

The Green Prescription and New Zealand Older Adults: Motives, Benefits and Barriers

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Asmita Patel

Date:

Conference Presentations and Publication Arising from this Doctoral Thesis

- Patel, A., Schofield, G., & Kolt, G. (2008). The effect of pedometer and time-based physical activity interventions on depressive symptomatology in low-active older adults [Abstract]. ASICS Conference of Science and Medicine in Sport. *Journal of Science and Medicine in Sport*, 11(Suppl.), 19.
- Patel, A., Schofield, G., Kolt, G., & Keogh, J. (2009). Barriers and motives for physical activity in older adults: Results from the Healthy Steps study. *Proceedings from the 6th Annual Scientific Conference of the Australasian Society for Behavioural Medicine* (p.106). Auckland, New Zealand: Australasian Society for Behavioural Health and Medicine.
- Patel, A., Schofield, G., Kolt, G., & Keogh, J. (2009). Participant evaluations of the Healthy Steps Green Prescription intervention. *Proceedings of the New Zealand Association of Gerontology and Age Concern New Zealand Conference* (p.67), Wellington, New Zealand.
- Patel, A., Schofield, G., Kolt, G., & Keogh, J. (2009). Perceived motives and barriers for physical activity: Results from a primary care physical activity intervention for older adults [Abstract]. Australian Conference of Science and Medicine in Sport and the Seventh National Physical Activity Conference. *Journal of Science and Medicine in Sport*, 12(Suppl.), 193.
- Kolt, G.S., Schofield, G.M., Kerse, N., Garrett, N., Schultzer, P., Ashton, T., Patel, A. (2009). The Healthy Steps study: A randomized controlled trial of a pedometer-based Green Prescription for older adults: Trial Protocol. *BMC Public Health*, 9, 404.

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My help has come from God (Psalm 121:2).

God (always) provides (Genesis 22:1-15).

Let us remember that we are created in Christ Jesus to do good works that God prepared in advance for us to do (Ephesians 2:10).

God, you have sustained me. You have told me (time and time again) that you will never leave me or forsake me (Hebrews 13:5).

Ethical Approval



MEMORANDUM

To: Grant Schofield
From: **Madeline Banda** Executive Secretary, AUTECH
Date: 4 December 2006
Subject: Ethics Application Number 06/185 **General Practitioners and prescribing physical activity: a qualitative study.**

Dear Grant

Thank you for providing written evidence as requested. I am pleased to advise that it satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTECH) at their meeting on 9 October 2006 that as the Executive Secretary of AUTECH I have approved your ethics application. This delegated approval is made in accordance with section 5.3.2.3 of AUTECH's *Applying for Ethics Approval: Guidelines and Procedures* and is subject to endorsement at AUTECH's meeting on 22 January 2007.

Your ethics application is approved for a period of three years until 29 November 2009.

I advise that as part of the ethics approval process, you are required to submit to AUTECH the following:

A brief annual progress report indicating compliance with the ethical approval given using form EA2, which is available online through <http://www.aut.ac.nz/research/ethics>, including when necessary a request for extension of the approval one month prior to its expiry on 29 November 2009;

A brief report on the status of the project using form EA3, which is available online through <http://www.aut.ac.nz/research/ethics>. This report is to be submitted either when the approval expires on 29 November 2009 or on completion of the project, whichever comes sooner;

It is also a condition of approval that AUTECH is notified of any adverse events or if the research does not commence and that AUTECH approval is sought for any alteration to the research, including any alteration of or addition to the participant documents involved.

You are reminded that, as applicant, you are responsible for ensuring that any research undertaken under this approval is carried out within the parameters approved for your application. Any change to the research outside the parameters of this approval must be submitted to AUTECH for approval before that change is implemented.

Please note that AUTECH grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to make the arrangements necessary to obtain this.

To enable us to provide you with efficient service, we ask that you use the application number and study title in all written and verbal correspondence with us. Should you have any further enquiries regarding this matter, you are welcome to contact Charles Grinter, Ethics Coordinator, by email at charles.grinter@aut.ac.nz or by telephone on 921 9999 at extension 8860.

On behalf of the Committee and myself, I wish you success with your research and look forward to reading about it in your reports.

Yours sincerely

Madeline Banda
Executive Secretary
Auckland University of Technology Ethics Committee
Cc: Asmita Patel asmita.patel@aut.ac.nz



MEMORANDUM

Auckland University of Technology Ethics Committee (AUTEC)

To: Grant Schofield
From: **Madeline Banda** Executive Secretary, AUTEC
Date: 17 August 2007
Subject: Ethics Application Number 07/89 **Process evaluation of the Healthy Steps Green prescription programme (study 1) and Barriers and motivators to physical activity in older adults (study 2).**

Dear Grant

Thank you for providing written evidence as requested. I am pleased to advise that it satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC) at their meeting on 11 June 2007 and that on 16 August 2007 as the Executive Secretary of AUTEC I approved your ethics application. This delegated approval is made in accordance with section 5.3.2.3 of AUTEC's *Applying for Ethics Approval: Guidelines and Procedures* and is subject to endorsement at AUTEC's meeting on 10 September 2007.

Your ethics application is approved for a period of three years until 16 August 2010.

I advise that as part of the ethics approval process, you are required to submit to AUTEC the following:

A brief annual progress report indicating compliance with the ethical approval given using form EA2, which is available online through <http://www.aut.ac.nz/about/ethics>, including when necessary a request for extension of the approval one month prior to its expiry on 16 August 2010;

A brief report on the status of the project using form EA3, which is available online through <http://www.aut.ac.nz/about/ethics>. This report is to be submitted either when the approval expires on 16 August 2010 or on completion of the project, whichever comes sooner;

It is also a condition of approval that AUTEC is notified of any adverse events or if the research does not commence and that AUTEC approval is sought for any alteration to the research, including any alteration of or addition to the participant documents involved.

You are reminded that, as applicant, you are responsible for ensuring that any research undertaken under this approval is carried out within the parameters approved for your application. Any change to the research outside the parameters of this approval must be submitted to AUTEC for approval before that change is implemented.

Please note that AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to make the arrangements necessary to obtain this.

To enable us to provide you with efficient service, we ask that you use the application number and study title in all written and verbal correspondence with us. Should you have any further enquiries regarding this matter, you are welcome to contact Charles Grinter, Ethics Coordinator, by email at charles.grinter@aut.ac.nz or by telephone on 921 9999 at extension 8860.

On behalf of the Committee and myself, I wish you success with your research and look forward to reading about it in your reports.

Yours sincerely

Madeline Banda
Executive Secretary
Auckland University of Technology Ethics Committee
Cc: Asmita Patel asmita.patel@aut.ac.nz

Abstract

Despite empirical evidence for the health-related benefits of physical activity, a large proportion of older adults are insufficiently active. Research has demonstrated that the primary care setting is an ideal context in which to counsel older adults for physical activity. In New Zealand, the Green Prescription is the nationwide physical activity scripting programme, whereby individuals (primary care patients) receive a prescription for physical activity from their primary care physician, combined with telephone-based counseling for physical activity from a trained exercise counselor. The Green Prescription has been found to be effective in increasing physical activity in previously low-active and sedentary adults, including older adults. However, more information is required about the efficacy of Green Prescription use with older adults. The present research was important because it examined participants' views and experiences of physical activity counseling via the conventional Green Prescription and a modified pedometer-based Green Prescription. The addition of a pedometer to the standard Green Prescription was done as pedometers have been shown to increase physical activity levels in low-active younger and older adults.

This thesis comprised of four interrelated studies that were designed to investigate the factors that can influence physical activity uptake and maintenance in low-active older adults. Study 1 was a qualitative study involving 15 primary care physicians. Physicians' views and experiences of physical activity counseling via the Green Prescription programme were examined. Data for Studies 2, 3 and, 4 were collected from participants who took part in the Healthy Steps study, a randomised controlled trial that compared the efficacy of a pedometer-based versus time-based Green Prescription in increasing physical activity in 330 community-dwelling older adults

The findings of this thesis indicated that physicians believed in the health-related benefits of physical activity. A nonmedication approach to a healthier lifestyle, and the ongoing specialised support that comprise the Green Prescription programme were perceived to be beneficial by physicians. Participants perceived both the conventional time-based and the modified pedometer-based Green

Prescription to be effective in helping aid and maintain their physical activity. Physician prescription for physical activity, combined with ongoing telephone-based support was found to be beneficial in aiding physical activity. Health and medical factors were identified as both barriers and motives for physical activity. Participants with multiple chronic health conditions and those in the oldest age category (76 years and older) perceived that they had more to gain from being physically active, compared to younger aged participants and those without chronic health conditions. Both versions of the Green Prescription were found to aid participants' mental health.

The findings from this thesis add to the literature, as this is the first piece of research that has examined in depth older adults' barriers and motives for physical activity within the context of the Green Prescription programme. Also, in conjunction with the Healthy Steps trial, this thesis was the first study that examined the effect that Green Prescription counseling has had on depressive symptomatology in low-active older adults. Taken together, these findings can be used to further enhance the existing, standard Green Prescription programme for older adults, by informing public health policy and primary care practice in relation to how older adults are counselled for physical activity in New Zealand. The findings from this thesis can also be applied to the design and implementation of physical activity interventions for older adults outside of New Zealand.

Chapter 1: Introduction

People aged 65 years and older are the fastest growing segment of the population in industrialised countries such as New Zealand. Statistics New Zealand has projected that those aged 65 years and older will make up a quarter of the New Zealand population by the year 2050 (Statistics New Zealand, 2004). With a worldwide trend for increased life expectancy it is important that individuals continue to experience good physical and psychological health to maintain good quality of life throughout their entire lifespan. An ageing population also places financial strain on governments and healthcare systems worldwide (Dalziel, Segal, & Elley, 2006; Roux et al., 2008). Older adults require more medical assistance, and as a group, have higher healthcare costs compared to all other age groups (Ministry of Health, 2004). To ensure both quality of life in the later years and a reduction in healthcare costs, regular physical activity engagement has been strongly recommended (DiPietro, 2001; Drewnowski & Evans, 2001; McMurdo, 2000).

Strong evidence indicates that engagement in regular (moderate-intensity) physical activity confers health benefits throughout the lifespan (Bauman, 2003; Boreham, Wallace, & Nevill, 2000; Nelson et al., 2007; Taylor et al., 2004; Wong, Wong, Pang, Azizah, & Dass, 2003). For older adults (65 years and older) regular physical activity helps to facilitate healthy ageing by lowering the risk of chronic disease, disability, and dependency in later life (DiPietro, 2001; McMurdo, 2000; Nelson et al., 2007; U.S. Department of Health and Human Services, 1996). Regular physical activity engagement can help prevent, delay, or manage non-communicable lifestyle-related diseases and conditions such as cardiovascular disease (Burke et al., 2001; Janssen & Jolliffe, 2006; Wannamethee, Shaper, Walker, 2000), type-2 diabetes (Hu et al., 1999; Sui et al., 2008; Tuomilehto et al., 2001), hypertension (Blumenthal et al., 2000; Stewart et al., 2005), some cancers (Bauman & Owen, 1999), osteoporosis, arthritis (Campbell, Roberston, Gardner, Norton, & Buchner, 1999; DiBrezzo, Shadden, Raybon, Powers, 2005; Norton et al., 2001), and depression (Brown, Ford Burton, & Marshall, 2005; Galper, Trivedi, Barlow, Dunn, & Kampert, 2006; Lampinen, Heikkinen, & Ruoppila, 2000).

Despite evidence for the health-related benefits of physical activity, a large number of older adults are low-active or sedentary, engaging in levels of physical activity insufficient for health gain (Drewnowski & Evans, 2001; Mummery, Kolt, Schofield, & McLean, 2007; Westerterp & Meijer, 2001). Recent data from a New Zealand population-based survey indicated that 66% of older adults did not meet national physical activity guidelines and 24% of older adults were sedentary (Sport and Recreation New Zealand, 2008a).

The primary health care setting is an ideal setting in which to implement a physical activity intervention for older adults (Kerse, Flicker, Jolley, Arroll & Young, 1999; Kerse, Elley, Robinson, & Arroll, 2005; Kolt, Schofield, Kerse, Garrett, & Oliver, 2007; Pinto, Goldstein, Ashba, Sciamanna, & Jette, 2005). The primary care physician (general practitioner) is usually the first point of medical contact for older adults, and with increasing age, older adults tend to visit their primary care physician on a regular basis (Croteau, Schofield, & McLean, 2006; Kerse et al., 1999). As a group, older adults tend to respect and value their primary care physician's advice and knowledge (Booth et al., 1997; Croteau et al., 2006; Kerse et al., 1999). Older adults are more likely to consider and comply with advice that has been suggested by their physician compared to younger age groups (Schutzer & Graves, 2004; Pfeiffer, Clay, & Conaster, 2001).

To address physical inactivity at a population-based level in New Zealand, the Green Prescription programme was developed and launched in 1997. The Green Prescription is the national physical activity scripting program in New Zealand. A Green Prescription is a prescription for physical activity that is administered by a primary care physician or practice nurse within the primary care setting. A number of randomised controlled trials have demonstrated the efficacy of the Green Prescription in increasing physical activity and health-related gain in previously low-active and sedentary adults, including older adults (Elley, Kerse, Arroll, & Robinson, 2003a; Kerse et al., 2005; Lawton et al., 2008; Pfeiffer et al., 2001; Swinburn, Walter, Tilyard, Russell, 1998). However, there is a gap in the current literature in relation to the factors which can influence the effectiveness of Green Prescription use (uptake and maintenance) with older adults.

The conventional time-based Green Prescription is based on achieving daily time-based goals in terms of accumulating physical activity. For example, an individual may be given a prescription that instructs them to engage in five separate 30 minute bouts of continuous physical activity per week. The conventional time-based Green Prescription is based on the recommendations of the US Surgeon General's 1996 report on the health-related benefits associated with engaging in 30 minutes of physical activity on five or more days of the week (US Department of Health and Human Services, 1996).

Recent evidence, however, suggests that health-related benefits can be conferred by short bouts of physical activity, including habitual physical activity, that accumulates throughout the day to reach the recommended level of daily physical activity that is required for health gain (Boreham et al., 2000; DeBusk, Stenestrand, Sheehan, & Haskell, 1990; Pescatello & Murphy, 1998; Wong, Wong, Pang, Azizah, & Dass, 2003). For older adults, short bouts of physical activity, such as habitual physical activity may be more achievable and sustainable. One way of monitoring and motivating this type of physical activity is through the use of pedometers.

Pedometers are an ideal mechanism for monitoring and measuring habitual physical activity (Croteau, 2004; Tudor-Locke, Myers, Bell, Harris, & Rodger, 2002). Pedometers provide instant feedback on the number steps an individual has taken, and in turn, can motivate individuals to increase their step-count and engage in more walking activity (Chan, Ryan, & Tudor-Locke, 2004; Pickering & Eakin, 2003). Pedometers are also ideal for helping individuals set step-based goals for achieving more physical activity (Dinger, Heesch, & McClary, 2005; Lauzon, Chan, Myers, & Tudor-Locke, 2008; Speck & Looney, 2001).

Pedometer-based interventions have been successful in increasing physical activity in low-active adults (Chan et al., 2004; Croteau, 2004; Mutrie, Wright, Wilson, & Gunnyeon, 2004; Stovitz, Van Wormer, Center, & Linstrom-Bremer, 2005), including older adults (Armit, Brown, Ritchie, & Trost, 2005; Farmer, Croteau, Richeson, & Jones, 2006; Jordon, Jurca, Tudor-Locke, Church, & Blair, 2005; Rosenberg et al., 2009; Talbot, Gaines, Huynh, & Metter, 2003).

Thesis Structure, Rationale and Objectives

This thesis is embedded in the larger, substantial Healthy Steps study. The Healthy Steps study was a randomised controlled trial designed to compare the efficacy of a pedometer step-count versus conventional time-based Green Prescription in increasing and maintaining physical activity in low-active, community-dwelling older adults (Kolt et al., 2009). Three hundred and thirty participants were randomly allocated to receive either the conventional time-based Green Prescription, which focused on accumulating minutes of physical activity, or a pedometer step-count Green Prescription, which focused on adding steps through habitual physical activity and goal setting.

