Survey, a physical activity questionnaire, before commencement of the group.

The focus group will consist of approximately 6 – 10 participants. It will be facilitated by one of the research team. The facilitator is very familiar with the study aims and methods but has not been involved in any aspect of the recruitment of participants, data collection or intervention provision. Each session will run for approximately 60 minutes.

Discussion will be encouraged and four main themes will be explored:

1. Group Exercise program enablers
2. Group Exercise program barriers
3. Adherence to physical activity
4. Physical activity preferences.

The focus group session will be audio-taped. Following each session, the data will be transcribed. The principal researcher will read the transcripts multiple times, identifying potential themes. Emerging themes will be discussed with the facilitator, aiming to reach a consensus on final themes and categories.

## Confidentiality

No one but the nominated researchers will have access to the material provided by the participants.

## Anonymity

For data analysis all data will be non-identifiable and all data recording sheets will not contain the name, nor allow the identification, of any participant.

## Data Storage

Only the researchers will have access to the original data. Paper records will be stored under lock and key and electronic data will be stored on a password-protected computer. All data will be stored at the University of Canberra for five years when the project is complete and at the end of this period the data will be deleted or shredded.

## Ethics Committee Clearance

This project has been approved by the University of Canberra Committee for Ethics in Human Research.

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Participants can raise queries on the project by contacting the principal researcher.

| | |
|---|---|
| Ms Nicole Freene | 0400 502 902 |
| Prof Gordon Waddington | 6201 2737 |
| Lifeline telephone counselling service | 13 11 14 |

Lifeline Counsellors will listen, support and assist you to clarify options and choices for yourself. Counsellors may also provide you with information about community services, or other Lifeline Services which you may find useful.


# Informed Consent Form

## Project Title

## Evaluating a group-based aerobic exercise program.

## Focus Group

## Consent Statement

I have read and understood the information about the research. I am not aware of any condition that would prevent my participation, and I agree to participate in this project. I have had the opportunity to ask questions about my participation in the research. All questions I have asked have been answered to my satisfaction. I am aware that I can withdraw from this project at any time.

Name…….…… Signature……..……
Date …….

A summary of the research report can be forwarded to you when published. If you would like to receive a copy of the report, please include your mailing address below.

Name……..…….
Address……..……..
……..……

UNIVERSITY OF CANBERRA
AUSTRALIA'S CAPITAL UNIVERSITY

# Participant Information Form

## Project Title

***Evaluating a home-based aerobic exercise program.***

***Focus Group***

## Researchers

Ms Nicole Freene, Physiotherapist, PhD Candidate, University of Canberra.

Supervisors:

Prof Gordon Waddington PhD, Faculty of Health, University of Canberra;

Dr Wendy Chesworth PhD, Faculty of Health, University of Canberra; and

Prof Rachel Davey PhD, Faculty of Health, University of Canberra.

## Project Aim

The aim of this study is to increase physical activity in middle-aged insufficiently active individuals to prevent chronic disease.

Barriers and enablers for increasing physical activity using a physiotherapy-led home-based physical activity program will be explored via Focus Groups.

## Benefits of the Project

It is well documented that physical activity protects individuals from a variety of chronic health problems, such as,

- cardiovascular disease,
- type 2 diabetes,
- obesity,
- colon and breast cancer,
- high blood pressure,
- lipid disorders,
- osteoporosis,
- depression and anxiety

- falls.

This project will evaluate the effectiveness of a physiotherapy-led home-based physical activity program in terms of health benefits, cost and providing long-term adherence to exercise.

## General Outline of the Project

Insufficiently active 50-65 years old living in the community that were eligible for this study were invited to take part in a physiotherapy-led home-based physical activity program for a period of six months. One home visit was conducted at the beginning of the program then telephone support was provided, approximately 6 phone calls, over the six month period.

In order to gain a better understanding of the barriers and enablers of increasing physical activity via the physiotherapy-led physical activity program, focus groups will be conducted. Potential participants will be randomly selected and invited via telephone to attend the focus groups. The focus groups will be held at the Chifley YMCA.

## Participant Involvement

You have been invited to attend the Chifley YMCA to take part in a focus group. You will be required to complete a written informed consent and the Active Australia Survey, a physical activity questionnaire, before commencement of the group.

The focus group will consist of approximately 6 – 10 participants. It will be facilitated by one of the research team. The facilitator is very familiar with the study aims and methods but has not been involved in any aspect of the recruitment of participants, data collection or intervention provision. Each session will run for approximately 60 minutes.

Discussion will be encouraged and four main themes will be explored:

1. Physiotherapy-led physical activity program enablers
2. Physiotherapy-led physical activity program barriers
3. Adherence to physical activity
4. Physical activity preferences.

The focus group session will be audio-taped. Following each session, the data will be transcribed. The principal researcher will read the transcripts multiple times, identifying potential themes. Emerging themes will be discussed with the facilitator, aiming to reach a consensus on final themes and categories.

## Confidentiality

No one but the nominated researchers will have access to the material provided by the participants.

## Anonymity

For data analysis all data will be non-identifiable and all data recording sheets will not contain the name, nor allow the identification, of any participant.