The overall aim of this thesis is to provide a holistic view of the factors that can influence older adults' physical activity uptake and maintenance. Factors that may affect how older adults perceive and participate in a physical activity intervention such as the Green Prescription include the following: social reasons (e.g., the influence and encouragement from the primary care physician and family and friends for physical activity), physical factors (e.g., health and mobility constraints and also achieving health and mobility improvements through physical activity engagement), psychological factors (e.g., need for social contact, and mental health benefits, such as improved mood), cognitive factors (e.g., perceived benefits and barriers for physical activity) and environmental factors (e.g., safe walking paths, weather constraints). The four interrelated studies that comprise this thesis are designed to examine how the above factors impact on physical activity participation for Healthy Steps participants (See Figure 1.1)

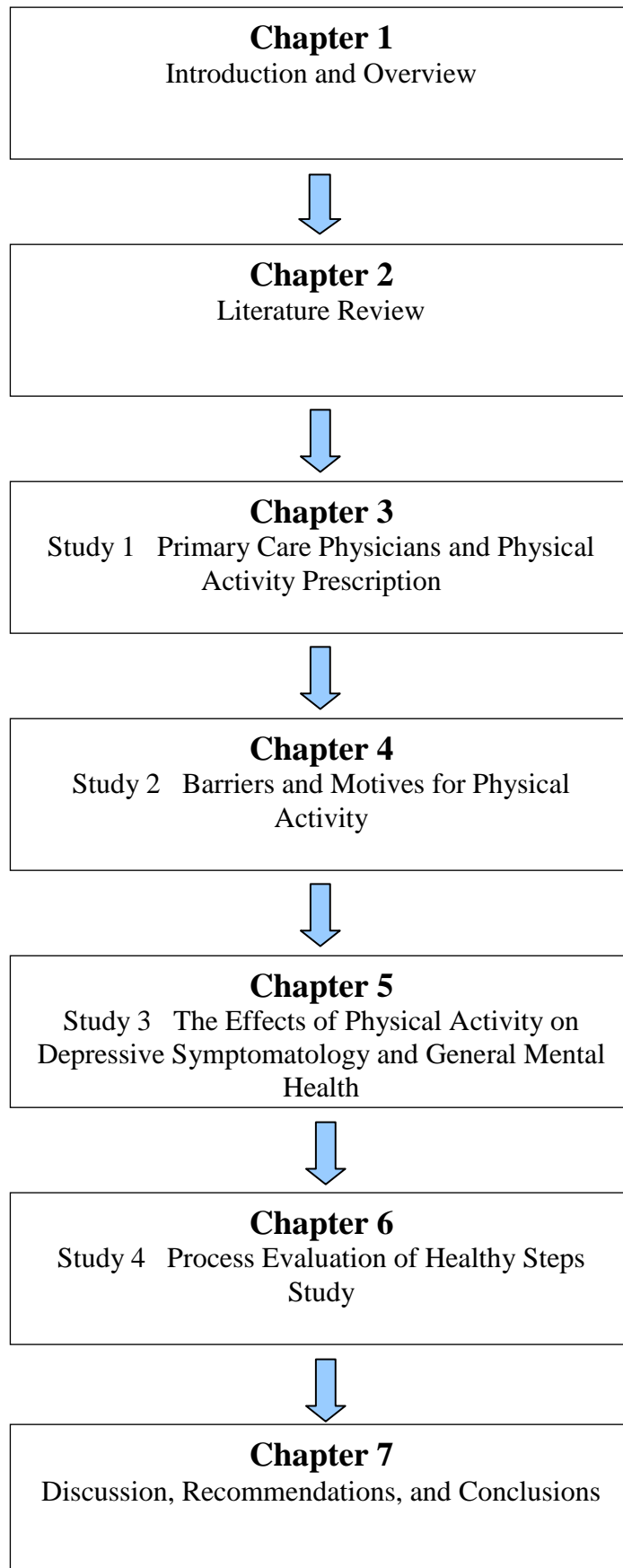


Figure 1.1 Overview of thesis structure

Figure 1.1 provides an overview of the thesis structure. This current chapter (Chapter 1) provides an introduction, rationale, and overview of the thesis. Chapter 2 provides a review of the relevant literature. Chapters 3-6 present the findings of the four studies, respectively. Each of these chapters contain a preface which is designed to provide a summary of the upcoming study and a link to earlier studies. The preface is followed by an introduction, methods, results, and discussion section. Chapter 3 examines primary care physicians' perspectives and experiences of counseling for physical activity, with a specific focus on the Green Prescription and its use with older adults. Chapter 4 focuses on the perceived barriers and motives participants experienced during their involvement in the Healthy Steps intervention. Chapter 5 examines the effect that physical activity via the two different versions of the Green Prescription had on depressive symptomatology and general mental health functioning in Healthy Steps participants over a 12-month period. Chapter 6 is designed to provide a process evaluation of the Healthy Steps study, with a focus on whether participants' evaluations of the intervention differed as a result of allocation to the two different versions of Green Prescription. This final study was also designed to identify the intervention components that participants perceived as helpful or unhelpful in aiding their physical activity participation. Chapter 7, the final chapter, provides a summary of the main findings of this thesis, and discusses recommendations for future research.

The rationale and objectives for the four interrelated studies that comprise the thesis are described in more detail below:

1. Study 1 is a qualitative study designed to identify the views and experiences of 15 primary care physicians of counseling for physical activity, with a specific focus on their views and use of the Green Prescription programme. This study is designed to examine physicians' thoughts and practices around Green Prescription use with older adults, as well as for the treatment and management of depression. Physicians' views on the role that pedometers can have in health promotion will also be explored. The rationale for this study is that within a New Zealand context limited research has been carried out that has examined primary care physicians' views and experiences of counseling for physical activity, as well as their specific use of the Green Prescription.

2. Study 2 is designed to determine if perceived barriers and motives for physical activity participation via the physician prescribed Green Prescription differ as a result of allocation to the two different versions of the Green Prescription (a time-based or a pedometer step-count Green Prescription). As well, this study will also examine if perceived barriers and motives for physical activity differ as a result of intervention outcome (an increase in physical activity at post-intervention regardless of allocation), while controlling for demographic factors (i.e., gender, age, number of chronic health conditions, and weight status) in a sample of 80 participants from the Healthy Steps study. The rationale for this study is that perceived barriers and motives for physical activity initiation and maintenance will be examined within the context of an intervention that is designed specifically for older adults. The focus of this study is on obtaining participants' perspectives as to why certain factors are perceived to be barriers or motives for physical activity.
3. Study 3 is designed to examine the effect that physical activity via the two different versions of the Green Prescription has on older adults' mental health status (i.e., depressive symptomatology and general mental health functioning). These outcomes were assessed at three time points (baseline, postintervention, and at the follow up period) in 299 participants who took part in the Healthy Steps study. The Geriatric Depression Scale (GDS-15) (Yeasavage et al., 1983) and the SF-36 health questionnaire (McHorney et al., 1993) will be used to assess depressive symptomatology and general mental health status, respectively, at the three time points. The rationale behind this study is that there is research-based evidence for the positive affect that physical activity can have on mental health functioning. Hence, this study is designed to examine the psychological health-related benefits associated with receiving a Green Prescription.
4. Study 4 is designed to examine if participants' evaluations of the Healthy Steps study differ as a result of allocation to either the conventional time-based Green Prescription or the pedometer-based Green Prescription. This study is also designed to gain an understanding of the participants'

perspectives as to why these two different Green Prescription interventions helped them to become and remain physically active. The rationale behind this study is that limited research has examined participants' evaluations of their Green Prescription experience. Participant feedback is required for the continued success (and improvement) of the Green Prescription programme. This information can also aid the design of similar physical activity interventions that are designed for older adults.

Significance of this Research

The overall findings of this thesis are of significance because this research has specifically focused on how the existing Green Prescription (time-based) and how a modified pedometer-based Green Prescription impacted on the physical activity levels of low-active older adults. The information gained from this thesis can contribute to the continued effectiveness of the conventional Green Prescription, as well as to the design and implementation of future interventions that aim to increase physical activity in low-active or sedentary older adults. The continued success of the Green Prescription programme is especially important as we live in an ageing society that is associated with rising healthcare costs. There also needs to be a focus on maintaining quality of life in the later years. There is strong evidence for the effectiveness of the conventional Green Prescription in increasing physical activity and health-related gain. The Green Prescription has also been shown to be a cost-effective intervention (Dalziel et al., 2006; Elley, Arroll, Swinburn, Ashton, & Robinson, 2004). The findings of this thesis can be disseminated to key stakeholders such as: Sport and Recreation New Zealand; Age Concern New Zealand; the New Zealand Association of Gerontology; and the Ministry of Health. These organisations can use the information gained from thesis to aid initiatives (such as the Green Prescription) that are designed to improve or maintain good physical and psychological health for older adults.

Chapter 2: Literature Review

The purpose of this review is to report, discuss, and evaluate research that has examined the factors that can effect physical activity initiation and adherence in older adults. This review will also examine and discuss the effect that physical activity can have on both physical and psychological health of older adults. This review is divided into six main sections encompassing:

1. The health-related benefits of physical activity
2. Primary care physicians and physical activity prescription
3. The Green Prescription
4. Barriers and motives for physical activity participation
5. The effects of physical activity on depressive symptomatology and general mental health
6. Process Evaluation of physical activity interventions: A rationale

2.1.0 The Health-Related Benefits of Physical Activity

Substantial epidemiological evidence indicates that insufficient physical activity is a significant and modifiable risk factor for both increased morbidity (disease and disability) and mortality (premature death) in relation to many noncommunicable chronic diseases and conditions that are more prevalent in both middle and older aged adults (Bauman, 2003; Chodzko-Zajko et al., 2009; Nelson et al., 2007; Stessman, Hammerman-Rozenberg, Cohen, Ein-Mor, & Jacobs, 2009; Wong et al., 2003). These conditions include; cardiovascular disease (Berlin & Colditz, 1990; Burke et al., 2001; Janssen & Jolliffe, 2006; Rejeski et al., 2002; Wannamethee et al., 2000), hypertension (Blumenthal et al., 2000; Brown et al., 2006; Stewart et al., 2005), type-2 diabetes (Hu et al., 1999; Kirk, Mutrie, MacIntyre, & Fisher, 2004; Miller & Dunstan, 2004; Tudor-Locke et al., et 2002; Tuomilehto et al., 2001), osteoporosis and fall related bone fractures (Campbell et al., 1999; DiBrezzo et al., 2005; Norton et al., 2001), as well as depression and anxiety (Brown et al., 2005; Cassidy et al., 2004; Galper et al., 2006; Kritz-Silverstein, Barrett-Connor, & Corbeau, 2001; Harris, Cronkite, & Moos, 2006; McNeil, LeBlanc, & Joyner, 1991; Singh, Clements, & Singh, 2001).

Physical activity has been defined as any bodily movement that is produced by the skeletal muscles, resulting in energy expenditure (McMurdo, 2000). Everyday activities such as housework, gardening, and habitual walking around the house may be considered a form of physical activity. Exercise is also a form of physical activity, though exercise is a planned repetitive movement with the intent to improve or maintain level of fitness (Schutzer & Graves, 2004).

Engagement in regular moderate-intensity physical activity has an important role in both the prevention and management of many noncommunicable lifestyle related chronic diseases and conditions (Boreham et al., 2000; Taylor et al., 2004; U.S. Department of Health and Human Services, 2008). While regular physical activity is beneficial throughout the lifespan, this may be especially so for older adults (65 years and older) as physical activity can significantly improve quality of life by improving physical function and decreasing the risk of disease and disability in old age (Chodzko-Zajko, 2007; McMurdo, 2000; Nelson et al., 2007). Research indicates that prolonged independence (independent living or non-dependency in the tasks of daily living, including mobility) and sustained cognitive functioning in older adults can result from the graded health benefits of physical activity (DiPietro, 2001; Drewnowski & Evans, 2001; Galgali, Norton, & Campbell, 1998). Research now indicates that the main reason for physical decline associated with old age (the ageing process) is inactivity (i.e., disuse of one's body) rather than the ageing process itself (McMurdo, 1999; National Health Committee, 1998). With a worldwide trend for increased life expectancy (Statistics New Zealand, 2004), physical activity has a salient role in aiding and maintaining both physical and psychological health-status for older adults.

2.1.1 Evidence-Based Benefits of Physical Activity

In 1996 the U.S. Surgeon General published the landmark document on physical activity and Health (U.S. Department of Health and Human Services, 1996). This report combined the most comprehensive review of research on physical activity and associated health benefits. The major conclusions of this report were that individuals of all ages benefit from regular physical activity of 30 minutes or

more on five or more days of the week. The report discussed how physical activity positively affects physiological functioning in relation to musculoskeletal, cardiovascular, respiratory, and endocrine functioning. This in turn works to reduce the risk of premature mortality through decreasing individual risk factors for cardiovascular disease, hypertension, certain cancers, and non-insulin dependent diabetes. These non-communicable lifestyle-related conditions and diseases are more prevalent in the later years of life (DiPietro, 2001; Drewnowski & Evans, 2001).

The current physical activity recommendations for older adults are similar to those for the general adult population proposed by the U.S. Surgeon General (i.e., engaging in 150 minutes of moderate-intensity physical activity over a 5-day period) (U.S. Department of Health and Human Services, 1996). A review of the recent literature on the health-related benefits of physical activity for older adults in a joint venture by both the American College of Sports Medicine (ACSM) and the American Heart Association (AHA) (Nelson et al., 2007) reinforced that older adults should engage in a minimum of 150 minutes of moderate-intensity aerobic physical activity (such as walking) per week, or 75 minutes of vigorous-intensity aerobic physical activity per week. It is also recommended that older adults should engage in muscle-strengthening activities that involve all major muscle groups on two or more days of the week. The US Department of Health and Human Services (US Department of Health and Human Services, 2008) reaffirmed these guidelines in their most recent report on physical activity guidelines and recommendations for adult Americans. While the guidelines stated above stress that a minimum of 150 minutes of moderate-intensity physical activity per week is required for health-related gain for older adults, it is strongly argued (Buchner, 2003; Fentem, 1994) that it is never too late to become physically active, and some or little physical activity is better than none.

2.1.2 The Effects of Physical Activity on Noncommunicable Diseases and Conditions: Evidence-Based Research

This section will provide a review of research-based evidence for the health-related benefits of physical activity in preventing, delaying, or managing lifestyle

related conditions and diseases that are typically more prevalent in older than younger adults such as: cardiovascular disease; hypertension; type 2 diabetes; osteoporosis and related falls. There will also be an examination of the role that physical activity can have in maintaining cognitive functioning in later life.

2.1.3 Cardiovascular Disease

At a physiological level, regular physical activity has been associated with improvements in overall cardiovascular functioning (Berlin & Colditz, 1990). The workload of the heart muscle is reduced when an individual engages in regular physical activity (Fentem, 1994). Regular physical activity is associated with improved coronary vessel blood flow, which leads to an overall reduction in blood pressure and improved oxygen supply to the body, which in turn may strengthen other muscles, enabling for better function and mobility, especially in later life (Fletcher, Gulanick & Braun, 2005). The American Heart Association view physical activity as a main form of prevention for cardiovascular disease (Janssen & Jolliffe, 2006). The New Zealand Heart Foundation has stated that regular physical activity engagement is an important part of the recovery process for individuals who have had a heart attack or have an ongoing heart condition, as physical activity is associated with reducing the chance of future attacks (National Heart Foundation, 2004).

A meta-analysis that examined the effect of physical activity in the prevention of coronary heart disease (CHD) (Berlin & Colditz, 1990) found a cross-sectional association between being sedentary and having an increased risk for CHD. This analysis also found an association between physical activity and an overall reduction in risk factors for CHD, whereby individuals who were physically active had lower rates of CHD. Thus, physical activity appeared to be a protective factor against the occurrence of CHD.

Two longitudinal studies (Janssen & Jolliffe, 2006; Wannamethee et al., 2000) were undertaken to examine whether physical activity lowered the risk for all-cause mortality in individuals who had cardiovascular disease. Wannamethee et al. examined the role that physical activity had on all-cause mortality over a 19-year

period in males who had cardiovascular disease. The sample comprised of 5,934 males aged 40 years and older at baseline. This study found that either sustained or newly-developed engagement in regular light to moderate-intensity physical activity reduced the risk of all-cause mortality in this sample of males who had cardiovascular disease.

Likewise, Janssen and Jolliffe (2006) examined whether there was an association between physical activity and lowered risk for all-cause mortality over a 9-year period in 1,045 adults aged 65 years and older who had coronary artery disease (CAD). An association was found between higher mortality rates in individuals who were physically inactive and lower mortality rates in individuals who were physically active over the 9-year period. This study found physical inactivity to be an independent risk factor for all-cause mortality in individuals with CAD regardless of gender, age (young old (65-75) or old old (76 years and older), or body mass index (BMI). While these longitudinal studies provide evidence for the beneficial effect of physical activity in protecting against premature death, these findings also need to be interpreted with caution. Follow-up measures in the Wannamethee et al. study were only administered at two time points, with a 12 to 14 year gap between baseline measurement. However, measures were administered on an annual basis in the Janssen and Jolliffe study.

2.1.4 Hypertension

Regular moderate-intensity physical activity can both prevent and manage hypertension (high blood pressure) (Blumenthal et al., 2000). Research in the form of cross-sectional epidemiological studies and randomised controlled trials have either indicated or demonstrated that regular sustained physical activity can lower blood pressure in individuals who have hypertension, independent of age or body weight (Brown et al., 2006; Cornelissen & Fagard, 2005; Fagard, 2006; Jamnik et al., 2005; Whelton, Chin, Xin, & He, 2002). Hypertension is a risk factor for other chronic conditions, such as cardiovascular disease (Arroll & Beaglehole, 1992; Carr, 2001). It has therefore been argued (Whelton, Chin, Xin, & He, 2002) that by lowering blood pressure in hypertensive individuals, premature mortality from

cardiovascular diseases (including stroke) can be greatly reduced. Population-based research shows that health-related quality of life (HRQOL) is higher in hypertensive individuals who engage in regular moderate-intensity physical activity than their sedentary peers (Brown et al., 2006). The Behavioural Risk Factor Surveillance Survey (BRFSS) (Brown et al., 2006) conducted in the United States with a sample of 215,670 adults aged 18 and older found that health-related quality of life was higher in hypertensive individuals who engaged in regular moderate intensity physical activity compared to those who were sedentary. Brown et al. also reported that these sedentary individuals experienced more sick days within a 30-day period compared to their more active hypertensive counterparts.