## Data Storage

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## Queries and Concerns

Participants can raise queries on the project by contacting the principal researcher.

| | |
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| Ms Nicole Freene | 0400 502 902 |
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# Informed Consent Form

## Project Title

## Evaluating a home-based aerobic exercise program.

## Focus Group

## Consent Statement

I have read and understood the information about the research. I am not aware of any condition that would prevent my participation, and I agree to participate in this project. I have had the opportunity to ask questions about my participation in the research. All questions I have asked have been answered to my satisfaction. I am aware that I can withdraw from this project at anytime.

Name…….…… Signature……..……
Date …….

A summary of the research report can be forwarded to you when published. If you would like to receive a copy of the report, please include your mailing address below.

Name……..…….
Address……..……..
……..……

**Appendix 5: Questionnaires**

**The Active Australia Survey**


# The Active Australia Survey

This survey asks questions about your current level of physical activity and your knowledge about the health benefits of physical activity. Thank you for completing these questions.

| **Name** | | **Date of Birth** | |
|---|---|---|---|

**The following questions have to do with basic descriptive information.**

**Q1a. Gender:** ❑Male ❑Female

**Q1b. Your Heritage:**
Are you of Aboriginal or Torres Strait Islander origin?
❑ No ❑ Yes Aboriginal ❑ Yes Torres Strait Islander

In which country were you born?
❑ Australia ❑ England ❑ New Zealand ❑ Italy
❑ Vietnam ❑ India ❑ Scotland ❑ Other – please specify
_____
What is your ancestry?
❑ English ❑ Irish ❑ Scottish ❑ Italian
❑ German ❑ Chinese ❑ Australian ❑ Other – please specify_____

**Q2. What is your age?**
❑50 to 55 years ❑56 to 60 years ❑61 to 65 years
❑66 to 70 years

**Q3. What is your relationship status?** ❑Partner ❑No partner

**Q4. What is the highest level of education you completed?**
❑Primary ❑Secondary ❑Tertiary

**Q5. What is your current employment status?**
❑Employed (full time paid) ❑Employed (part time paid) ❑Voluntary work only
❑Unemployed (looking for work) ❑Not in labour force (includes homemaker, pensioner, retired)

**Q6. In the last 6-months how many times have you attended your General Practitioner (GP)?**
_____

**Q7. In the last 6-months how many times have you attended a Medical Specialist or Specialist Clinic? _____**

**Q8. In the last 6-months how many times have you been to hospital?** Same day _____
Overnight _____

**Q9a. Do you have a chronic disease eg: heart disease, type II diabetes, chronic lung disease, osteoarthritis, etc? If so, how many**
❑0 ❑1 ❑2 ❑3 ❑>=4

**Q9b. Are you <u>currently</u> taking any medications for blood pressure?** ❑ Yes ❑ No

**The next questions are about any physical activities that you may have done in the last week:**

**Q10. In the last week, how many times have you walked continuously, for at least 10 minutes, for recreation, exercise or to get to or from places?**
Times_____

**Q11. What do you estimate was the total time that you spent walking in this way in the last week?**
In hours and/or minutes minutes_____
Hour's _____

**Q12. In the last week, how many times did you do any vigorous gardening or heavy work around the yard, which made you breathe harder or puff and pant?**
Times _____

**Q13. What do you estimate was the total time that you spent doing vigorous gardening or heavy work around the yard in the last week?**
In hours and/or minutes minutes_____
Hour's _____

**The next questions exclude household chores, gardening or yard work:**

**Q14. In the last week, how many times did you do any vigorous physical activity which made you breathe harder or puff and pant? (e.g. jogging, cycling, aerobics, competitive tennis)**
Times _____

**Q15. What do you estimate was the total time that you spent doing this vigorous physical activity in the last week?**
In hours and/or minutes minutes_____
Hour's _____

**Q16. In the last week, how many times did you do any other more moderate physical activities that you have not already mentioned? (e.g. gentle swimming, social tennis, golf)**
Times _____

**Q17. What do you estimate was the total time that you spent doing these activities in the last week?**
In hours and/or minutes minutes_____
Hour's _____

**To what extent do you agree or disagree with the following statements about physical activity and health?**

**Q18(a) Taking the stairs at work or generally being more active for at least 30 minutes each day is enough to improve your health.**
❑strongly disagree ❑disagree ❑neither agree nor disagree ❑agree ❑strongly agree

**Q18 (b) Half an hour of brisk walking on most days is enough to improve your health.**
❑strongly disagree ❑disagree ❑neither agree nor disagree ❑agree ❑strongly agree

**Q18(c) To improve your health it is essential for you to do vigorous exercise for at least 20 minutes each time, three times a week.**
❑strongly disagree ❑disagree ❑neither agree nor disagree ❑agree ❑strongly agree

**Q18 (d) Exercise doesn't have to be done all at one time—blocks of 10 minutes are okay.**
❑strongly disagree ❑disagree ❑neither agree nor disagree ❑agree ❑strongly agree

**Q18 (e) Moderate exercise that increases your heart rate slightly can improve your health.**
❑strongly disagree ❑disagree ❑neither agree nor disagree ❑agree ❑strongly agree

**Enjoyment of physical activity**

**Q19 I enjoy doing physical activity or exercise.**
❑strongly disagree ❑disagree ❑neither agree nor disagree ❑agree ❑strongly agree

**Group Exercise program only**

**Q20. In a typical week what is the estimated time you spent travelling to and from the Group Exercise Program?**
_____

**What was your mode of transport?** _____

*Thank you for completing these questions!*

**The SF-12v2 Health Survey, Acute (Australia)**

UNIVERSITY OF CANBERRA
AUSTRALIA'S CAPITAL UNIVERSITY

# Your Health and Well-Being

| | |
|---|---|
| Name | |
| Address | |

---

**This questionnaire asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities.** ***Thank you for completing this survey!***

**For each of the following questions, please mark an ☒ in the one box that best describes your answer.**

1. **In general, would you say your health is:**

| Excellent | Very good | Good | Fair | Poor |
|---|---|---|---|---|
| ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

2. **The following questions are about activities you might do during a typical day. Does <u>your health now limit you</u> in these activities? If so, how much?**

| | Yes, limited a lot | Yes, limited a little | No, not limited at all |
|---|---|---|---|
| a | <u>Moderate activities</u>, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf | ☐ 1 | ☐ 2 | ☐ 3 |
| b | Climbing <u>several</u> flights of stairs | ☐ 1 | ☐ 2 | ☐ 3 |

**3. During the <u>past week</u>, how much of the time have you had any of the following problems with your work or other regular daily activities <u>as a result of your physical health</u>?**

| | All of the time | Most of the time | Some of the time | A little of the time | None of the time |
|---|---|---|---|---|---|
| a <u>Accomplished less</u> than you would like | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| b Were limited in the <u>kind</u> of work or other activities | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

**4. During the <u>past week</u>, how much of the time have you had any of the following problems with your work or other regular daily activities <u>as a result of any emotional problems</u> (such as feeling depressed or anxious)?**

| | All of the time | Most of the time | Some of the time | A little of the time | None of the time |
|---|---|---|---|---|---|
| a <u>Accomplished less</u> than you would like | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| b Did work or other activities <u>less carefully than usual</u> | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

**5. During the <u>past week</u>, how much did <u>pain</u> interfere with your normal work (including both work outside the home and housework)?**

| Not at all | A little bit | Moderately | Quite a bit | Extremely |
|---|---|---|---|---|
| ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

**6. These questions are about how you feel and how things have been with you <u>during the past week</u>. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the <u>past week</u>…**

| | All of the time | Most of the time | Some of the time | A little of the time | None of the time |
|---|---|---|---|---|---|
| a Have you felt calm and peaceful? | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| b Did you have a lot of energy? | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| c Have you felt downhearted and depressed? | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

**7. During the <u>past week</u>, how much of the time has your <u>physical health or emotional problems</u> interfered with your social activities (like visiting with friends, relatives, etc.)?**

| All of the time | Most of the time | Some of the time | A little of the time | None of the time |
|---|---|---|---|---|
| ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

***Thank you for completing these questions!***

## Appendix 6: Home-based physical activity program


Your Physical Activity Program

Your goal:

Type of physical activity:

How often:

How hard:

How long:

Monitor yourself:

- Symptoms
- How hard you're working

Progress your program:

Do:

- Wear comfortable clothing and footwear
- Drink plenty of water before, during and after exercise

Don't:

- exercise straight after heavy meals. Allow 1-2 hours.
- exercise if you have a fever or are unwell
- exercise in extreme temperatures

*"30 minutes of regular, moderate intensity physical activity on most days is needed to reduce the risk of disease and injury".*
(World Health Organization 2004, National Physical Activity Guidelines for Australian Adults 2005)

**Appendix 7: Physical activity diary**

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## Exercise Diary

*Evaluating an aerobic exercise program.*

Name _____

Address

_____

Every time you exercise please record the following information.
Remember at the end of <u>every month</u> to return your exercise diary to the researchers in the reply paid envelope.
If you have any queries or concerns, contact Nicole Freene on 0400 502 902.

| Date | Type of exercise eg: walk, bike, swim | Duration ie: how long did you exercise for? | Rate of perceived exertion (RPE) (0-10) | Distance eg: 2 km, 20 laps |
|---|---|---|---|---|
| | | | | |
| | | | | |

## Borg rating of perceived exertion scale (RPE)

0. Nothing

0.5. Very very weak

1.Very weak

2.Weak (light)

3. Moderate

4. Somewhat strong

5. Strong

6.

7.Very very strong

8.

9.

10. Maximal !

| Date | Type of exercise eg: walk, bike, swim | Duration ie: how long did you exercise for? | Rate of perceived exertion (RPE) (0-10) | Distance eg: 2 km, 20 laps |
|---|---|---|---|---|
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| Date | Type of exercise eg: walk, bike, swim | Duration ie: how long did you exercise for? | Rate of perceived exertion (RPE) (0-10) | Distance eg: 2 km, 20 laps |
|---|---|---|---|---|
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**Thank you for completing!**
**Please return in the reply paid envelope at the end of the month**

**Appendix 8: ActiGraph instructions**

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# *Evaluating a group-based aerobic exercise program.*

# *ActiGraph Information Leaflet*

The aim of this study is to increase physical activity in middle-aged insufficiently active individuals to prevent chronic disease.