A number of studies have found an association between regular physical activity engagement and a reduction in blood pressure (Blumenthal et al., 2000; Stewart et al., 2005). Blumenthal et al. found that exercise alone or exercise in conjunction with a behavioural weight loss program resulted in significantly lowered blood pressure in individuals who had mild hypertension compared to participants in a non-exercise control condition. One hundred and thirty three adults aged 29 years and older took part in this randomised controlled trial. Participants had stage one or two hypertension, were physically inactive, and were overweight or obese. Participants were not taking any kind of blood pressure medication during the course of the 6-month intervention. Participants were randomly allocated into one of three groups. Participants in the first group took part in a 6-month exercise program. Participants in group two took part in a 6-month exercise and weight management program. The third condition was a control condition. Participants in group three received no exercise or weight management counseling. Blood pressure had significantly decreased in both intervention groups at the completion of the 6-month intervention, and there was no change in blood pressure for the control group.

Similarly, Stewart et al. (2005) found that participation in a 6-month exercise program resulted in lowered blood pressure for both mid aged and older aged participants. One hundred and four participants aged 55 to 75 years of age took part in this randomised controlled trial. Participants had a diagnosis of mild hypertension, were not taking any blood pressure medication, and were classified as low-active at baseline. Participants were randomly allocated into one of two groups.

Participants in the intervention condition took part in a 6-month exercise program. Participants in the control condition received 'usual care' physical activity and diet advice from their primary care physician. At post-intervention, diastolic blood pressure had significantly reduced for participants in the intervention condition compared to those in the control condition. Systolic blood pressure had significantly reduced in both groups of participants.

A main strength of both these studies (Blumenthal et al., 2000; Stewart et al., 2005) is that a structured physical activity intervention was carried out over a long-term period. Both these randomised controlled studies demonstrated that an increase in physical activity resulted in decreased blood pressure, as participants were insufficiently active at baseline and were not taking any medication for their hypertension. Thus, there were no confounding effects of medication on outcome assessment. While the Blumenthal et al. study had a true control group, Stewart et al. did not have true control group, as participants in the control condition received usual care physician advice for physical activity. It is not known whether participants in the control condition engaged in regular physical during the course of the intervention. A main limitation of both studies is that there was no follow-up period to ascertain the long-term effect that each intervention had on participants' blood pressure and future physical activity levels.

2.1.5 Type 2 Diabetes

Physical inactivity and obesity are the two main environmentally modifiable risk factors for developing type 2 diabetes (Sui et al., 2008; Tuomilehto et al., 2001). Type 2 diabetes is more prevalent than type 1 diabetes and is estimated to account for 85% of all cases of diabetes in the United States (Miller & Dunstan, 2004). Epidemiological evidence in the form of clinical trials, intervention studies, and prospective observational studies has demonstrated that regular physical activity may reduce the risk of developing type 2 diabetes (Hu et al., 1999; Sui et al., 2008; Tuomilehto et al., 2001). The development of type 2 diabetes through impaired glucose intolerance can be reduced or delayed by up to 58% by changes in diet and physical activity (Miller & Dunstan, 2004). A single session of moderate-intensity physical activity can increase the uptake of glucose by almost 40% (Hu et al., 1999; Miller & Dunstan, 2004). However, this effect only lasts for up to two to three days

after the activity session. Regular physical activity is also beneficial for individuals who have type 2 diabetes, as physical activity can help to manage their condition by improving glycemic control, which in turn can reduce complications associated with diabetes (Kirk et al., 2004; Miller & Dunstan, 2004; Tudor-Locke et al., 2002). Individuals who have type 2 diabetes are at increased risk for premature mortality as result of increased risk factors for cardiovascular disease and circulatory disorders, thus, physical activity interventions are seen as beneficial in the management of type 2 diabetes (Tudor-Locke et al., 2002; Sui et al., 2008).

The following two prospective studies (Hu et al., 1999; Sui et al., 2008) found a cross-sectional association between physical inactivity and an increased risk for developing type 2 diabetes. Hu et al. (1999) examined the relationship between dose-response physical activity, walking activity, and vigorous physical activity and the occurrence of type 2 diabetes. Data was based on the Nurses' Health study, a prospective study carried out over an 8-year period with 70,102 female nurses. Participants were aged 40 to 65 years of age at baseline. Prospective participants who had type 1 or 2 diabetes at baseline were excluded from participation. Physical activity was measured at baseline and again in years, 2, 4, and 8. Over an 8-year period, 1,419 participants were diagnosed with type 2 diabetes. This study found an association between engaging in moderate-intensity physical activity (i.e., walking activity) and vigorous physical activity (i.e., running, tennis, aerobics) and a reduction in the risk of developing type 2 diabetes.

Likewise, Sui et al. (2008) found physical inactivity to be associated with a greater risk for developing type 2 diabetes. Sui et al. examined if there was an association between cardiorespiratory fitness (CPF) and body mass index (BMI) with the incidence of type 2 diabetes in a large cohort of American women. The sample consisted of 6,249 women aged 20 to 79 years at baseline. At baseline all participants were free of cardiovascular disease, cancer and diabetes. This prospective study was carried out over a 17-year period. Assessment measures were administered 6 times during this 17-year period. During a 17-year follow-up period, 143 women developed type 2 diabetes. Lower Cardiorespiratory fitness (CPF) and higher body mass index BMI) were associated with the incidence of type 2 diabetes in these participants. Other factors that appeared to be associated with the incidence of type 2 diabetes were being older, having high blood pressure, and having a family

history of diabetes. This study indicated that being less physically active and being overweight or obese were strong predictors for developing type 2 diabetes. A main strength of both these studies was that they were longitudinal in design and participants were free of diabetes at baseline. Physical activity and other health-related measures were administered at regular time-points.

In another study Tuomilehto et al. (2001) demonstrated that lifestyle changes in physical activity engagement and dietary intake could result in a reduction in the incidence of type 2 diabetes for individuals who were at most risk for developing diabetes. The Finnish Diabetes Prevention study was conducted by Tuomilehto et al. to examine whether changes in lifestyle (i.e., increasing physical activity and changes in diet) could prevent or delay the onset of type 2 diabetes in individuals who had impaired glucose tolerance. The sample comprised of 522 adults aged between 40 and 65 years of age. To be able to participate in this study, potential participants had to be overweight or obese, have impaired glucose intolerance and be free of diabetes. Participants were randomised into a control or intervention condition. The overall goals for the intervention group were to lose 5 kg or more, reduce fat intake, increase fibre intake, as well as the consumption of fruit and vegetables, and to engage in a minimum of 30 minutes of moderate physical activity on a daily basis during the course of the 6-year intervention. Participants in the intervention condition periodically kept a food record diary and received tailored advice from a nutritionist about what food to consume and information about suitable portion sizes. These participants also received individual guidance on how to increase their physical activity by an exercise counselor. Participants in the control condition were given verbal and print information about diet and exercise at baseline and then at each annual visit, though they received no individualised information and did not receive the services of a nutritionist or exercise counselor during the course of the intervention. During the course of the study, 86 participants were diagnosed with type 2 diabetes (27 in the intervention group and 59 in the control group). As well, the risk of diabetes was significantly reduced by 58% in the intervention group. A limitation of this study is that there was no follow up to see if the incidence of diabetes had changed once intervention participants had ceased to receive individualised physical activity and diet advice.

The following studies (Kirk et al., 2004; Tudor Locke et al., 2002) examined the effectiveness of counseling individuals who have type 2 diabetes for physical activity. Kirk et al. (2004) undertook a randomised controlled trial to examine the effect that a 12-month physical activity intervention had on the physical activity levels of overweight or obese, low-active individuals with type 2 diabetes. The sample comprised of 70 individuals who had a mean age of 57.6 years (SD=7.9 years). Participants were randomly allocated to a control or intervention condition. Participants in the intervention condition received physical activity counseling that was underpinned by the transtheoretical model of behaviour change (Prochaska & Marcus, 1994). During the course of the 12-month intervention, participants in the intervention condition received both face-to-face and telephone-based counseling from a research assistant. Physical activity counseling matched an individual's stage of readiness for physical activity. The ongoing telephone support was designed to ascertain whether participants were meeting their physical activity goals. The telephone support was also designed to provide support and encouragement for physical activity. Participants in the control condition received a standard exercise pamphlet about the importance of physical activity for diabetes management. Control participants received telephone calls at the same time that intervention participants did, though, topics unrelated to physical activity and exercise were discussed. At post intervention, intervention participants' physical activity had significantly increased, whereas there were no significant changes in physical activity for control participants. This study demonstrated that extended external support for physical activity was effective in increasing and in maintaining physical activity over a long-term period in previously low-active diabetics. Usual care advice (i.e., print educational materials) alone were not effective in aiding physical activity.

Tudor-Locke et al. (2002) also found a face-to-face and combined telephone-based physical activity intervention to be effective in increasing physical activity in previously sedentary individuals with type 2 diabetes. Nine individuals with a mean age of 53 years (SD = 6 years) took part in this 8-week intervention. The intervention consisted of two phases. During the first phase (month one) participants attended four group meetings that were taken by an exercise counselor. During group meetings, participants provided weekly progress reports and planned and discussed their goals for the coming week. Participants also went on a group walk.

This first phase focused on adoption and adherence to walking behaviour. During the second phase (month two) participants received weekly phone support from the exercise counselor. The focus was on providing support and relapse prevention. During this last month of the intervention, participants wore a pedometer on a daily basis and kept a log of their daily step counts. At post intervention, participants had significantly increased their walking by an average of 34.3 minutes per day. This increase was still evident at the two month follow-up period, even though participants were no longer wearing a pedometer. In terms of health-related benefits, there were reductions in blood pressure and waist girth. While this study had a small sample size which may limit the generalisability of findings it demonstrated that structured physical activity counseling in conjunction with pedometer use aided and maintained physical activity in previously sedentary individuals with type 2 diabetes. This increase in physical activity was also associated with health-related gain.

2.1.6 Osteoporosis and Falls

There is research based evidence for the benefits of physical activity in both the prevention and management of osteoporosis and related falls (Campbell et al., 1999; DiBrezzo et al., 2005; Norton et al., 2001). Engagement in regular moderate-intensity physical activity decreases the rate of bone loss, especially in later life. Regular physical activity helps to maintain bone growth and preserves and increases bone mineral density (bone mass) (Abell, Hootman, Zack, Moritarty, & Helmick, 2005). Regular physical activity has also been associated with improved muscle strength, as well as improved joint structure and function. In turn, mobility, posture, balance, coordination, and flexibility are maintained and enhanced, which can help prevent falls that lead to hip-related fractures in older adults (Abell et al., 2005; Fontaine & Heo, 2005). Older adults who are physically active may avoid injury if they do fall, and they may also recover better from a falls-related injury (Alberta Centre for Active Living, 2009). Fall-related injuries are one of the most salient causes of disability in old age (Chan, Anderson, & Lau, 2003; Khan, Liu-Ambrose, Donaldson, & McKay, 2001). Physical activity engagement has also been used as a form of pain management by individuals who have osteoporosis (Abell et al., 2005).

Campbell et al. (1999) and DiBrezzo et al. (2005) demonstrated the role that physical activity had in helping improve muscle strength, balance and flexibility, which in turn were associated with a reduction in the risk of falls for those aged 60 years and older. Campbell et al. (1999) undertook a randomised controlled trial to examine the role that physical activity could have in reducing falls and hip-related fractures in older adults. Two hundred and thirty three women aged 80 years and older took part in this 2-year study. Participants were randomised into either a usual care control group or a home-based intervention group. Participants in the intervention condition received 4 home visits by a physiotherapist. At these home visits, an individualised exercise plan was put into place for each participant. The focus of this home-based program was to instruct and encourage participants to engage in muscle strengthening and balance retraining exercises as well as regular walking. Intervention participants were told to engage in their individually tailored exercise routine at least 3-times per week, as well as to walk 3 times a week. During the 12-month intervention period and during the preceding 12-month follow-up period, these participants could contact the physiotherapist via telephone for advice and support. Participants in the control condition only received usual care information from their primary care physician regarding the importance of physical activity engagement in helping prevent falls. At 12-months post-baseline there was a 33% reduction in the risk for falls for the intervention group compared to the control group. This reduced risk for falls was sustained for those participants in the intervention group who continued with their individualised home-based exercise programme. Forty four percent of the intervention group were still engaging in their prescribed exercise (at least 3-times per week) at the end of the 2-year period. Intervention participants who were more likely to be compliant with their exercise routine in the second year, were those who had been physically active at baseline and/or had at least one fall prior to enrolling in the study. Overall there was a significant reduction in falls over a 2-year period for participants in the intervention group compared to the control group.

Likewise, DiBrezzo et al. (2005) evaluated the effectiveness of a 10-week exercise programme in improving functional strength, flexibility, and balance among community-dwelling older adults. The sample comprised of 16 adults aged between 60 and 92 years of age. During the course of the 10-week programme, participants attended three one hour exercise classes per week at the local senior citizens centre.

The exercises used in the intervention incorporated stretching, balance and strengthening, with a focus on upper body strengthening exercises, as well as lower extremity exercises. At post-intervention there were significant improvements in the chair-stand, arm curl and back scratch movements, indicating improved balance upper and lower extremity muscle strength and improved upper body flexibility.

The intervention-based studies carried out by Campbell et al. (1999) and DiBrezzo et al. (2005) demonstrated the positive effect that physical activity can have in reducing the risk of falls via exercise engagement that strengthens muscles and improves balance and flexibility in older adults. A strength of the Campbell et al. study is that a control group was employed, this allowed for inferences to be made about the effect that the intervention had on participants' health-status. DiBrezzo et al. did not have a control group, thus, it is not known if improvements were related to the exercise intervention. Both of these studies had a structured exercise plan and, in most cases, exercise engagement was monitored by a specialist. A further strength of the Campbell et al. study is that the intervention was carried out over a long term 12-month period. There was a 12-month follow-up period, which allowed for an examination of the long-term effects that the intervention had on participants' physical activity behaviour and related health-status.

2.1.7 Cognition

Several studies have demonstrated that an association exists between regular physical activity engagement and sustained cognitive functioning in older age (Dustman et al., 1984; Hillman et al., 2006; Jedrzejewski, Lee, & Trojanwski, 2007; McDowell, Kerick, Santa Maria, & Hatfield, 2003; Moul, Goldman, & Warren, 1995; Valliant & Asu, 1985; Yaffe, Barnes, Nevitt, Lui, & Covinsky, 2001). Several hypotheses exist in relation to how physical activity may protect against cognitive decline in old age. Firstly, regular physical activity results in increased cerebral blood flow, which may reduce the risk of both cerebrovascular and cardiovascular diseases (Dustman et al., 1984; Jedrzejewski et al., 2007; Yaffe, Barnes Nevitt, Lui, & Covinsky, 2001). Secondly, neural growth is stimulated and protected by increased cerebral blood flow. In turn, neuron activity is stimulated by this type of blood flow.

Neuron activity effects the processing of cognitive information and may also protect against dementia (Blumenthal et al., 1991; Lautenschlager et al., 2008). A recent meta-analysis (Jedrziwski et al., 2007) reviewed experimental and observational studies that examined the relationship between physical activity and cognitive processing in middle and older aged adults. An association was found between engagement in regular moderate-intensity aerobic activity (e.g., walking activity) and sustained cognitive functioning in tasks of processing and recalling information.

The following studies (Dustman et al., 1984; Lautenschlager et al., 2008; Moul et al., 1995) found that engagement in aerobic-based physical activities resulted in improvements in cognitive functioning in mid- and older-aged adults. Participants who took part in a 16-week supervised aerobic exercise training program experienced a significant improvement in cognitive processing compared to participants who were allocated to either a 16-week supervised strength and flexibility condition or a no exercise control condition (Dustman et al., 1984). Forty three participants took part in this randomised controlled trial. Participants were aged between 55 and 70 years of age and were classified as being low-active at baseline. Cognition was measured at baseline and at post intervention via a battery of neuropsychological tests that included the Culture Fair Intelligence Scale (Western Psychological Services, 1973), the Wechsler Adult Intelligence Scale (WAIS) (Wechsler, 1981) and the Symbol Wechsler subset (Wechsler, 1981).

Moul et al. (1995) also found cognitive processing to improve significantly more in participants who took part in a supervised aerobic walking intervention compared to participants who took part in either a supervised weight training condition or a placebo flexibility and stretching condition. Thirty low-active adults 65 years and older took part in this 16-week randomised controlled trial. Cognition was measured at baseline and at post-intervention by the Ross Information Processing Assessment (RIPA) (Ross, 1986).

Lautenschlager et al. (2008) found a structured physical activity intervention reduced cognitive decline in individuals who were at risk for Alzheimer's disease. One hundred and 70 participants aged 50 years and older took part in this 6-month randomised controlled trial. Participants in the control condition were given

educational materials on memory loss, healthy diet, stress management, alcohol consumption and smoking, though no information on physical activity. Participants in the intervention condition were encouraged to engage in 150 minutes of physical activity per week (i.e., such as walking activity). Intervention participants received a face-to-face counseling session delivered by a physical activity counselor, and received between two and six support phone calls that were designed to monitor activity levels and encourage compliance. Both groups of participants kept a diary of their daily physical activity, which they mailed to the physical activity counselor (in a pre-paid envelope) at the end of each month during the intervention period. At post intervention, physical activity had significantly increased for participants in the intervention condition compared to participants in the control condition. Participants in the intervention group demonstrated a reduction in cognitive decline over the course of an 18-month follow-up period as assessed by the Alzheimers Disease Assessment Scale (ADAS-Cog) (Rosen et al., 1984). While these studies (Dutsun et al., 1984; Lautenschlager et al., 2008; Moul et al., 1995) demonstrated an association between certain types of physical activity and improvements in cognitive functioning, findings need to be interpreted with caution. A main strength of all three studies (Dutsun et al.; Lautenschlager et al.; Moul et al.) is that a control group was employed. This helped demonstrate the efficacy of aerobic physical activity on cognitive processing. Dustman et al. and Moul et al. did not have a follow-up period, hence, the long term effects of physical activity on cognitive processing was not examined in either of those studies.