As part of this study we are asking people to wear a physical activity monitor like the one pictured here, called the **"ActiGraph"**. This leaflet provides more information about the ActiGraph.


**What is the ActiGraph?**
The ActiGraph is a small machine that records information about physical activity patterns. The ActiGraph records body movements during normal daily activities such as walking and jogging. It records no other information and is not harmful in any way.

**What is involved?**
Everyone participating in this study will be asked to wear an ActiGraph for 7 days.
If you are agree to take part, the principal researcher will give you the ActiGraph during one of your group exercise sessions. Following the completion of the group exercise sessions, the ActiGraph will be given to you during your follow-up assessments over the 2 year study period. The principal researcher will explain in more detail what is involved and can answer any questions you may have.

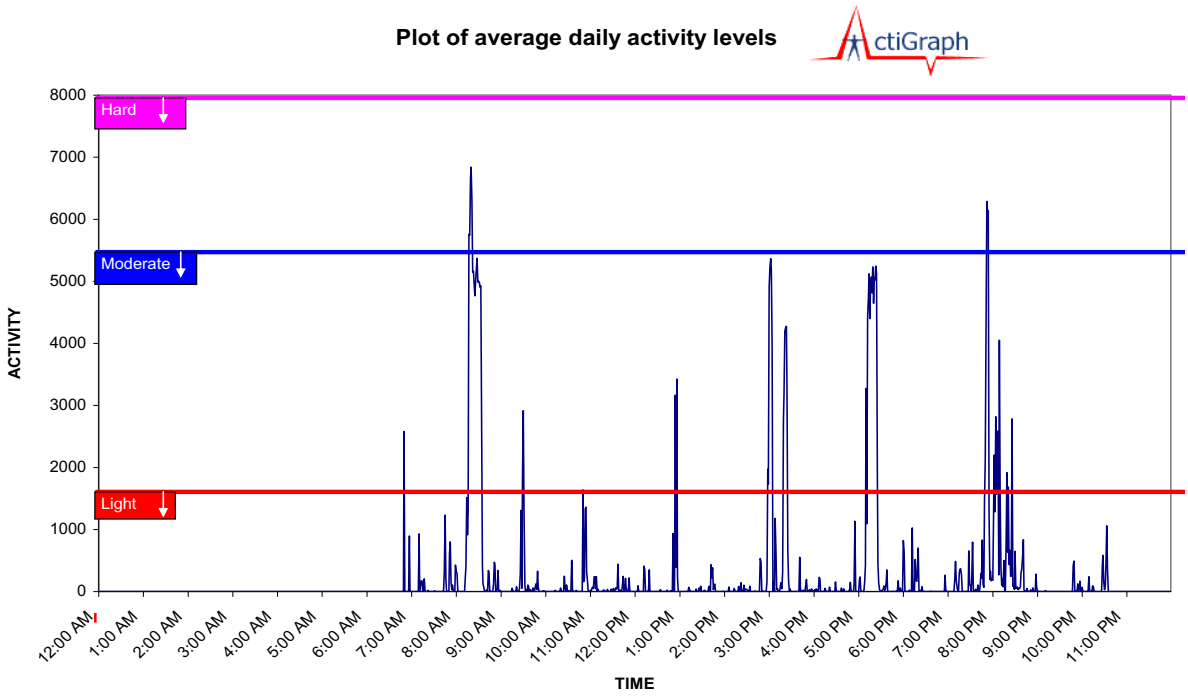
**What am I supposed to do with the ActiGraph?**
You will be asked to wear the ActiGraph for 7 days during the time you are awake, putting it on in the morning and taking it off when you go to bed at night. You will

need to remove the monitor before you shower, bath or go swimming as it may be damaged if it gets wet.

The ActiGraph should be worn on the waist using an elastic belt, which will be provided. It can be worn either underneath or on top of your clothing. The principal researcher who visits you will show you how to wear the monitor.

**What do I do after I have worn the ActiGraph for 7 days?**
After you have worn the ActiGraph for 7 days you will return it to the Chifley YMCA at a pre-arranged time where the principal researcher will collect it.

**Do I get anything for taking part?**
You will receive personalised feedback on your activity levels, which will look similar to the graph shown in the picture below.




**What will happen to my personal details?**
Your details will be kept completely confidential and will only be used for research purposes. Only authorised researchers at the University of Canberra will have access to your personal information. The results of the study will never include any names and addresses.

**What if I have any other questions?**
If you have any additional questions please call Nicole Freene, PhD Candidate, Faculty of Health, University of Canberra, on 0400 502 902.

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# Thank you for agreeing to wear the ActiGraph!

Please find enclosed:

- **The ActiGraph.**
  As soon as you open this package please put on the ActiGraph. The ActiGraph should be placed around your waist using the elastic belt and held snugly against the body. The ActiGraph device needs to be worn on the right hip. It can be worn above or beneath clothing as it is not necessary for the device to make contact with the skin. If there is excess elastic, please fill free to trim the length.