2.1.8 Physical Inactivity and Healthcare Costs

Despite empirical evidence for the health-related benefits of physical activity, a large proportion of the adult population is insufficiently active (Boreham et al., 2000; Westerterp & Meijer, 2001). Physical inactivity appears to be more prevalent in those aged 65 years and older (Drewnowski & Evans, 2001; McMurdo, 2000; Mummery et al., 2007). The World Health Organization has estimated that two million global deaths per year are caused by physical inactivity (World Health Organization, 2008a). In New Zealand, physical inactivity is ranked as the second highest risk factor for increased mortality. It is estimated that 8% of deaths per year result from a sedentary lifestyle (Ministry of Health, 2004). Despite empirical

evidence for both the physical and psychological benefits of physical activity, a high proportion of the adult New Zealand population remains inactive, achieving less than the recommended level of physical activity per week that is required for health-related gain (Sport and Recreation New Zealand, 2008a). A recent population-based survey indicated that less than one half of adult New Zealanders (48.2%) meet the national physical activity guidelines of achieving 30 minutes of physical activity on five or more days of the week. Thirty one percent of the adult New Zealand population was engaging in some physical activity and 12.7% were found to be inactive (Sport and Recreation New Zealand, 2008a). In relation to the older adult New Zealand population, 34% of adults aged 65 years and older meet national physical activity guidelines, 42% of older adults were engaging in some physical activity and 24% of older adults were inactive (achieving less than 30 minutes of physical activity over a seven day period) (Sport and Recreation New Zealand, 2008a).

The World Health Organization has estimated that 1.9 million deaths and 19 million disability adjusted life years (DALYs, a measure of years of healthy life lost because of poor health or related disability) are attributable to physical inactivity in any given year (World Health Organization, 2008b; 2008c). The related healthcare costs of physical inactivity are increasing, costing governments billions of dollars annually. Physical inactivity is estimated to cost the United States government 75 billion dollars annually (World Health Organization, 2008a). In New Zealand, a growing ageing population is resulting in high healthcare costs. During the 2000/2001 period, ACC (Accident Compensation Corporation) spent 43 million dollars on treatment and rehabilitation costs for those aged 65 years and older (Ministry of Health, 2004). An effective way to reduce healthcare costs and increase physical activity in adults, including older adults is through physical activity interventions that are introduced and initiated in the primary care setting (Dalziel et al., 2006; Elley et al., 2004; Roux et al., 2008). The following section examines the role that primary care physicians can have in physical activity prescription. A review of the effectiveness of primary care physical activity interventions will also be examined.

2.1.9 Physical Activity Prescription in the Primary Care Setting: A Rationale

The following section will discuss the rationale for physical activity prescription and counseling in the primary care setting, as well as primary care physicians' perceived barriers toward physical activity counseling. The final section will provide a review of the effectiveness of primary care interventions in increasing the physical activity levels of insufficiently active individuals, including low-active older adults.

The primary healthcare setting provides an ideal environment for physical activity counseling and prescription, as primary care physicians (also referred to as general practitioners (GPs) in some parts of the world) come into contact with a large majority of the population on a regular basis (Tulloch, Fortier, & Hogg, 2006). It is estimated that 80 percent of New Zealand adults and 90 percent of those aged 65 years and older visit their primary care physician at least once a year (Croteau et al., 2006). Primary care physicians are in a unique position to identify high risk patients, such as individuals who are insufficiently active and/or overweight, or have preexisting chronic health conditions. Primary care physicians can influence both the knowledge and behaviour of their patients regarding health promotion advice, especially in the context of physical activity counseling (Elley et al., 2004).

In many cases, the primary healthcare setting may be the only venue or avenue where patients receive intervention and prevention based information for physical activity and nutrition advice (Kennedy & Meeuwisse, 2003; Tulloch et al., 2006). Research has shown that patients both expect and want to receive advice from their primary care physician regarding physical activity (Booth, Bauman, Owen, & Gore, 1997; Podl, Goodwin, Kikano, & Stange, 1999). There is evidence that some patients are likely to consider health promotion advice if it is delivered by their primary care physician (Elley et al., 2003a). Research indicates that primary care physicians are viewed by their patients as being credible sources of health care information, and their advice is respected and valued (Kennedy & Meeuwisse, 2003). This is especially the case regarding older patients. Older adults (aged 65 years and older) are more likely to consider and adhere to advice that has been suggested by

their primary care physician compared to younger age groups (Schutzer & Graves, 2004). Also, some patients have a long lasting professional relationship with their primary care physician, which reinforces this view of respect and credibility (Lawlor, Keen & Neal, 1999).

Physical activity counseling has consistently been shown to be understood and undertaken on both a short and long-term basis by adults in the primary care setting, and especially by older adults (Kerse et al., 1999; Kerse et al., 2005; Swinburn, Walter, Arroll, Tiyland, & Russell, 1997; Williford, Barfield, Lazenby, & Olson, 1992). Research indicates that older adults are more responsive to physical activity counseling when it is undertaken in the primary care setting (Kerse et al., 1999; Kerse et al., 2005). A population-based survey found that older adults most preferred source of information regarding physical activity advice was from their primary care physician (Booth et al., 1997). Thus, members of this age group are more likely to consider and adhere to such advice when it is dispensed in the primary care setting (Blade, Figueras, Hawking, & Miller, 2003).

2.2.0 Primary Care Physicians' Perceived Barriers toward Physical Activity

Counseling and Prescription

While the health related benefits of physical activity engagement are well documented in the literature and understood by primary care physicians, there remains a gap between theory and practice on both a national and international level (Croteau et al., 2006; Kennedy & Meeuwisse, 2003; McKenna, Naylor, & McDowell, 1998; Van der Ploeg et al., 1997; Wee, McCarthy, Davis, & Phillips, 1999). Both national and international literature has consistently cited time constraints within the patient consultation as being the most salient barrier for physical activity counseling. This is related to primary care physicians not having adequate time to explain both the benefits of physical activity and to also prescribe physical activity (Gribben, Goodyear-Smith, Grobbelaar, O'Neil, & Walker, 2000; Kennedy & Meeuwisse, 2003; McKenna et al., 1998; Ribera, McKenna, & Riddoch, 2006; Swinburn et al., 1997). Other barriers have been related to lack of reimbursement in relation to extended consultation time and patient follow up (McKenna et al., 1998; Williford et al., 1992), and the absence of a standard format

(i.e., clear guidelines to follow) regarding physical activity promotion and prescription (Kennedy & Meewisse, 2003; Ribera, McKeena, & Riddoch, 2005; Williford et al., 1992). Primary care physicians' perceptions of whether their patients would adhere to physical activity advice and prescription has also affected whether they would counsel their patients for physical activity (Gribben et al., 2000; Swinburn et al., 1997). In some cases, physicians self-confessed lack of knowledge about the health-related benefits of physical activity and lack of training in physical activity counseling have also been cited as potential barriers to physical activity counseling (Kennedy & Meeuwisse, 2003; Williford et al., 1992). A perceived lack of confidence in counseling patients for physical activity has also been identified as a barrier for physical activity counseling by primary care physicians (Kennedy & Meeuwisse, 2003; McKenna et al., 1998; Ribera et al., 2005).

2.2.1 Physical Activity Prescription in Primary Practice: Prevention or Management?

This section will discuss research that has been carried out at a population-based level to examine the prevalence and the characteristics of patients who receive physical activity counseling within the primary care setting. Despite the potential for physical activity counseling in general practice, research has shown (Croteau et al., 2006) that New Zealand primary care physicians prescribe physical activity at half the prevalence of their counterparts in countries such as Australia and the United States. Population survey data show that 13% of New Zealanders reported receiving physical activity advice from their physician in the previous 12-months, and 3% reported receiving a Green Prescription in the previous 12-months. At the same time, individuals with preexisting conditions were more likely to receive a Green Prescription or general advice for physical activity. The analysis carried out by Croteau et al. has demonstrated that physical activity prescription has been used as a form of secondary treatment for chronic disease management rather than primary prevention for sedentary individuals who are at risk for future lifestyle related diseases and conditions because of their inactive lifestyles.

A recent study carried out in Queensland, Australia (Eakin, Brown, Schofield, Mummery, & Reeves, 2007a) found that individuals who were either overweight or

obese, or had preexisting chronic conditions were more likely to receive physical activity advice from their primary care physician. This study also found males and those who frequently visited their physician (five or more visits in the previous 12-months), were also more likely to receive advice to engage in physical activity. A similar study carried out in the New South Wales region of Australia (Van der Ploeg et al., 2007) also found that primary care physicians were more likely to counsel patients who had existing chronic conditions for physical activity.

Population-based data from the United States (Wee et al., 1999) also yields similar findings. Primary care physicians in the United States appear to promote or prescribe physical activity as a form of secondary treatment for those who are obese, aged 30 or older, or have existing chronic health conditions. Research shows that some primary care physicians believe that physical activity prescription is more effective when it is directly linked to a presenting condition or complaint (Lawlor et al., 1999; van Sluijs, van Poppel, Stalman, & van Mechelen, 2004; Van der Ploeg et al., 2007).

The population-based studies (Croteau et al., 2006; Eakin et al., 2007a; Wee et al., 1999) cited above provide evidence that primary care physicians are counseling patients who are most in need for a physical activity intervention. While it is beneficial to use physical activity counseling, including the Green Prescription, as a form of secondary prevention to manage existing conditions, there also needs to be a focus on using physical activity prescription for primary preventive purposes. For example, sedentary individuals can benefit from a Green Prescription, as they are currently disease free, but are at risk for future noncommunicable diseases and conditions because of their inactive lifestyle. Failure to counsel sedentary individuals is a missed opportunity for primary prevention that will most likely lead to adverse health outcomes for such individuals in the future (Croteau et al., 2006).

2.2.2 Interventions to Promote Physical Activity Counseling and Prescription in the Primary Care Setting

There is a growing body of empirical evidence that supports the feasibility and acceptability of promoting (counseling for, and prescribing) physical activity in

the primary care setting for low-active adults, including low-active older adults (Armit et al., 2009; Bull & Jamrozik, 1998; Calfas et al., 1996; Harland et al., 1999; Hillsdon, Thorogood, White, & Foster, 2002; Kerse et al., 1999; King et al., 1998; Kolt et al., 2007; Morey et al., 2009; Petrella et al., 2003; Pinto et al., 2005; Sims, Huang, Pietsch, & Naccarella, 2004; Smith, Bauman, Bull, Booth, & Harris, 2000; van Sluijs et al., 2004). This section provides a review of interventions in which primary care physicians were specifically trained to counsel for physical activity. This section will also examine and discuss how physical activity prescription has been implemented in the primary care setting, and whether such interventions were efficacious in increasing physical activity (See Table 2.1. for a summary of the interventions).

The following interventions focused on training primary care physicians to counsel for physical activity and examined the effect that this training had on the physical activity levels of primary care patients (Calfas et al., 1996; Sims et al., 2004; van Sluijs et al., 2004). Overall, these studies demonstrated that physicians could be trained to counsel for physical activity and that brief physician counseling for physical activity was effective in increasing physical activity over a short-term period in previously low-active primary care patients. The PACE (physician-based assessment and counseling for exercise) program was designed to promote the adoption of regular physical activity in low-active adults via primary care physicians in the United States (Calfas et al., 1996). Seventeen general practices participated in this study. Physicians were either allocated into the control or intervention practices. Physicians in the intervention practices received two training sessions on physical activity counseling and were given a support manual. Physicians in the control practices received training on current procedures for diagnosing and treating hepatitis B. Two hundred and twelve primary care patients were placed into either a control or intervention practice based on the clinic they attended. Patients in the intervention practices received 3 to 5 minutes of structured physical activity counseling from their physician during their regular doctor's visit. Two weeks after their physician visit, patients in the intervention group received a 10-minute booster phone call from a health educator. The purpose of this phone call was to monitor progress and provide support. This intervention was found to be effective, with the physical activity levels

of intervention patients significantly increasing at post-intervention (4 to 6 weeks post-baseline). Intervention patients had increased their weekly walking by 37 minutes per week at post intervention compared to a 7 minute per week increase for control participants. This original PACE intervention had no follow-up period. Thus, it is not known if this increase in physical activity was maintained over time.

A Dutch version of the PACE intervention (physician-based assessment and counseling for exercise) was carried out in the Netherlands (van Sluijs et al., 2004). Fifteen general practices were randomised into the PACE intervention group and 14 practices into the control group. The physical activity levels of patients in the intervention practices significantly increased at post-intervention by 62 minutes per week. This increase was still evident at the 6-month follow-up period, but not at the 12-month follow-up period. This study validated the PACE method as being a feasible and acceptable way of counseling for physical activity in a primary care setting outside the country of its origin. This study also employed follow-up periods that provided information about the long-term effect the intervention had on the physical activity levels of previously low-active individuals.

The Active Script Programme (ASP) (Sims et al., 2004) was designed to increase consistent and effective physical activity counseling in primary practices in the Victoria region of Australia. Two hundred and ninety nine primary care physicians participated in this study. The main outcome measures were concerned with assessing changes in physicians' knowledge and behaviour towards physical activity prescription, and to examine patients' perceptions of their physician's ability to counsel for physical activity. Physicians were trained through seminars and individual practice visits. Physicians were given an ASP kit which contained a physician information folder, script pad, and patient record stamp. Fifty four patients took part in the programme's clinical audit. Both patients and physicians provided positive feedback on the efficacy of the intervention. Patients stated that they became aware of the benefits of physical activity for their health from their physician consultation, and that the written scripts helped them to remember to engage in physical activity. Physicians felt that their knowledge and behaviour concerning physical activity prescription had increased and improved because of the training they had received.

The following two studies demonstrated that physician's verbal advice combined with written educational materials on the health benefits of physical activity can help increase physical activity in previously low-active adults (Bull & Jamrozik, 1998; Smith et al., 2000). Research was undertaken (Bull & Jamrozik, 1998) to compare the effectiveness of two different modalities of physical activity advice: combined verbal and written (print) advice as received from a primary care physician compared to a no-intervention control group. The sample comprised 763 low-active adults recruited from 10 general practices in Perth, Australia. Patients were randomly allocated into one of three groups. Group one was a no-intervention control group who received no form of physical activity advice. Patients in group two received a standard intervention consisting of verbal advice from their physician to engage in physical activity combined with a standard pamphlet on exercise engagement. Patients in the third group received the same verbal advice from their physician and a tailored pamphlet (created by a computer) on exercise advice. The main outcome measure was patients' physical activity levels at 1, 6 and 12- months. At all three follow up intervals, patients in the two intervention groups reported engaging in significantly more physical activity than those in the control group. Similarly, Smith et al. (2000) found that participants (n=1,142 primary care patients) who received a written prescription from their primary care physician combined with tailored stage-of-change print materials for physical activity reported significantly higher levels of physical activity at all four follow-up periods (6 and 10-weeks post baseline and at 7 and 8-months post baseline) compared to participants in the control condition and those who received only a written prescription for physical activity. A main strength of both these studies (Bull & Jamtozik, 1998; Smith et al., 2000) is that there were three or more follow-up periods. This allowed for an examination of the long-term effects that the interventions had on participants' physical activity levels. A possible limitation of these studies is that physical activity information was based on self-reported data. This type of reporting can be open up issues concerned with social desirability bias, and issues related to participants' accuracy of quantifying such data. However, validated physical activity questionnaires were used to measure physical activity in these studies.

The following two studies carried out in the United Kingdom demonstrated the effectiveness of using motivational interviewing based on stage of behaviour change to help low-active adults initiate and maintain their physical activity (Harland et al., 1999; Hillsdon et al., 2002). A randomised controlled trial was conducted by Harland et al. (1999) to evaluate the effectiveness of different frequencies of motivational interviewing for physical activity and to also examine whether fitness vouchers acted as an incentive to increase physical activity in low-active adults. Five hundred and twenty three primary care patients aged 40 to 65 years of age were recruited from a large urban general practice. Participants were randomised into one of five groups. Group 1 was the control group; participants in this condition received no physical activity counseling. Participants in group 2 received one motivational interview session. Participants in group 3 received one motivational interview session and 30 fitness vouchers (redeemable at the local community leisure centre, including the local swimming pool during the 12-week intervention period). Participants in group 4 received six motivational interviews. Participants in group 5 received six motivational interviews and 30 fitness vouchers. Motivational interviewing was based on the transtheoretical model of behaviour change (Prochaska & Marcus, 1994). This type of counseling is centered around an individual's stage of readiness for physical activity. A health visitor (similar to a health educator) undertook all motivational interviewing sessions. There was a significant increase in physical activity levels at post intervention (3-months post baseline) for participants in all four intervention groups compared to the control group, with no significant difference in physical activity levels between the four intervention groups. This increase in physical activity for all four intervention groups was not maintained at the 12-month follow-up period.