  Please record the date and time you put on the ActiGraph in the exercise diary provided. Also recording at the end of the week the date and time you take the device off.

  Please wear the ActiGraph for 7 consecutive days during the time you are awake, putting it on in the morning and taking it off when you go to bed at night. You will need to remove the device before you shower, bath or go swimming as it may be damaged if it gets wet.

  The ActiGraph devices are worth approximately $300 each, so please be very careful with them.

- **Exercise Diary.**
  The exercise diary should be completed for the week that you are wearing the ActiGraph only. It should be completed on a daily basis so you keep an accurate record of what you have been doing.

  Please continue to fill in your monthly exercise diary as well. Unfortunately this means doubling up on your physical activity entries for a week but if this is possible it would be much appreciated. If you are only able to do one diary, I would prefer that you complete the exercise diary for the week that you are wearing the ActiGraph.

- **The Active Australia Survey.**
  Please complete this at the end of the week that you have been wearing the ActiGraph.

**Once you have worn the ActiGraph for 7 consecutive days please place it in the provided envelope, along with your completed Exercise diary and Active Australia Survey and return it to the YMCA during your exercise class.**

During your assessment at the end of the group exercise program I will provide you with a printout of your activity levels from the ActiGraph recording period.

Any questions please call me 0400 502 902. Thanks again – NICOLE.

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# *Evaluating a home-based aerobic exercise program.*

## *ActiGraph Information Leaflet*

The aim of this study is to increase physical activity in middle-aged insufficiently active individuals to prevent chronic disease.

As part of this study we are asking people to wear a physical activity monitor like the one pictured here, called the **"ActiGraph"**. This leaflet provides more information about the ActiGraph.


**What is the ActiGraph?**

The ActiGraph is a small machine that records information about physical activity patterns. The ActiGraph records body movements during normal daily activities such as walking and jogging. It records no other information and is not harmful in any way.

**What is involved?**

Everyone participating in this study will be asked to wear an ActiGraph for 7 days.

If you are agree to take part, you will be sent the ActiGraph in the mail. The principal researcher will telephone you to explain in more detail what is involved and can answer any questions you may have.

**What am I supposed to do with the ActiGraph?**

You will be asked to wear the ActiGraph for 7 days during the time you are awake, putting it on in the morning and taking it off when you go to bed at night. You will

need to remove the monitor before you shower, bath or go swimming as it may be damaged if it gets wet.

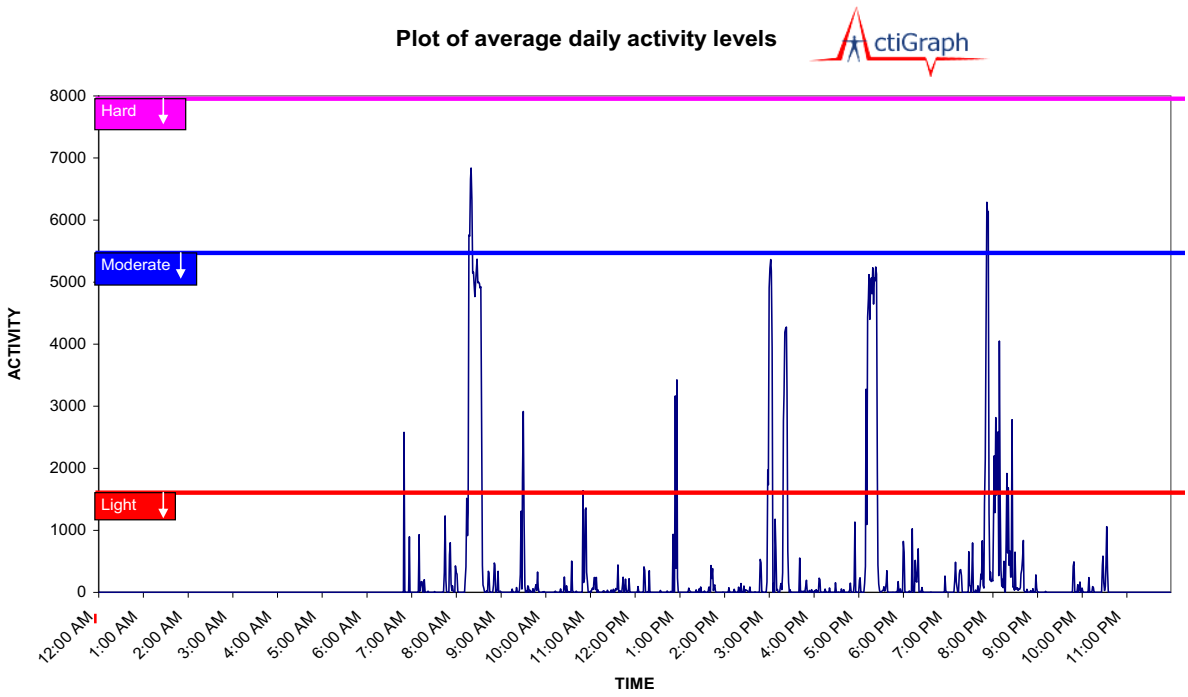
The ActiGraph should be worn on the waist using an elastic belt, which will be provided. It can be worn either underneath or on top of your clothing.