A similar study carried out by Hillsdon et al. (2002) examined the effect that two different communication styles of physical activity counseling had on the physical activity levels and health-related status of low-active primary care patients. The sample comprised 1,658 participants aged 45 to 64 years of age. Participants were randomly assigned into one of three groups. Participants in the first group received a brief negotiation approach to physical activity counseling. This was based on motivational interviewing, a patient-centered approach to negotiating behaviour change for physical activity between patient and physician (Miller & Rollnick, 1991; Rollnick et al., 1992). Participants in the second group received direct advice on the

benefits of physical activity from their physician. The third group acted as a control and received no physical activity advice. Compared to the control group, physical activity significantly increased for participants in both intervention groups, with no significant difference between these two groups at the 12-month follow-up period. There was no significant change in body mass index (BMI) for any group. There was a significant reduction in systolic blood pressure for both intervention groups, with no significant difference between these two groups. There was a significant reduction in diastolic blood pressure for participants in the brief negotiation group. A major strength of these two studies (Harland et al., 1999; Hillsdon et al., 2002) was that a randomised controlled design with a true control group was employed. This type of design allowed for inferences to be made regarding the effect that various intervention components may have had on participants' physical activity. Both studies also employed a follow-up period that provided information regarding the impact that the interventions had on participants' long term physical activity behaviour (See Table 2.1 for a summary of these interventions).

2.2.3 Older Adults and Physical Activity Counseling and Prescription in the Primary Care Setting

This section will provide a review of primary care-based interventions that were designed to increase physical activity and health-related gain in low-active older adults (Armit et al., 2009; Kerse et al., 1999; Kolt et al., 2007; Morey et al., 2009; Petrella, Koval, Cunningham, & Paterson, 2003; Pinto et al., 2005). The majority of these interventions were carried out within the primary care setting (see Table 2.1 for a summary of these studies).

A randomised controlled trial carried out by Kerse et al. (1999) demonstrated that older aged primary care patients both considered and adhered to health promotion advice received by their primary care physician. Forty two primary care physicians were randomly allocated to either a control or an intervention group. Physicians in the control condition received no training for physical activity and were not expected to counsel their older-aged patients for physical activity. Physicians in the intervention condition undertook an educational and clinical practice programme, that covered topics related to physical activity prescription and

vaccination practices for older adults. Intervention physicians were expected to incorporate what they had learned into their daily practice. Two hundred and sixty seven primary care patients aged 65 years and older also participated in this study. The main outcome measures being assessed were patients' physical activity levels, functional status, self-rated health, and immunisation status at the 12-month follow-up period. The patients of intervention physicians increased their physical activity (via walking activity), and rated their health as being higher compared to the patients of physicians who received no health promotion training. This study demonstrated that physician advice for physical activity had a long-term impact on the physical activity levels of older-aged adults.

Likewise, a primary care physical activity intervention carried out by Petrella et al. (2003) also resulted in physical activity increase and health-related gain in previously low-active adults aged 65 years and older. Petrella et al. examined the effect that an exercise prescription program, the Step Test Exercise Prescription (STEP) had on aerobic fitness and exercise efficacy over a 12-month period in 284 low-active older adults who were recruited from four general practices. Participants in both the control group and the intervention (STEP) group received usual-care verbal advice for physical activity from their primary care physician. Participants in both conditions were given a list of physical activity facilities they could attend in their local area. Participants in the control condition were instructed to keep a log of their physical activity over a 12-month period. This log contained information on the type of activity and its frequency and duration. Participants in the STEP intervention group undertook the STEP test, which included stepping up and down two small steps 20 times, at a comfortable pace. Participants' heart rate was recorded following this exercise. STEP participants were given examples of exercises to engage in, and made aware of their target heart rate as per the STEP test. Participants in this condition were also instructed to keep a log of their physical activity (location of activity, type of activity, and its duration and frequency) over the 12-month period. Participants also had to indicate whether their target heart rate was achieved during the particular activity they engaged in. Logs for both groups were collected at 3, 9, and 12 months. Measures were administered at 3, 9 and 12 months. Aerobic fitness was significantly higher for participants in the STEP group at all three follow-up periods compared to participants in the control group. Body mass index (BMI) and systolic blood pressure significantly decreased for participants in the STEP group

during the intervention compared to the control group. At the 9-month follow-up period there was a significant reduction in systolic blood pressure and a reduction in body mass index (BMI) for participants in the STEP group. This study demonstrated the long-term effectiveness of initial physician advice for physical activity combined with education about the different types of activity to engage in to maximise target heart rate. While this study did not have a 'true' control group, as control participants received 'usual care' advice for physical activity and additional components relating to information for physical activity facilitates, and also participants in the control condition kept a physical activity log. This design helped demonstrate that there was an association between the additional training and educational components of the STEP test and an increase in physical activity with an associated reduction in BMI and systolic blood pressure for participants in the STEP group.

The following two interventions (Kolt et al., 2007; Pinto et al., 2005) demonstrated the effective role that telephone-based counseling had in helping support and increase physical activity in previously low-active older adults. A randomised controlled trial (Physically Active for Life 2) was carried out (Pinto et al., 2005) to examine the effectiveness of brief physician advice for physical activity (brief advice) versus physician advice combined with telephone-based counseling (extended advice). One hundred primary care patients aged 60 years and older took part in this 6-month intervention. Participants who were randomly allocated to the brief advice group received brief verbal advice from their physician to engage in physical activity. Participants who were randomly allocated to the extended advice group also received brief verbal advice for physical activity from their physician. However, participants in the extended advice condition also received three face-to-face counseling sessions with a health educator over a 3-month period. Participants in this extended advice condition received counseling based on the transtheoretical model of behaviour change. This model proposes that individuals move through five distinct stages of behaviour (precontemplation, contemplation, preparation, action, maintenance) before they will engage in some degree of regular physical activity (Prochaska & DiClemente, 1983). Thus, telephone-based counseling was tailored to meet their individual stage of readiness for physical activity. For the first 3-months of the intervention, these participants received 12 telephone calls, and at the same time, 12 physical activity tip sheets were mailed out to coincide with this telephone support. For the remainder of the intervention, participants in the extended advice

condition received fortnightly telephone calls from months 3 to 6. Physical activity was the main outcome measure in this study. Physical activity was measured at baseline, 3 and 6 months. Participants in the extended advice condition reported significantly greater participation in moderate-intensity physical activity compared to the brief advice group at both 3 and 6 months. At 3-months, participants in the extended advice condition increased their physical activity levels by 58 minutes per week compared to 12 minutes per week for the brief advice group. At post-intervention (6-months post baseline) participants in the extended advice group had increased their weekly physical activity levels by 63 minutes per week compared to 17 minutes per week for the brief advice group.

Similarly, Kolt et al. (2007) also found telephone-based counseling to be effective in helping previously low-active older adults become physically active. The TeleWalk study was a randomised controlled trial designed to examine the effect that telephone-based counseling had on physical activity and health-related quality of life in low-active older adults. One hundred and eighty six adults aged 65 years and older were recruited from primary care practices. Ninety three participants were randomised into a control group. These participants received no intervention and only took part in outcome assessments. Ninety three participants were randomised into the intervention group. During the first month of the 3-month intervention participants in the intervention condition received one telephone counseling session per week from an exercise counselor. For the remaining 8-weeks, these participants received one phone call every 2-weeks from the counselor. Telephone counseling was based on the transtheoretical model of behaviour change (Prochaska et al., 1992). The exercise counselor tailored each telephone call according to the current stage an individual participant was at. The telephone support centered on setting goals for physical activity and problem-solving barriers to such goals. Participants in the intervention condition also received supplementary print materials via mail that were designed to aid their physical activity and support components of the telephone counseling. Intervention participants were also encouraged to keep a walking log during the course of the intervention. Physical activity and health-related quality of life were assessed at post intervention (3-months post baseline), and at both the 6 and 12-month follow-up periods. At post intervention, and at the two follow-up periods, participants in the intervention condition were engaging in significantly more physical activity than participants in the control condition. Overall, moderate leisure

physical activity increased by 86 minutes in the intervention group compared to the control group. A greater proportion of participants in the intervention group were achieving 150 minutes of moderate or vigorous leisure physical activity per week after 12-months compared to participants in the control condition. There were no significant differences in health-related quality of life between the two groups at any of the assessment periods. One possible explanation for why there was no significant increase in health-related quality of life is that participants in both conditions had high scores to begin with, thus, a ceiling effect was evident, meaning that there was little room for improvement.

These two interventions (Kolt et al., 2007; Pinto et al., 2005) provided empirical support for the effectiveness of ongoing telephone-based support that is matched to participants' stage of readiness for physical activity. The Pinto et al. study highlighted that verbal advice alone for physical activity by a primary care physician is not effective in increasing physical activity in some low-active adults. The Kolt et al. study demonstrated the long-term effectiveness of a telephone-based intervention, as participants in the intervention condition were still physically active at the 12-month follow-up period, which was 9-months post intervention.

The following two studies (Armit et al., 2009; Morey et al., 2009) examined the effect that telephone-based counseling had on both physical activity and health-related gain in older adults. Armit et al. (2009) carried out a randomised controlled trial to evaluate the effect that three different strategies had in increasing physical activity within the primary care setting. One hundred and thirty six primary care patients aged 50 to 70 years of age took part in this 12-week intervention. Participants in the first group received 'usual care'. This involved receiving 3 to 5 minutes of brief verbal advice for physical activity and a brochure on physical activity from their primary care physician. Participants in the second group received the 'usual care' components and a 30-minute behaviour change counseling session with an exercise scientist (ES) one week after recruitment and three follow-up telephone calls over the 12-week intervention period. Participants in the third group received the same intervention components that participants in groups one and two received and in addition a pedometer, with the focus being on goal-setting in relation to daily step-counts and self-monitoring through pedometer use. The telephone-based counseling that participants in groups two and three received was based on the

transtheoretical model of behaviour change (Prochaska & Marcus, 1994). Thus, the telephone counseling matched participants' stage of readiness for physical activity. Physical activity levels significantly increased in all three groups at post intervention (3-months post baseline) and this increase was still evident at the 24-month follow-up period. Mean physical activity increased by 84 minutes per week at post intervention and by 128 minutes per week at the follow-up period. There were no significant differences in reported physical activity between the three groups. Participants across all three groups experienced significant reductions in blood pressure and post-exercise heart rate. However, participants in the third group (those who received the most intensive intervention) experienced greater improvements in systolic blood pressure at post intervention. At the 24-month follow up period, participants in the third group were more likely to report meeting recommended physical activity guidelines compared to participants in group one. Also, participants in the third condition kept their pedometers until the 24-month follow-up period. Armit et al. argued that pedometer use may have helped participants in this condition to maintain their physical activity.

Morey et al. (2009) found that both physical activity (minutes of moderate/vigorous physical activity) and rapid gait speed improved significantly for participants who received a 12-month telephone-based intervention compared to control participants who received 'usual care'. Three hundred and ninety eight male veterans aged 70 years and older took part in this 12-month randomised controlled trial. Participants in the intervention condition received a baseline face-to-face counseling session with a lifestyle health counselor. At this session, intervention participants received an exercise workbook, elastic bands for resistance work, a poster that demonstrated leg strengthening exercises and a pedometer. Intervention participants then received monthly telephone-based support from the same counselor during the course of the 12-month intervention. The telephone-support was designed to provide support for exercise goals and to quantify participants' physical activity levels. During the course of the intervention participants received via mail three individualised progress reports. These reports were designed to provide intervention participants' information regarding their progress (See Table 2.1 for a summary of these interventions).

Table 2.1. Summary of primary care physical activity interventions

Study	Participants	Study aim(s) and design	Main findings	Strengths	Limitations
Armit et al. (2009)	136 participants aged 50 to 70 years of age	A randomised controlled trial (RCT) designed to examine the effect that three different strategies had on physical activity	Physical activity significantly increased in all three groups. This increase was still evident at the 24-month follow-up period	This study had a follow-up period.	This study had no true control group to compare the effects of the three strategies
Bull and Jamrozik. (1998)	763 participants (age range not stated)	An RCT designed to examine the effect that usual care versus verbal advice combined with a tailored pamphlet had on physical activity	Physical activity significantly increased for participants in both intervention conditions, compared to control participants (who received no physical activity advice)	This study had a true control group and three follow-up periods. This allowed for an examination of the long-terms effects of physician advice for physical activity	
Calafas et al. (1996)	212 participants (age range not stated)	An RCT designed to test of the efficacy of brief physician counseling for physical activity (PACE)	Physical activity increased significantly for intervention participants compared to control participants	The study had a true control group.	This study had no follow-up period
Harland et al. (1999)	523 participants aged 40 to 65 years of age	An RCT designed to examine the effectiveness of different frequencies of motivational interviewing for physical activity	Physical activity increased significantly for participants in all four intervention groups compared to participants in the control group	Had a true control group and a 12-month follow-up period	
Hillsdon et al. (2002)	1,658 participants aged 45 to 64 years of age	An RCT designed to examine the effect that two different communication styles of physical activity counseling had on physical activity	Physical activity significantly increased for participants in both intervention groups, compared to participants in the control group	Had a true control group and a 12-month follow-up period	
Kerse et al. (1999)	267 participants aged 65 years and older	A RCT designed to examine the effect that physician health-promotion training had on the health-related behaviours of their patients	The patients of intervention physicians' increased their physical activity and rated their health as being higher compared to the patients of control physicians'	This study had a true control group and a follow-up period	

Kolt et al. (2007)	168 participants aged 65 years and older	An RCT designed to examine the effect that telephone-based counseling had on physical activity and health-related quality of life	Compared to control participants, physical activity significantly increased for participants in the intervention condition	This study had a control group and two-follow-up periods	
Morey et al. (2009)	398 retired male veterans aged 70 years and older	An RCT designed to increase physical activity via physician endorsement and telephone-based counseling	Physical activity significantly increased for intervention participants compared to control participants	This study had a control condition	
Petrella et al. (2003)	284 participants aged 65 years and older	An RCT designed to examine the effect that exercise prescription had on participants' aerobic fitness	Aerobic fitness was significantly higher for participants who received the STEP intervention compared to participants in the control group		This study did not have a true control group
Pinto et al. (2005)	100 participants aged 60 years and older	An RCT designed to examine the effectiveness of brief physician advice for physical activity versus extended advice via telephone-based counseling	Physical activity significantly increased more for participants in the extended advice group compared to participants in the brief advice group		This study had no true control group and no follow-up period
Sims et al. (2004)	299 primary care physicians and 54 primary care patients (ages not stated)	A study designed to assess the Active Script Programme (ASP)	Both physicians and patients found the programme to be effective	Feedback from both physicians and patients was sought	
Smith et al. (2000)	1,142 participants (age not stated)	An RCT comparing the effect that a written prescription versus a written prescription combined with stage-of-change print materials had on physical activity	Participants who received a written prescription combined with print materials reported engaging in significantly more physical activity than participants who received only written advice or those in the control condition	This study had a true control group and four follow-up periods	
van Sluijs et al. (2004)	771 participants aged 18 to 70 years of age	A Dutch version of the PACE intervention in which primary care physicians prescribe physical activity	The physical activity levels of participants in the intervention condition significantly increased compared to control participants	This study had a true control group and two follow-up periods	

In conclusion, this section of the review has discussed the rationale for physical activity counseling and prescription within the primary care setting. Primary care physicians' perceived barriers toward physical activity counseling and prescription were also identified and discussed. A review of the feasibility, acceptability, and effectiveness of primary care physical activity interventions designed to increase physical activity in low-active adults, including low-active older adults was also examined and discussed. The following section will examine the role that the New Zealand Green Prescription can have in increasing physical activity in low-active adults, including low-active older adults.

2.2.4 Physical Activity Counseling and Prescription in New Zealand: The Green Prescription, Introduction, Rationale, and Process

The following section will discuss the rationale behind the New Zealand Green Prescription, the Green Prescription process will be detailed, and a review of the effectiveness of the Green Prescription programme will be examined by way of empirical findings. To counteract a sedentary lifestyle and to encourage physical activity engagement at a population-based level the Hillary Commission (now Sport and Recreation New Zealand, SPARC) developed and launched the Green Prescription programme (GRx) in 1997. This programme was designed as a preventive public health measure in which primary care physicians (the first level of medical contact for the general population) prescribe physical activity to individuals who have preexisting medical conditions (e.g., cardiovascular disease, type 2 diabetes, weight problems) and who are likely to gain health-related benefits from engaging in physical activity. The Green Prescription is based on the U.S. Surgeon General's recommendation of achieving 30 minutes of moderate-intensity physical activity on five or more days of the week (Pringle, 1998; US Department of Health and Human Services, 1996).

In 2002 the New Zealand Ministry of Health published the 'Health of Older People Strategy' (Ministry of Health, 2002). This document consisted of eight objectives that are designed to support the goal of positive ageing in New Zealand. Objective five is concerned with public health initiatives, and focuses on increasing

physical activity engagement in older adults. This objective specifically supports the Green Prescription programme in relation to promoting physical activity in later life. The overall rationale for physical activity engagement throughout the lifespan (and especially in the later years) is that evidence-based findings have shown that by engaging in regular physical activity there can be a reduction in the prevalence of noncommunicable lifestyle related conditions and diseases. This, in turn, can significantly benefit the physical and psychological health of older individuals, and can also reduce the economic strain that older adults place on the healthcare system (Ministry of Health, 2003a). The Green Prescription can then be viewed as a preventive tool in helping to achieve these goals.

The Green Prescription process consists of a primary care physician or registered practice nurse administering/writing out a Green Prescription for a patient who has a stable medical condition and can benefit from physical activity. The physician discusses and negotiates with the patient the best type of physical activity for them to engage in. The physician then writes down the type of activity and its frequency and intensity on the actual prescription. The patient receives a copy of the prescription and a copy is then faxed to the Regional Sports Trust (RST). There are 17 Regional Sports Trusts throughout New Zealand. They are independent, nonprofit organisations which work alongside local sports organisations, health agencies and educational institutions. RSTs aim to support and assist local organisations in implementing physical activity at a community level. During the following three to four months the patient will receive one phone call a month from a (trained) patient support counselor. These calls are designed to provide the patient with ongoing support and advice for physical activity. Telephone counseling is based on the transtheoretical model of behaviour change (Prochaska & Marcus, 1994). According to this model an individual moves through five stages of behaviour change before they maintain a desired behaviour (i.e., regular physical activity engagement). The telephone counseling an individual receives is matched to their current level of readiness for maintaining behaviour change. The patient support counselor reports the patient's progress back to the physician or practice nurse. At the completion of their Green Prescription, the patient can ask their physician (or nurse) to issue them with another Green Prescription if they have found it beneficial, and resume the process again. The Green Prescription is funded by the Ministry of

Health (Sport and Recreation New Zealand, 2006a). The Green Prescription has been found to be a cost effective intervention in relation to increasing physical activity and improving health-status in adult New Zealanders (Dalziel et al., 2006; Elley et al., 2004).

2.2.5 The Green Prescription Process

A schematic diagram of the Green Process can be found in Figure 2.1

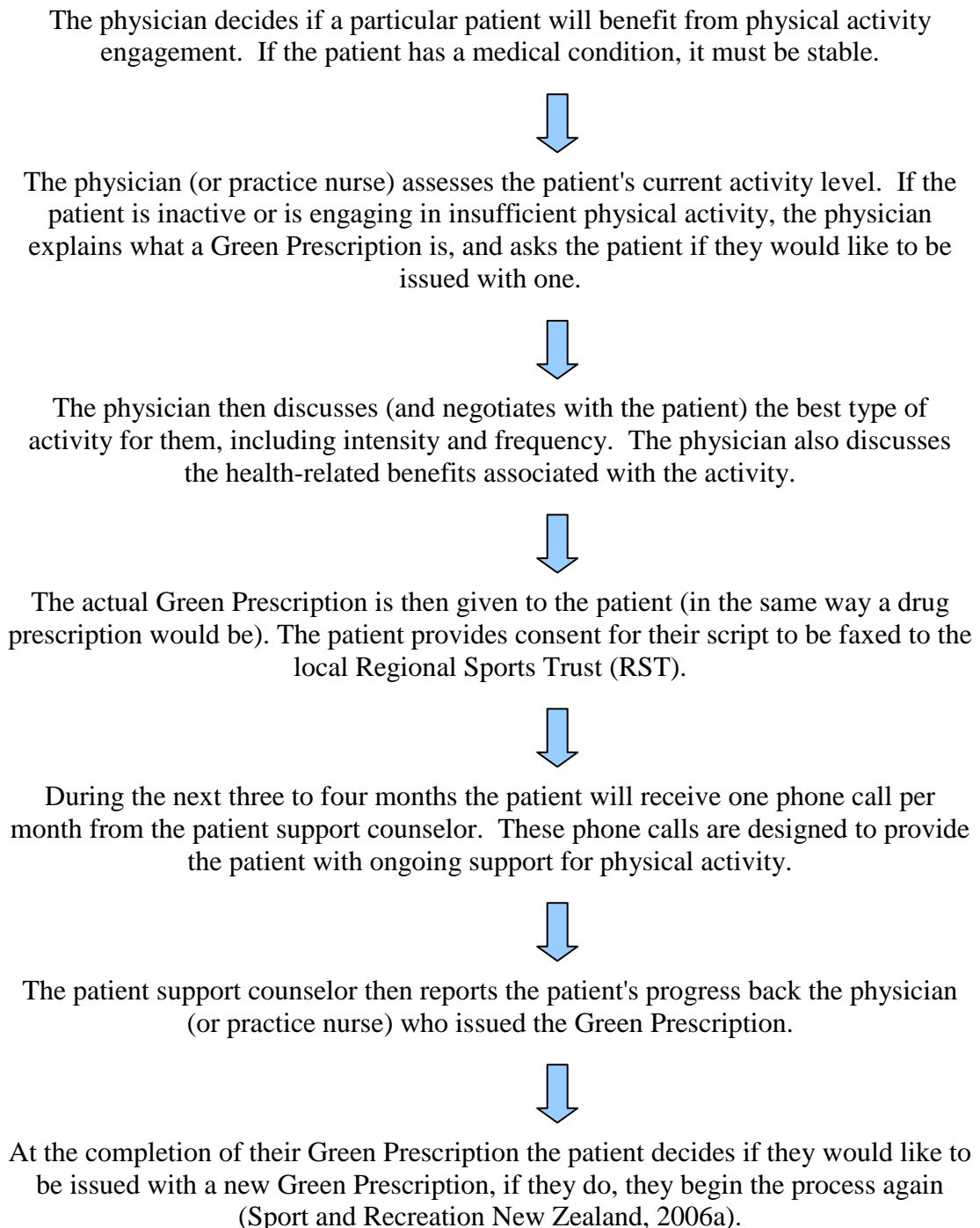


Figure 2.1 The Green Prescription process.

2.2.6 Primary Care Physicians' Perspectives, Attitudes and Experiences of the Green Prescription Programme

This section provides a review of studies that have been carried out to examine primary care physicians' attitudes and experiences of Green Prescription use, including their perceived barriers and benefits of Green Prescription counseling (refer to Table 2.2 for a summary of the Green Prescription studies). Swinburn et al. (1997) carried out one of the first studies that examined primary care physicians' early experiences and attitudes toward Green Prescription counseling. This qualitative study examined the attitudes and practices of 25 primary care physicians toward issuing Green Prescriptions. These primary care physicians were found to be comfortable in introducing and discussing exercise prescription with their patients. Physicians' emphasised that they preferred to give written advice in the form of a Green Prescription, rather than verbal advice alone. It was felt that a (written) Green Prescription formalised and made more concrete their verbal advice regarding physical activity promotion. Physicians also felt that patients would comply with the Green Prescription, as it allowed some patient involvement (i.e., negotiating the type of physical activity). In relation to barriers, these physicians perceived that time constraints would be a major barrier to the overall implementation of Green Prescription use in the primary practice setting. Physicians stated that for the Green Prescription to be successful appropriate training, resource materials, and patient follow up systems would need to be implemented. It was found that the physicians in this study tended to administer Green Prescriptions for patients who had existing chronic health conditions. Physicians stated that they were more likely to administer a Green Prescription for patients that they perceived would be more compliant, as well as patients they saw on a regular basis, to make follow up easier.

Gribben et al. (2000) reported similar findings in a study that examined the circumstances under which Green Prescriptions were issued and also examined physician barriers toward Green Prescription use. Physicians were more likely to issue a Green Prescription for patients who had preexisting chronic health conditions, and also for patients who they perceived would be more compliant. The physicians

who took part in both the Swinburn et al. (1997) and Gribben et al. (2000) studies reported time constraints to be the main barrier toward Green Prescription use. Interestingly, however, some new research shows that in some cases it can be less time-consuming for a physician to outline the Green Prescription programme and write a Green Prescription compared to starting a patient on a new medication (Wynard, 2006). Gribben et al. (2000) found that over one third of physicians in their study felt that more publicity, such as media awareness and promotion of physical activity benefits would be effective in increasing the initial acceptance and uptake of the Green Prescription. Research shows that physicians as group feel that the media has a salient role in helping to promote and 'normalise' the Green Prescription and physical activity engagement in general (Sport and Recreation New Zealand, 2008b; Van Aalst & Daly, 2005a).

2.2.7 Evidence-Based Health Benefits and Cost Effectiveness of the Green Prescription

This section provides a review of research carried out in the form of randomised controlled trials that examined the effect that Green Prescription counseling had on both the physical activity levels and health status of low-active and sedentary adults. One of the first randomised controlled trials that examined the effectiveness of Green Prescription use in the primary care setting was carried out by Swinburn et al (1998). Four hundred and fifty six low-active adults were randomly allocated to either the control (verbal advice only) group or the intervention (Green Prescription) group. At post intervention (6-weeks post baseline), physical activity levels had increased in both groups, but significantly more in the intervention group. This study found that a Green Prescription was more effective than verbal advice alone in significantly increasing physical activity in previously low-active individuals over a short term period. Swinburn et al. attributed the significant differences in physical activity between the two groups to several factors. Firstly, the Green Prescription format of a written prescription for physical activity can be easily understood by patients, because the use of a prescription is a well understood interaction between doctor and patient. Prescriptions are viewed by most patients as being sources of medical help or remedy. Pfeiffer et al. (2001) replicated this randomised controlled trial in the

United States with older adults, they found that a Green Prescription helped convey a message that physicians believe in the health related benefits of physical activity in the same way that they believe in medication, predominately through the use of a symbolic prescription. Recent research into patients' perspectives, attitudes, and experiences of the Green Prescription programme (Elley, Dean, & Kerse, 2007) have found that the issuing of Green Prescriptions in the primary care setting by either a physician or practice nurse adds credibility for physical activity as a form of valid medical treatment.

The long-term effectiveness of the Green Prescription programme was assessed in research carried out by Elley et al. (2003a). Eight hundred and seventy eight sedentary individuals aged 40 to 79 years of age took part in this randomised controlled trial. Participants were randomly allocated to either the control (usual advice) group or the intervention (Green Prescription) group. Changes in physical activity, quality of life, cardiovascular risk and blood pressure were measured over a 12-month period. The Green Prescription intervention was carried out over a 3-month period. Compared to control participants, the physical activity levels of participants in the intervention group increased significantly over a 12-month period. There was a significant increase in intervention participants' mean total energy expenditure and leisure time physical activity. Participants in the intervention group perceived their health as significantly improving compared to the control group. Similar findings have been reported in annual Sport and Recreation New Zealand Surveys that monitor Green Prescription use (Sport and Recreation New Zealand, 2006b; Sport and Recreation New Zealand, 2007b). It was reported that over one half of respondents were engaging in more physical activity than they did prior to being issued a Green Prescription. Respondents also perceived their general health to have improved (i.e., feeling better, less stressed, having more energy) as a result of completing the Green Prescription programme. In the Elley et al. (2003a) study there was a trend (non-statistically significant improvement) in the intervention participants' blood pressure. The study did not have sufficient statistical power to detect a significant change in blood pressure between the two groups. There was no significant change in the risk for cardiovascular disease between the two groups. However, this study demonstrated that for every 10 Green Prescriptions written, one individual achieved and maintained over the 12-month period the minimum amount

of physical activity required for health gain. This is associated with a 20 to 30% risk reduction in all cause mortality compared to individuals who are sedentary. A major strength of this study was that it was a randomised controlled trial and had a true control group. Also the long-term effects of Green Prescription use were examined. Most Green Prescriptions trials are carried out over a short-term period. This study had a large sample, and participants were from a range of diverse socioeconomic groups. This may allow for greater generalisability of the findings.

Elley et al. (2003b) carried out a baseline cross-sectional analysis of data from their 2003 Green Prescription trial (Elley et al., 2003a) in which 878 sedentary primary care patients participated. It was found that blood pressure and body mass index (BMI) were significantly greater in this population compared to the general population. These participants also had higher rates of diabetes (10.5%), obesity (43%), hypertension (52%), and previous cardiovascular disease (19%), and there was an estimated 93% risk for present or future cardiovascular disease in this study population. Simons-Morton et al. (2000) also found that a high proportion (84%) of the primary care patients who took part in a primary care physical activity intervention (The Activity Counseling Trial) had higher cardiovascular risk factors than physically active peers. Elley et al. (2003b) have strongly argued that the primary care setting is an ideal venue in which individuals can be screened for inactivity. Insufficiently active individuals are more at risk for cardiovascular disease and other noncommunicable diseases and conditions. Such diseases and conditions can be managed, minimised, delayed, or prevented at the primary care level through physician-based physical activity interventions such as the Green Prescription. A prospective cost-effective analysis of the Green Prescription programme was undertaken by Elley et al. (2004) based on data from the 2003 Green Prescription trial (Elley et al., 2003a). The Green Prescription programme was found to be a cost effective way to reduce morbidity and premature mortality for insufficiently active adults and for individuals who have preexisting chronic health conditions. Dalziel et al. (2006) undertook a cost utility analysis of the Green Prescription programme based on data from the 2003 Elley et al. (2003 a) study. They suggested that policy makers should encourage primary care physicians to utilize the Green Prescription programme, as it provides better value for money than 'usual care'.

A recent Green Prescription trial (Lawton et al., 2008) also reported a significant increase in intervention participants' physical activity and perceived quality of life over a 2-year period. One thousand and eighty nine low-active female participants aged between 40 and 74 years of age took part in this 2-year randomised controlled trial. Participants in the intervention condition received a Green Prescription from a practice nurse and control participants received usual care during the course of the 9-month intervention period. Intervention participants received monthly telephone-based counseling over a 9-month period. The primary outcome measure was physical activity and secondary outcome measures were quality of life (as assessed by the SF-36 health questionnaire) (McHorney et al., 1993), weight, waist circumference, blood pressure and biochemical measures. Measures were administered at baseline, and at 12 and 24-months. At both 12 and 24-months, significantly more intervention participants were achieving the recommended 150 minutes of moderate-intensity physical activity per week compared to control participants. Compared to control participants, intervention participants experienced a significant increase in both the SF-36 physical and mental health functioning scores at 12-months. Though no longer statistically significant, this increase was still evident at 24-months. The significant increase in physical activity was not associated with significant improvements in biochemical variables. Compared to earlier Green Prescription trials (Elley et al., 2003a) there was an increase in falls and injuries for intervention participants. A major strength of this study is that there was an extended follow-up period that examined the long-term effects that the Green Prescription had on physical activity and health-related status.

2.2.8 Benefits of Green Prescription Use with Older Adults

This section provides a review of two studies that examined the efficacy of Green Prescription counseling with older adults (Kerse et al., 2005; Pfeiffer et al., 2001). Kerse et al. (2005) examined the effectiveness of the Green Prescription programme in increasing physical activity and quality of life in older adults over a 12-month period. Data from a subgroup of 270 adults aged 65 years and older from the Elley et al. (2003a) Green Prescription trial was analysed. At the 12-month follow-up period, intervention participants' leisure time physical activity levels had significantly increased in comparison to aged matched control participants.

Compared to control participants, there was a significant increase in intervention participants' perceived quality of life in relation to the general health and vitality dimensions of the SF-36 health questionnaire (McHorney, Ware, & Raczek, 1993). Blood pressure, injuries and falls remained stable for the intervention group. The Green Prescription was found to be a safe way for these older adults to engage in physical activity. This study provided empirical support for older adults' compliance with their physician's physical activity advice and prescription, as well as evidence for the long term benefits of physical activity prescription for health gain. Pfeiffer et al. (2001) found both the Green Prescription (verbal and written advice for physical activity) versus verbal advice only to be effective in significantly increasing physical activity over a 6-week intervention period in previously low-active adults aged 62 years and older. This study was carried out at a primary care practice in the United States and replicated the randomised controlled trial carried by Swinburn et al. (1998). Pfeiffer et al. argued that the significant increase in physical activity for both groups regardless of the two different advice modalities may have been attributed to the fact that the patients at this particular practice were used to receiving written information and instruction from their physician, this in turn may have increased patient compliance for the Green Prescription.

2.2.9 Patient Attitudes and Experiences of the Green Prescription Programme

This section will provide a review of the limited research that has examined how patients/participants have perceived their Green Prescription experience. Elley et al. (2007) undertook a qualitative study alongside their randomised controlled trial (Elley et al., 2003a) to examine patient attitudes, perspectives and experiences of receiving a Green Prescription. This study was also designed to establish what components of the Green Prescription acted as motives and barriers for physical activity. One of the main themes that emerged in relation to motivational factors was centered on the individual tailoring effect of the Green Prescription. This related to the realistic aligning of the actual Green Prescription (activity plan) with the individual patient's capabilities (i.e., taking into account preexisting medical conditions, an individual's discomfort with attending a gym). Another theme that emerged was related to internal motives. This entailed participants talking about their subjective experiences of the Green Prescription. Patients discussed how

undertaking a Green Prescription helped improve their sleep, helped to increase their feeling of wellbeing and also helped raise their self esteem. Two main sets of barriers emerged from participants accounts. Barriers that participants encountered during their Green Prescription were either external (i.e., environmental factors such as the weather, lack of footpaths) or internal (i.e., lack of motivation, low self esteem).

Another motivation based theme that emerged related to the role that significant others had in helping an individual to both initiate and maintain their physical activity engagement. Significant others were primary care physicians, practice nurses, the patient support counselor, family, and friends and in some cases a pet dog. Some patients discussed how the phone support from the patient support counselor helped keep them motivated and active. Patients talked about how the ongoing phone support helped make them feel accountable to their Green Prescription 'contract'. This finding is consistent with annual sport and recreation surveys (Sport and Recreation New Zealand, 2006b; Sport and Recreation New Zealand, 2008c; Van Aalst & Daly, 2005b) that monitor Green Prescription use. Respondents have consistently stated that the advice, support and encouragement that they have received from their patient support counselor has helped to keep them physically active and complete their Green Prescription. In some cases this was attributed to someone 'checking up' on them, as well as the perception that someone (the patient support counselor) carried about their wellbeing (See Table 2.2 for a summary of Green Prescription studies).