**What do I do after I have worn the ActiGraph for 7 days?**

After you have worn the ActiGraph for 7 days you will be required to return the ActiGraph via mail in the provided reply paid envelope.

**Do I get anything for taking part?**

You will receive personalised feedback on your activity levels, which will look similar to the graph shown in the picture below.




**What will happen to my personal details?**

Your details will be kept completely confidential and will only be used for research purposes. Only authorised researchers at the University of Canberra will have access to your personal information. The results of the study will never include any names and addresses.

**What if I have any other questions?**

If you have any additional questions please call Nicole Freene, PhD Candidate, Faculty of Health, University of Canberra, on 0400 502 902.

UNIVERSITY OF CANBERRA
AUSTRALIA'S CAPITAL UNIVERSITY

# Thank you for agreeing to wear the ActiGraph!

Please find enclosed:

- **The ActiGraph.**
  As soon as you open this package please put on the ActiGraph. The ActiGraph should be placed around your waist using the elastic belt and held snugly against the body. The ActiGraph device needs to be worn on the right hip. It can be worn above or beneath clothing as it is not necessary for the device to make contact with the skin. If there is excess elastic, please fill free to trim the length.

  Please record the date and time you put on the ActiGraph in the exercise diary provided. Also recording at the end of the week the date and time you take the device off.

  Please wear the ActiGraph for 7 consecutive days during the time you are awake, putting it on in the morning and taking it off when you go to bed at night. You will need to remove the device before you shower, bath or go swimming as it may be damaged if it gets wet.

  The ActiGraph devices are worth approximately $300 each, so please be very careful with them.

- **Exercise Diary.**
  The exercise diary should be completed for the week that you are wearing the ActiGraph only. It should be completed on a daily basis so you keep an accurate record of what you have been doing.

  Please continue to fill in your monthly exercise diary as well. Unfortunately this means doubling up on your physical activity entries for a week but if this is possible it would be much appreciated. If you are only able to do one diary, I would prefer that you complete the exercise diary for the week that you are wearing the ActiGraph.

- **The Active Australia Survey.**
  Please complete this at the end of the week that you have been wearing the ActiGraph.

**Once you have worn the ActiGraph for 7 consecutive days please place it in the reply paid padded bag, along with your completed Exercise diary and Active Australia Survey and post it back to me.**

I will be in touch with you in the near future to arrange a home visit to do your assessment at the end of the physical activity program. At this time I will also provide you with a printout of your activity levels from the ActiGraph recording period. Any questions please call me 0400 502 902. Thanks again – NICOLE.

## Appendix 9: Australian New Zealand Clinical Trials Registry (ANZCTR) PAAH trial protocol

Questions in **bold** text are mandatory. **(*)**

| | |
|---|---|
| **Request Number:** | 343366 |
| **Current Page:** | Review |

# Trial from ANZCTR

| | |
|---|---|
| **Trial ID** | ACTRN12611000890932 |
| **Trial Status:** | Registered |
| **Date Submitted:** | 19/08/2011 |
| **Date Registered:** | 19/08/2011 |
| | **Retrospectively registered** |

**Page 1**

| | |
|---|---|
| **Public title** | 'Physical Activity at Home (PAAH)', Evaluation of a group versus home based physical activity program in community dwelling middle aged adults. |
| **Study title in 'Participant-Intervention-Comparator- Outcome (PICO)' format** | In middle-aged community dwelling adults is a physiotherapy-led home based physical activity program more effective than a community group based physical activity program in terms of long term physical activity adherance, health benefits and cost? |
| **Secondary ID [1]** | Nil |
| UTN | Nil |
| Trial acronym | PAAH |

**Page 2**

| **Health condition(s) or problem(s) studied:** | |
|---|---|
| cardiovascular disease | |
| type 2 diabetes | |
| obesity | |
| high blood pressure | |
| lipid disorders | |
| osteoporosis | |
| colon cancer | |
| breast cancer | |
| depression | |
| anxiety | |
| **Condition category:** | **Condition code:** |
| Public Health | Health promotion/education |

**Page 3**

| | |
|---|---|
| **Descriptions of intervention(s) / exposure** | Home based intervention.<br>Baseline outcome measures were taken in participants homes eliminating a number of barriers to physical activity adoption. Participants were encouraged to invite a support person to attend. After baseline measures were completed motivational interviewing was used to devise a physical activity program. A physiotherapist discussed type, frequency, intensity, duration, benefits, barriers, goals, self-monitoring and progression of physical activity aiming to achieve 30 minutes of moderate intensity physical activity on most days of the week eventually.<br>Participants were contacted by a physiotherapist via phone providing advice and support 2 weeks after the initial assessment and them monthly over a six month period, a total of approximately 6 phone calls. |
| **Intervention Code:** | Prevention |
| **Intervention Code:** | Lifestyle |
| **Intervention Code:** | Behaviour |
| **Comparator / control treatment** | Group exercise program.<br>This group acted as an active control, replicating standard physical activity options provided in the community. Participants attended a local YMCA for their baseline measures. Participants had a choice of times for the group based exercise program which were all during business hours. These sessions were run by a YMCA fitness instructor at the YMCA once a week, for 60 minutes, over 6 months. The exercise program involved upper and lower body strengthening exercises, gross motor skill training |

| | |
|---|---|
| | and aerobic fitness training. Participants were encouraged to increase their physical activity levels outside of the group sessions, aiming to achieve 30 minutes of moderate intensity exercise most days but individual physical activity programs were not specifically designed for this group. |
| **Control group** | Active |