Table 2.2. Summary of Green Prescription studies

Study	Participants	Study aim(s) and design	Main findings	Strengths	Limitations
Dalziel et al. (2006)	Data from 878 primary care patients from the Elley et al. (2003a) study	An economic cost utility analysis of the Green Prescription programme	The Green Prescription can be more cost effective than 'usual care'	Analysis was based on data from a Green Prescription RCT	
Elley et al. (2003a)	878 participants aged 40 to 79 years of age	An RCT designed to examine the long-term effectiveness of the Green Prescription	Intervention participants experienced a significant increase in physical activity over a 12-month period and perceived health-based improvements compared to control participants	This study had a true control group and a large sample. Participants were from a range of socioeconomic backgrounds	
Elley et al. (2003b)	Data from 878 primary care patients from the Elley et al. (2003a) study	A baseline cross-sectional analysis of data from the Elley et al. (2003a) study to examine self-reported physical activity levels and cardiovascular risk factors for participants compared to the general population	Body mass index and blood pressure were significantly greater for participants compared to the general population. Participants also had higher rates of diabetes and, future risk for cardiovascular diseases compared to the general population	This study provided empirical evidence for the importance of screening primary care patients for physical inactivity	
Elley et al. (2004)	Data from 878 primary care patients from the Elley et al. (2003a) study	Prospective study to assess the cost effectiveness of the Green Prescription programme	The Green Prescription is an inexpensive way of increasing physical activity in low-active individuals	Analysis based on data from well designed RCT	
Elley et al. (2007)	15 participants from the Elley et al. (2003a) study	A qualitative study examining participants views and experiences of receiving a Green Prescription	Four themes emerged. Overall, participants perceived the Green Prescription to be helpful in initiating and aiding their physical activity	This study allowed for participants to explain in detail their experiences of undertaking the Green Prescription programme	
Gribben et al. (2000)	433 primary care physicians (age not stated)	To establish the prevalence of Green Prescription use, circumstances under which Green Prescriptions were administered, and physicians' perceived barriers to Green Prescription use	65% of respondents had issued at least one Green Prescription, mostly for management purposes for preexisting chronic health conditions. Perceived barriers to Green Prescription use were centered around time constraints	This study had a high response rate	

Kerse et al. (2005)	270 participants aged 65 years and older	Subgroup analysis of the Elley et al. (2003a) study designed to establish the effectiveness of the Green Prescription programme with older adults	Intervention participants physical activity had significantly increased, and these participants perceived their general health as been better compared to age-matched control participants	This study demonstrated that the Green Prescription is an effective, safe way for older adults to engage in physical activity	
Lawton et al. (2008)	1,089 female participants aged 40 to 74 years of age	An RCT designed to examine the effectiveness of the Green Prescription in increasing physical activity over a 2-year period	A significant proportion of intervention participants were achieving recommended levels of physical activity at post-intervention compared to control participants	Physical activity was assessed at two time-points.	There was no follow-up period
Pfeiffer et al. (2001)	49 participants aged 62 and older	An RCT replicating the study carried out by Swinburn et al. (1998)	Physical activity significantly increased for participants in both conditions	This U.S. based study was designed to replicate a New Zealand study	
Swinburn et al. (1997)	25 primary care physicians (age not stated)	A qualitative study designed to assess primary care physicians' attitudes toward Green Prescription use	Physicians' preferred a Green Prescription format compared to verbal advice alone for physical activity. Perceived barriers toward Green Prescription use were centered around time constraints	A study designed to allow physicians' to discuss in depth their views on Green Prescription use	
Swinburn et al. (1998)	456 participants (mean age 49 years)	An RCT designed to determine whether a Green Prescription increased physical activity compared to verbal advice alone	Physical activity increased in both groups, though, significantly more in the intervention group	This study had a control group	This study had no follow-up period

In conclusion, this section has discussed the rationale behind the New Zealand based Green Prescription programme. A review of randomised controlled trials designed to examine the effectiveness of the Green Prescription in increasing the physical activity in low-active individuals, including older adults, was examined and discussed. The following section will identify and discuss barriers and motives that can effect physical activity participation in older adults. The role that pedometers can have in health promotion will also be examined.

2.3.0 Barriers and Motives for Physical Activity Participation in Older Adults

Physical activity participation is associated and determined by many diverse factors in later life, such as physical, psychological, social, and environmental factors (Dishman, 1994; Jones, 2003; Schutzer & Graves, 2004). To encourage physical activity participation in later life information is required about the subjective and objective barriers and motives that older adults as a group can face. Barriers and motives need to be identified and accommodated for if interventions such as the Green Prescription are to be successful on a long-term basis and bring about health-related gain (Booth, Owen, Bauman, Clavisi, & Leslie, 2000; Chad et al., 2005; Cohen-Mansfield, Marx, & Guralnik, 2003; Kaplan, Newsom, McFarland, & Leinin, 2001; Lim & Taylor, 2005).

2.3.1 Health and Medical Factors

Health and medical conditions have been cited in the literature as being both salient motives and barriers for physical activity participation for older adults compared to younger age groups (Belza et al., 2004; Booth, Bauman, Owen, & Gore, 1997; Guerin, Mackintosh, & Fryer, 2008; Kalavar, Kolt, Giles, & Driver, 2004; Kirkby, Kolt, Habel, & Adams, 1999; Kolt, Giles, & Driver 2004; Schutzer & Graves, 2004). In most cases older adults are motivated to engage in physical activity to help manage their chronic health conditions, though, at the same time their medical condition(s) may limit their ability to engage in regular physical activity (Newsom & Kemps, 2007).

Newson and Kemps (2007) undertook a study to identify motives and barriers for physical activity among older adults. The study was designed to determine if barriers and motives differed as a function of age, gender, and current exercise level and whether these factors related to intentions to exercise in the future. The sample consisted of 217 respondents (mean age 70.05 years). Older aged participants (75 years and older) were motivated to exercise to maintain an active lifestyle. Though, medical problems acted as a barrier for exercise engagement for this oldest age group compared to younger-aged participants (63 to 74 years of age). Compared to females, males were motivated to exercise for the challenging nature of exercise engagement. This finding is consistent with Kalavar et al. (2004) who reported that the older males' motives for physical activity participation reflected the challenging nature of physical activity. Compared to males, females were more motivated to exercise for health reasons. Previous studies (Krikby et al., 1999; Kolt et al., 2004) that have examined motives for physical activity and exercise participation have also found female respondents to cite health and medical reasons as motives for exercise participation (i.e., engaging in physical activity to keep healthy and/or manage existing health conditions).

Belza et al. (2004) undertook focus group interviews to examine barriers and motives for physical activity and exercise participation with a sample of 71 ethnic minority adults aged 52 to 85 years of age. Respondents were motivated to engage in physical activity to help manage their chronic health conditions (i.e., arthritis, diabetes, hypertension). However, health and medical conditions also acted as a barrier for physical activity participation (i.e., experiencing pain, fear of injury). Health and medical conditions were found to act as both motives and barriers for physical activity participation in a study carried out by Kolt, Paterson, and Cheung (2006a) which examined barriers for physical activity participation in a sample of Tongan adults (mean age 69.1 years of age) who resided in New Zealand. Respondents discussed how existing health conditions such back pain, cardiovascular disease, as well as fear of new injury acted as barriers for physical activity participation. Some respondents also discussed the health benefits they received from engaging in physical activity. For example, one respondent discussed how they experienced improved breathing after engaging in physical activity in relation to their chest problem. Resnick and Spellbring (2000) found that older adults (mean age

81.0 years) who experienced improved physical health (i.e., lowered blood pressure, improved mobility, and breathing) as a result of engaging in regular physical activity (via walking) were more likely to adhere to a six-month walking program regardless of existing health conditions.

In some cases, motives and barriers for physical activity participation appear to be the same regardless of whether an individual is community dwelling or living in an assisted care facility. Guerin, Mackintosh, and Fryer (2008) undertook a focus group study to identify perceived barriers and motives for participation in an exercise class that was offered for residents in a low-level residential facility. Motives for residents to attend the exercise class included the following factors; wanting to improve one's health, to maintain or improve mobility, and maintain fitness (a way of continuing one's previous active life). Barriers were centered around the effects of living with chronic health conditions (i.e., experiencing pain, becoming fatigued, fear of new injury), with incontinence and hearing problems also identified as barriers for exercise participation by some respondents.

2.3.2 Environmental Factors

The physical environment can act as a barrier for physical activity participation in old age. Research shows that if older adults perceive their neighbourhood to be unsafe they are unlikely to take up walking as form of physical activity (Belza et al., 2004). The safety of footpaths, accessibility of lights and crossings, as well as benches to rest on, seasonal weather changes, lack of proximity to physical activity and exercise venues, and lack of reliable transport to activity venues have been shown to effect physical activity participation in some older adults (Kalavar et al., 2004; Kolt et al., 2004; Lees, Clark, Nigg, & Newman, 2005; Phillips, Schneider, & Mercer, 2004).

One of the most salient environmental barriers for physical activity participation in old age is associated with seasonal weather changes (Schutzer & Graves, 2004). Respondents in the Kalavar et al. (2004) study discussed why they found the physical environment to be a barrier for physical activity. One respondent

stated that he could only take part in outdoor physical activities for one half of the year because of severe winter weather (i.e., snow, wet weather, and extreme cold temperatures). This respondent discussed how he was afraid of injuring himself by slipping and falling in the snow. Likewise, respondents in the Kolt et al. (2006a) study reported that extreme temperatures acted as a barrier for outdoor physical activity participation. Weather conditions were also identified as a barrier for physical activity in a focus group study that was carried out with 66 respondents aged 65 and older (Lees et al., 2005). Weather constraints were also identified as a barrier for physical activity participation in the Belza et al. (2004) study. However, some respondents in the Belza et al. study discussed how they overcame this environmental barrier. Respondents mentioned that if they could not walk outdoors they would walk in shopping malls instead, and if they were unable to work in their gardens they would engage in indoor dancing activities.

Booth et al. (2000) examined the role that perceived environmental influences had on physical activity participation in a sample of 449 adults aged 60 years and older. Having access to either safe footpaths or local exercise facilities was significantly associated with physical activity participation. In line with this finding, Belza et al. (2004) reported that perceptions of unsafe neighbourhoods and lack of local exercise facilities were reported to be barriers for physical activity and exercise participation. Lack of access to local exercise facilities was reported to be a barrier for exercise participation for female respondents and those who were categorised as low-level exercisers (those who engaged in one hour of moderate-level exercise per week) (Newson & Kemps, 2007). Lack of reliable and affordable transportation to activity venues has also been identified as a barrier for physical activity participation, especially in studies involving older adults from ethnic minority groups (Belza et al., 2004; Kolt et al., 2006a).

King et al. (2000) examined personal and environmental factors that were associated with physical inactivity in a population-derived sample of 2912 women aged 40 years and older from differing ethnic groups in the United States. The absence of enjoyable scenery and lack of hills in one's neighbourhood, as well as infrequently seeing other people exercising were reported to be barriers for physical activity participation. Interestingly, frequently seeing others in one's neighbourhood

exercising, the presence of hilly neighbourhoods, and unattended dogs were associated with an increase in physical activity engagement for African American women in this sample. King et al. speculated that respondents perceived hilly terrain as requiring more effort to walk than flat ground. These findings are consistent with Chad et al. (2005) who found that physical activity participation was positively associated with the following environmental factors in a sample of 764 respondents aged 65 years and older; having access to walking and biking trails, presence of hilly terrain, seeing other's being physically active, presence of unattended dogs, and having access to physical activity and exercise facilities.

2.3.3 Lack of Knowledge about the Health-Related Benefits of Physical Activity

Lack of knowledge about the health-related benefits of regular moderate intensity physical activity have been reported in the literature as being a strong barrier for physical activity participation among some older adults (Dishman, 1994; McMurdo, 1999; Newson & Kemps, 2007; Schutzer & Graves, 2004). Within a New Zealand context, research carried out by Galgali et al. (1998) examined the prevalence of physical inactivity among older New Zealanders. The sample consisted of 910 respondents aged 60 years and older. Forty percent of respondents were found to be sedentary (engaging in less than 150 minutes of physical activity per week). Galgali et al. argued that there may be misconceptions with older adults regarding knowledge about the health-related benefits of physical activity. Some older adults believe that physical activity needs to be intense and vigorous if it is to provide health-related benefits. This finding is consistent with McMurdo (1999) who stressed that some older adults believe that they need to engage in vigorous physical activity to achieve health-related gain. There is also some misconception that older adults do not benefit from physical activity engagement to the extent of younger adults (Galgali et al.). There is also a belief that physical activity engagement is only a recreational pursuit, and thus not important (Schutzer & Graves, 2004). Lack of education about the benefits of physical activity, as well as lack of knowledge about how to engage in physical activity was identified as barriers for physical activity participation by some older Tongan adults who took part in a qualitative study that examined barriers for physical activity participation (Kolt et al., 2006a).

A study that examined motives and barriers for exercise participation in older adults (Newson & Kemps, 2007) found that female respondents and those who were categorised as low-level exercisers (engaging in less than one hour of moderate intensity exercise per week) were more likely to report that lack of exercise-specific knowledge was as a barrier for exercise participation compared to male respondents and respondents who were categorised as high-level exercisers (engaging in more than one hour of moderate intensity exercise per week). The majority of respondents conveyed that they were motivated to exercise and reported few barriers for exercise engagement. Newson and Kemps suggested that past exercise experience may have influenced present attitudes and actions toward how exercise is perceived (i.e., if an individual had a life long history of inactivity they not likely to want to become active in later adulthood). There appears to be an association between past exercise or physical activity engagement and the likelihood of engaging in regular physical activity participation in older age. The majority of older-aged participants who adhered to a six month walking programme had been physically active when they were younger (Resnick & Spellbring, 2000). Another study (Guerin et al., 2008) found that a previous physically active lifestyle acted as a motivator for exercise engagement in later life for individuals who lived in a low-level care facility.

2.3.4 Societal and Cultural Specific Factors and Physical Activity

Societal and cultural-specific views and perceptions of physical activity and its relationship to ageing and gender have been reported to act as barriers for physical activity participation for some groups of older adults (Kalavar et al., 2004; Kolt et al., 2006a). Traditionally, old age has been portrayed as being a time of sickness and of physical and cognitive deterioration, as well as a time of rest and relaxation (Ory, Hoffman, Hawkins, Scanner, & Mokenhaupt, 2003). These stereotypical views have perpetuated the myth that older adults should remain inactive. Regular physical activity and exercise engagement has also been viewed as an unladylike activity to engage in, with sweating and labored breathing and sore muscles been viewed as doing more harm than good (Schutzer & Graves, 2004).

Ageing was identified as a barrier for physical activity participation in a study that examined barriers and motives for physical activity in older Asian Indian adults (Kalavar et al., 2004). For some respondents there was an incompatibility between physical activity engagement and old age. Respondents viewed old age as a time of rest and relaxation. Physical activity and exercise were seen as activities that younger individuals engaged in. For example, one respondent stated that engaging in physical activity would be interpreted as trying to be youthful. Similarly, a focus group study carried out with 112 older New Zealand adults aged 69 to 91 years of age found that some older adults who had moved to a retirement village perceived that their new living environment signified a move to a more relaxed and less overburdened setting. Respondents were more inclined to engage in passive and social activities, and were less likely to use the swimming pool and exercise studio, even though they acknowledged the health-related benefits of engaging in physical activity (Grant, 2006).

Cultural-specific differences were identified as barriers for physical activity by some respondents who took part in a qualitative study that examined barriers for physical activity participation in older Tongan adults (Kolt et al., 2006a). This was in relation to feeling uncomfortable or embarrassed about engaging in physical activities in front of other people. One example given was in relation to swimming. In their native Tonga, individuals of both genders would wear a 'lavalava' (which would cover the lower half of their body) whilst, in New Zealand, the thought of wearing a bathing suit acted as a barrier for swimming for some respondents. Time constraints in relation to caring for grandchildren were cited as barriers for physical activity in both the Kolt et al. (2006a) and Kalavar et al. (2004) studies.

2.3.5 Social Factors

Perceived social support and/or opportunities for social interaction can act as a motive for physical activity participation in older adults (Schutzer & Graves, 2004). Belza et al. (2004) found social support to be a motive for physical activity for respondents who took part in a focus group study that examined barriers and motives for physical activity participation in older ethnic minority adults. Respondents who had either received verbal encouragement for physical activity engagement from family members, or had a friend to exercise with, or had received

social support from peers attending the same exercise class were more likely to remain active. Kirkby et al. (1999) found social interaction opportunities (e.g., “liking the company”) to be a strong motive for exercise engagement for women aged 65 years and older who took part in a study that examined motives for exercise participation. In their research that examined the motives for why older Australians participate in exercise and sport, Kolt et al. (2006a) reported that female respondents significantly rated social reasons as being a strong motive for physical activity participation compared to their male peers. A focus group study that was designed to identify motives and barriers for physical activity in Indian Asian older adults who had immigrated to the United States (Kalavar et al., 2004) reported that male respondents compared to female respondents rated social factors as motives for physical activity participation.

A focus group study was undertaken to identify perceived barriers and motives for exercise class participation among older adults who lived in a low-level residential care facility (Guerin et al., 2008). The theme of social benefits emerged in which some respondents discussed how attending the exercise class provided them with an opportunity to interact with other residents, which in turn helped to prevent isolation. Some respondents also mentioned that this was an ideal venue in which they could 'show off' their physical activity abilities. Verbal support and encouragement from family members, as well as from staff at the facility acted as a motive to regularly attend the exercise class. In contrast, other studies have reported that perceived social support was not significantly associated with physical activity participation in older adults (Allison & Keller, 2000; Howze, Smith, & DiGilio, 1989).