**Page 4**

| | |
|---|---|
| **Primary Outcome:** | Physical activity adherence assessed via exercise diaries. Participants were encouraged to record any exercise completed in the exercise diary and return the diaries in the provided reply paid envelope at the end of the month. Exercise completed will be compared to exercise prescribed to determine adherence. |
| ***Timepoint:*** | 6 (end of intervention period), 12, 18 and 24 months. |
| **Primary Outcome:** | Physical activity adherence or 'sufficient' physical activty via the Active Australia Survey. All particpants will complete this survey at the below timepoints. |
| ***Timepoint:*** | Baseline, 6(end of intervention period), 12, 18 and 24 months. |
| **Primary Outcome:** | Physical activity adherence via the Actigraph GT1M accelerometer. All particpants will wear the accelerometer for a week in the month prior to the data collection points. The Active Australia Survey will be completed at the end of this week. |
| ***Timepoint:*** | 6 (end of the intervention period), 12, 18 and 24 months. |
| **Secondary Outcome:** | Aerobic capacity via the 2 minute step test. |
| ***Timepoint:*** | Baseline, 6 (end of the intervention period), 12, 18 and 24 months. |
| **Secondary Outcome:** | Quality of life via the SF-12 quality of life survey. |
| ***Timepoint:*** | Baseline, 6 (end of the intervention period), 12, 18 and 24 months. |
| **Secondary Outcome:** | Disease biomarkers via waist circumference (cm), waist:hip ratio, body mass index (kg/m2) and blood pressure (mmHg). |
| ***Timepoint:*** | Baseline, 6(end of the intervention period), 12, 18 and 24 months. |

**Page 5**

| | |
|---|---|
| **Key inclusion criteria** | 1. 50-65 years old.<br>2. Sedentary, that is, no participation in regular moderate or vigorous physical activity for 30 minutes 2 or more times a week for at least 6 months.<br>3. No serious medical conditions, such as unstable angina, uncontrolled hypertension, diagnosed or hospitalised with chest pain, heart attack or heart surgery in the past 6 months.<br>4. No servere functional impairments due to multiple medical or psychiatric diseases.<br>5. Not planning to move from the area within 2 years.<br>6. Only one person per household was eligible.<br>7. English speaking and appropriate cognitive skills to provide informed consent and actively engage in a physical activity program.<br>8. Medical screening was undertaken using the Sports Medicine Australia (SMA) Pre-Exercise Screening System. If a participant answered 'yes' to any of the SMA screening questions, they were asked to attend their local medical officer to receive medical clearance before they were included in the study. |
| **Minimum age** | 50 Years |
| **Maximum age** | 65 Years |
| **Gender** | Both males and females |
| **Healthy volunteers?** | Yes |
| **Key exclusion criteria** | 1.See the above inclusion criteria.<br>2. Resting systolic blood pressure > 200mmHg, diastolic blood pressure > 100mmHg, resting heart rate > 100 bpm. |

**Page 6**

| | |
|---|---|
| **Study type** | Interventional |
| **Purpose of the study** | Prevention |
| **Allocation to intervention** | Nonrandomised trial |
| Describe the procedure for enrolling a subject and allocating the treatment (allocation concealment procedures)<br><br>Describe the methods used to generate the sequence in which subjects will be randomised (sequence generation) | |
| Masking / blinding | Open (masking not used) |
| Who is / are masked / blinded (choose all that | |

| | |
|---|---|
| apply) | |
| Assignment | Parallel |
| Other design features | |
| Type of endpoint (s) | Efficacy |
| Statistical Methods/Analysis | |

**Page 7**

| | |
|---|---|
| Phase | Not Applicable |
| **Anticipated date of first participant enrolment** | 16/02/2011 |
| Date of first participant enrolment | 16/02/2011 |
| Anticipated date last participant recruited/enrolled | 16/04/2011 |
| Actual date last participant recruited/enrolled | 16/04/2011 |
| **Target sample size** | 158 |
| **Recruitment status** | Completed |

**Recruitment in Australia**

| | |
|---|---|
| **Recruitment state(s)** | |
| **Postcode:** | 2606 |

**Recruitment outside Australia**

**Page 8**

| | |
|---|---|
| **Funding Source:** | University |
| **Name:** | University of Canberra Research Student Funds |
| **Address:** | University of Canberra<br>ACT<br>2601 |
| **Country:** | Australia |
| **Primary Sponsor** | Individual |
| **Name:** | Nicole Freene |
| **Address:** | Faculty of Health<br>University of Canberra<br>ACT<br>2601 |
| **Country:** | Australia |
| **Secondary Sponsor:** | Individual |
| **Name:** | Gordon Waddington |
| **Address:** | Physiotherapy<br>Faculty of Health<br>University of Canberra<br>ACT<br>2601 |
| **Country:** | Australia |
| **Secondary Sponsor:** | Individual |
| **Name:** | Wendy Chesworth |
| **Address:** | Physiotherapy<br>Faculty of Health<br>University of Canberra<br>ACT<br>2601 |
| **Country:** | Australia |
| **Secondary Sponsor:** | Individual |
| **Name:** | Rachel Davey |
| **Address:** | Centre for Reserach & Action in Public Health<br>Faculty of Health<br>University of Canberra<br>ACT<br>2601 |
| **Country:** | Australia |

**Page 9**

| | |
|---|---|
| **Has the study received approval from at least one Ethics Committee?** | Yes |
| Ethics Committee name: | University of Canberra Committee for Ethics in Human Research |
| Address: | University of Canberra<br>ACT<br>2601 |
| Country: | Australia |
| Approval Date: | 20/11/2009 |
| Submitted Date: | |
| HREC: | 09-97 |
| Brief summary | The aim of this study is to evaluate a new evidence based model for increasing the adoption and maintenance of physical activity in sedentary community dwelling middle aged individuals. Specifically targeting those individulas who are less likely to adopt and maintain exercise as they do not normally access the currently available community group exercise programs.<br><br>We hypothesize that<br>(i) There are a large number of individuals in the community aged 50-65 years who are not interested in group exercise, the common method used to increase the population's level of physical activity.<br>(ii) A proportion of this group would commence exercising if an alternative method of increasing physcial activity was available, such as a home based approach.<br>(iii) The home based program would produce health benfits equivalent to those seen in the group based exercise program for sedentary adults 50-65 years old.<br>(iv) Those that commence the home based program are more likely to continue with an increase in physical activity in the long term, as compared to a group based program.<br>(v) A home based approach to increasing physical activity with minimal support is more cost effective than a group based intervention, taking into consideration long term physical activity maintenance. |
| Trial website | |
| Trial related presentations / publications | Freene N, Waddington G, Chesworth W, Davey R, Cochrane T (2013). Community group exercise versus physiotherapist-led home-based physical activity program: barriers, enablers and preferences in middle-aged adults. Physiotherapy Theory and Practice 0(0), 1-9. DOI: doi:10.3109/09593985.2013.816894.<br><br>Freene N, Waddington G, Chesworth W, Davey R, Cochrane T (2013). Physiotherapist-led home-based physical activity program versus community group exercise for middle-aged adults: Quasi-experimental comparison. Open Journal of Preventive Medicine 3, 229-237. DOI: 10.4236/ojpm.2013.32031.<br><br>Freene N, Waddington G, Chesworth W, Davey R, Cochrane T (2013). Validating two self-report physical activity measures in middle-aged adults completing a group exercise or home-based physical activity program. Journal of Science and Medicine in Sport(0) DOI: http://dx.doi.org/10.1016/j.jsams.2013.11.002.<br><br>Freene N, Waddington G, Chesworth W, Davey R, Goss J (2011). 'Physical activity at home (PAAH)', evaluation of a group versus home based physical activity program in community dwelling middle aged adults: rationale and study design. BMC Public Health 11, 883-883.<br><br>Freene N, Waddington G, Davey R, Cochrane T (2013). Longitudinal comparison of a physiotherapist-led, home-based and group-based program for increasing physical activity in community-dwelling middle-aged adults. Australian Journal Of Primary Health. |
| Public Notes | |

**Page 10**

**Principal Investigator**

| | |
|---|---|
| Title: | Ms |
| Name: | Nicole Freene |
| Address: | Faculty of Health University of Canberra BRUCE ACT 2601 |
| Country: | Australia |
| Tel: | +61 2 6201 2638 |
| Fax: | |
| Email: | u3033443@uni.canberra.edu.au |

**Contact person for public queries**

| | |
|---|---|
| Title: | Ms |
| Name: | Nicole Freene |
| Address: | Faculty of Health University of Canberra ACT 2601 |
| Country: | Australia |
| Tel: | +61 2 6201 2638 |

| | |
|---|---|
| Fax: | |
| Email: | u3033443@uni.canberra.edu.au |

**Contact person for scientific queries**

| | |
|---|---|
| Title: | Ms |
| Name: | Nicole Freene |
| Address: | Faculty of Health University of Canberra ACT 2601 |
| Country: | Australia |
| Tel: | +61 2 6201 2638 |
| Fax: | |
| Email: | u3033443@uni.canberra.edu.au |

**Contact person responsible for updating information**

| | |
|---|---|
| Title: | Ms |
| Name: | Nicole Freene |
| Address: | Faculty of Health University of Canberra ACT 2601 |
| Country: | Australia |
| Tel: | +61 02 6201 2638 |
| Fax: | |
| Email: | u3033443@uni.canberra.edu.au |

**Appendix 10: PAAH Injury recording sheet**

**Evaluating an aerobic exercise program: PAAH**

**Injury Recording Sheet**

| Date & Initial | Participant Name | Injury Description | Treatment / Action | Follow-up (if indicated) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**Please note:** If the injuries reported are any greater than mild muscular soreness or fatigue and require a medical review, please inform the principal researcher, Nicole Freene, on 0400 502 902. Thank you.