Booth et al (2000) examined the role that social-cognitive influences had on physical activity participation in a sample of 449 adults aged 60 years and older. Physical activity engagement was measured and coded by metabolic energy expenditure based on self-reported physical activity. Respondents who were more physically active were more likely to have reported receiving verbal support and encouragement from family and friends to engage in physical activity. There was also a significant association between a respondent being physically active and having a spouse and/or friends who were also physically active. Pettee et al. (2006)

found social factors to influence physical activity participation in a group of 345 spousal pairs aged 70 to 79 years of age. A physically active husband was more likely to have a physically active wife.

A growing body of research-based evidence has demonstrated that endorsement and prescription for physical activity from a primary care physician can be a strong motive for some older adults to consider, initiate, and adhere to regular physical activity participation (Booth, Bauman, Owen, & Gore, 1997; Elley et al., 2007; Phillips et al., 2004; Schutzer & Graves, 2004). A study (Booth et al., 1997) that examined preferred sources of support for physical activity among three different age groups (18 to 39, 40 to 59 and 60 to 78 years of age) found the oldest age group preferred to receive advice and support for physical activity from their general practitioner (primary care physician) compared to younger age groups. Elley et al. (2007) undertook a qualitative study that examined participants' experiences of receiving a Green Prescription. Some participants viewed their primary care physician as a 'significant other' in relation to the authoritative knowledge that their physician had about health promotion. A physician's prescription for physical activity acted as a motive for physical activity participation for some participants who had received a Green Prescription. For example, one participant discussed how she was more inclined to engage in physical activity because the advice/prescription was given to her by her physician.

2.3.6 Theory of Behaviour Change: Transtheoretical Model of Behaviour Change

The telephone support counseling component of the Green Prescription has been underpinned by the transtheoretical model of behaviour change. The transtheoretical model of behaviour change also referred to as the stage of change model, theorises that an individual moves through a series of stages before they maintain a particular behaviour (i.e., regular physical activity engagement). The first stage is pre-contemplation; the individual is not physically active and does not intend to become active in the near future. The second stage is contemplation; the individual is not physically active but is planning to become active within the next

six months. Preparation is the third stage, where the individual is making small changes and intends to become physically active within the next month. The fourth stage is the action stage, where the individual has become physically active, but has been active for less than six months. Maintenance is the fifth stage, during which the individual has been engaging in physical activity on a regular basis for over a six month period (Prochaska & Marcus, 1994).

This model has been used to understand (and theorise) how an individual changes a behaviour (Marcus, Rossi, Selby, Niaura, & Abrams, 1992). The transtheoretical model was originally used to help individuals with smoking cessation, more recently; this model has been used to understand behaviour change in relation to regular exercise and physical activity adoption and adherence (Prochaska & Marcus, 1994). Behaviour change is underpinned by decisional balance and self efficacy. Decisional balance involves assessing benefits and costs to self and others in relation to changing one's behaviour. Self efficacy is the extent to which the individual believes that they can successfully sustain a particular behaviour (Prochaska & Marcus, 1994).

Research has demonstrated that when a particular intervention is tailored to meet an individual's stage of change it is more likely to result in a successful outcome (i.e., adoption and maintenance of a desired behaviour) (Burbank, Padula, & Nigg, 2000). Elley et al. (2007) found that individuals who were contemplating becoming physically active became so when they were given a Green Prescription. A Green Prescription helped these individuals initiate physical activity engagement, and the ongoing telephone counseling helped them to maintain their physical activity participation. Previous physical activity interventions (Gillis, Grossman, McLellan, King, & Stewart, 2002; Kolt et al., 2006b) that have been underpinned by the transtheoretical model of behaviour change have been successful in helping older adults initiate and maintain physical activity participation.

2.3.7 Telephone-Based Counseling

Physical activity interventions that have incorporated telephone-based support as part of their intervention design have been effective in increasing

participants' physical activity over both a short and long-term period (Bombardier et al., 2008; Eakin, Lawolor, Vanelanotte, & Owen, 2007b; Green et al., 2002; Kolt et al., 2007; Marcus et al., 2007; Van Wormer & Boucher, 2004). Ongoing telephone-based support can help facilitate behaviour change. The repeated 'booster' contact nature of telephone-based interventions can help support the maintenance of the behaviour change (Eakin et al., 2007b). Telephone-based interventions that are underpinned by theories that underlie behaviour change have been found to be more effective in aiding behaviour change (Ball, Salmon, Leslie, Owen, & King, 2005; Gillis et al., 2002; Kolt et al., 2007). Telephone-based interventions for physical activity are generally cost effective, require minimal contact with participants, and can be carried out with participants who have low literacy (Ball et al., 2005; Wolf, Lepore, Vandergrift, Basch, & Yaroch, 2009).

Eakin et al (2007b) undertook a systematic review of telephone interventions for physical activity and dietary behaviour change. Twenty of the 26 studies reviewed reported significant behavioural improvements (i.e., a significant increase in physical activity and or dietary change) during the course of the intervention period. It appears that interventions that last between 6 and 12 months and those that include at least 12 telephone calls are more beneficial than shorter interventions. Telephone-based interventions that have been employed to encourage physical activity in populations who have specific medical conditions have been beneficial in helping these individuals become physically active (Bombardier et al., 2008; Van Wormer & Boucher, 2004). VanWormer and Boucher (2004) found telephone counseling to be an effective tool for changing health-related behaviour (i.e., increasing physical activity and aiding dietary change) in individuals who had a diagnosis of coronary artery disease (CAD). Telephone-based counseling has also been effective in increasing health promotion activities, including physical activity in individuals with multiple sclerosis. Bombardier et al. (2008) examined the effect that motivational interviewing-based telephone counseling had in increasing health promotion activities such as physical activity in community-dwelling individuals who had multiple sclerosis. Sixty participants were randomly allocated to the control (wait-list condition) and 70 participants were randomly allocated to the intervention condition. Intervention participants had an individual in-person motivational interview and goal-setting meeting. During the 3-month intervention period,

participants in the intervention condition received 5 follow up telephone counseling sessions. Telephone counseling was designed to support participants in achieving their goals. At post intervention, participants in the intervention condition reported significantly greater improvement in health promotion activities, including physical activity (i.e., self selected walking speed, lower limb strength) compared to participants in the control condition.

Perceived social support via telephone counseling has been found to be a strong motivating factor in helping older adults initiate and maintain their physical activity participation (Elley et al., 2007; Gillis et al., 2002; Kolt et al., 2006b; Sepsis et al., 1995). A qualitative study (Elley et al., 2007) that examined participants' experiences of the Green Prescription intervention found that social support via ongoing telephone contact from the patient support counselor was perceived by participants as being a strong motive for adhering to their Green Prescription. Likewise, annual surveys that monitor Green prescription use (Van Aalst & Daly, 2005b; Sport and Recreation New Zealand, 2007b) consistently report that respondents have found the social support they received via the telephone counseling to be beneficial in helping them remain focused and motivated to complete their Green Prescription. Participants who took part in focus groups interviews for the Community Healthy Activities Model Program for Seniors (CHAMPS II) (Gillis et al., 2002) discussed how the telephone contact they received during the course of the intervention provided them with ongoing support and encouragement to remain physically active. Some respondents also mentioned that the ongoing telephone contact ensured they remained accountable to completing the program. The telephone calls helped create a bond between the participant and support counselor, which helped some participants to adhere to the program.

The telephone-based counseling that participants received as part of their Green Prescription program, as well as the telephone-based support participants received in the CHAMPS II intervention was underpinned by the transtheoretical model of behaviour change. The application of this theory based model appears to be effective in achieving desired behaviour change, as the counseling participants receive is matched to their current level of readiness for behaviour change (Prochaska & Marcus, 1994). The effectiveness of this stage-of-change model in

helping low-active individuals become physically active is highlighted in an intervention carried out by Green et al. (2002) that was designed to increase physical activity among low-active primary care patients. The telephone-based counseling participants received for physical activity during the 3-month intervention phase was underpinned by the Transtheoretical stages-of-change model (Reed et al., 1997). The intervention was successful in significantly increasing physical activity in intervention participants at post-intervention compared to control participants.

The following studies provided mixed findings for the effectiveness of telephone versus print-based interventions in increasing physical activity in low-active individuals (Ball et al., 2005; Humpel, Marshall, Iverson, Leslie, & Owen, 2004; Lewis, Napolitano, Whitley, & Marcus, 2006; Marcus et al., 2007). A study carried out by Ball et al. (2005) found a print-plus telephone-mediated intervention to be more effective in increasing physical activity than a print-based intervention alone in 66 low-active individuals aged 45 to 78 years of age. During the course of the 3-month intervention, participants in both groups received two instructional newsletters that included information on physical activities and how to overcome common barriers for physical activity. All participants were given a pedometer and were instructed to complete weekly activity logs. Participants in the print-plus telephone condition received a series of 6 telephone calls during the course of the intervention. Telephone counseling was based on the transtheoretical model of behaviour change (Prochaska & Marcus, 1994). An individualised activity plan was designed for participants in the combined print and telephone condition and was based on participants' stage of change for physical activity. Physical activity increased significantly for both groups between baseline and post intervention. This increase in physical activity was still maintained at the 4-week follow up period, however, participants in the combined print and telephone condition had slightly higher (non-significantly different) physical activity scores compared to participants in the print only condition.

In contrast, Humpel et al. (2004) found no significant difference for walking activity in participants who were allocated to either a print-based intervention or a print plus telephone intervention. Walking activity increased significantly in both intervention groups during the course of the intervention. Likewise, Lewis et al.

(2006) found that physical activity increased significantly for participants who received either a print-based intervention versus a telephone-based intervention for physical activity. At both 6 and 12 months participants in both conditions had significantly increased their physical activity levels, with no significant differences between the two intervention groups.

Marcus et al., (2007) found print materials to be more effective in maintaining physical activity over a 12-month period compared to telephone counseling alone in a sample of 239 low-active individuals. The physical activity levels of participants in both the telephone and the print intervention conditions significantly increased between baseline and 6 months. However, at 12 months, participants in the print condition reported significantly greater increase in physical activity minutes per week compared to participants in the telephone and control conditions. Marcus et al. speculated that telephone counseling may assist in the adoption and uptake of physical activity and that print materials may assist in maintaining physical activity over time (See Table 2.3 for a summary of the telephone-based interventions).

Table 2.3. Summary of telephone-based interventions designed to increase physical activity

Study	Participants	Study aims and design	Main findings	Strengths	Limitations
Ball et al. (2005)	66 participants aged 45 to 78 years of age	To examine the effectiveness for increasing physical activity via a print-based intervention and a print-plus telephone mediated intervention	Physical activity increased significantly for participants in both groups at post-intervention and at the follow-up period	There was a follow-up period to examine the long-term effects that the interventions had on physical activity	
Bombardier et al. (2008)	130 participants aged 18 years and older	An RCT designed to determine if motivational interviewing-based telephone counseling increased health promotion activities, such as physical activity in individuals with multiple sclerosis	Health promotion activities, such as physical activity engagement improved for intervention participants compared to control participants	This study had a true control group	There was no follow-up period
Eakin et al. (2007b)	Systematic review of 26 studies with participants aged 18 years and older	Systematic review of studies that incorporated telephone-based counseling to aid behaviour change	20 of the studies reported significant behavioural improvements, such as increases in physical activity	A set criteria was used to extract studies for review	
Elley et al. (2007)	15 participants aged 40 to 79 years of age	A qualitative study designed to examine participants' views and experiences of receiving a Green Prescription	The telephone-based counseling was perceived to be an avenue of social support and a strong motive for completing one's Green Prescription	Qualitative methodology employed to ascertain participants' views and experiences	
Gillis et al. (2002)	86 participants aged 65 to 90 years of age	An intervention designed to increase physical activity in low-active older adults	On-going telephone contact was perceived to aid and support physical activity for some participants	This study had two focus group interviews at post-intervention.	
Humpel et al. (2004)	399 participants aged 40 years and older	An RCT designed to examine the effect that print materials versus print plus telephone counseling had on walking activity	Participants in both conditions significantly increased their walking activity		No follow up period

Lewis et al. (2006)	239 participants aged 18 to 65 years of age	An RCT designed to examine the effect that print versus telephone based counseling had on physical activity	Physical activity significantly increased for participants in both conditions, with no significant differences between the two conditions		No true control group and no follow-up period
Marcus et al. (2007)	239 participants aged 18 to 65 years of age	An RCT designed to examine the effect that print versus telephone-based counseling had on physical activity	At post-intervention, participants in the print condition reported engaging in significantly more physical activity compared to those in those in the telephone condition	This study had a true control group.	
Van Wormer and Boucher (2004)	22 participants with a mean age of 70.3 years (SD+8.0 years)	Telephone-based intervention designed to increase health-related behaviours in individuals who have coronary artery disease	Intervention was effective in increasing physical activity and aiding dietary change	Pedometers were used to measure walking activity	Small sample size

2.3.8 Self Efficacy

Self efficacy has been identified as a factor that can influence physical activity initiation and adherence in older adults. Self-efficacy is a cognitive process that underpins motivation and behavioural change. It relates to the extent to which an individual believes they can successfully complete a particular task (Phillips et al., 2004; Schutzer & Graves, 2004). A number of studies have found an association between high self-efficacy and long-term physical activity participation (Allison & Keller, 2000; Brassington, Atienza, Perczek, DiLorenzo, & King, 2002; Howze et al., 1989; McAuley, Jerome, Elavsky, Marquez, & Ramsey, 2003; Stutts, 2002).

Allison and Keller (2000) found high self-efficacy to be significantly associated with continued physical activity participation in a sample of 31 older adults who took part in a cardiac rehabilitation program. Likewise, Resnick and Spellbring (2000) found that older-aged participants who adhered to a six month walking program had higher self-efficacy expectations regarding their ability to exercise. Some participants discussed how they had an inner motivation to exercise and a belief in their ability to carry out the program. Perceived psychological benefits also acted as motives for continued participation in the program. For example, some participants mentioned that they experienced subjective feelings of happiness, feeling good, and feeling a sense of inner satisfaction as a result of engaging in and completing the walking program.

The following two studies found high self-efficacy to be a predictor of physical activity (McAuley et al., 2003; Stutts, 2002). McAuley et al. (2003) examined the role that self-efficacy and social support had in helping maintain long-term adherence for physical activity in older adults. One hundred and seventy four adults aged 60 to 75 years of age took part in a 6-month physical activity intervention. Participants were allocated to either a walking or a stretching and toning programme. Each group engaged in their given exercise three times a week (40 minutes per session) for 6 months. At post intervention, perceived social support within the exercise class was beneficial, but did not affect long-term exercise

maintenance at the 18-month follow up. Participants who had higher self-efficacy scores at post intervention were more likely to be physically active at the 18-month follow up period. Stutts (2002) examined if perceived self-efficacy for physical activity was a determining factor for physical activity engagement in a sample of 137 respondents. Respondents who had higher self-efficacy levels were more likely to be physically active. Low self-efficacy levels were associated with more perceived barriers for physical activity engagement. These findings on perceived self-efficacy for physical activity line up with Bandura's theory on self-efficacy, in which he argued that perceived barriers are viewed less as obstacles and more like challenges when an individual's level of self-efficacy increases (Bandura, 1976).

2.3.9 Motivation and Enjoyment

Lack of motivation was identified as a barrier for physical activity participation by respondents in both the Kalavar et al. (2004) and Kolt et al (2006a) studies. Respondents in both studies mentioned that there were less opportunities for habitual (incidental) physical activity in the tasks of daily living in the United States and New Zealand respectively, compared to their country of origin and that this resulted in needing to specifically set time aside to engage in physical activity. For example, some respondents in the Kalavar et al. study discussed how a heavy reliance on car use resulted in fewer opportunities for habitual physical activity in the United States. Lack of motivation has been cited in previous studies (Guerin et al., 2008; Lees et al., 2005) as a barrier for physical activity participation.

It appears that older adults will initiate and maintain participation in a physical activity they enjoy (Howze et al., 1989; Kerse et al., 1999). Research undertaken by Kirkby et al. (1999) and Kolt et al. (2004) found that enjoyment of a particular physical activity or sport was a strong motive for continuing with participation in that particular physical activity. Perceived feelings of enjoyment and satisfaction with a particular physical activity are better predictors of long-term adherence, more so than knowledge/information about the health-related benefits of physical activity (Schutzer & Graves, 2004).

2.4.0 Pedometers and Physical Activity

Within the past decade there has been a growing focus on the role that pedometers can have in health promotion (i.e., in increasing physical activity and health-related gain) (Bravata et al., 2007; Croteau, 2004; Dinger et al., 2005; Hultquist, Albright, & Thompson, 2005; Panton et al., 2007; Speck & Looney, 2001; Vallance, Courneya, Plotnikoff, Dinu, Mackey, 2007). A pedometer is a small mechanical measuring device that is worn at the hip (Van Wormer, 2004). A pedometer provides instant, (relatively reliable) feedback concerning the number of steps an individual has accumulated (Croteau, 2004). This information can help an individual be aware of how active or inactive they are, in turn, this step-count information can be used to motivate individuals to walk more to increase their daily step-count (Tudor-Locke et al., 2002). Pedometers can help with goal setting, especially in the context of physical activity interventions (Lauzon et al., 2008). A number of studies have demonstrated that pedometer use can help increase physical activity in low-active and sedentary individuals, including older adults (Chan et al., 2004; Engel & Lindner, 2006; Johnston et al., 2006; Pickering & Eakin, 2003; Farmer et al., 2006; Jordan et al., 2005; Rosenberg et al., 2009; Talbot et al., 2003). Compared to other physical activity monitoring devices (i.e., accelerometers) pedometers are less complicated to use, and are a more cost effective tool for supporting physical activity (Stovitz et al., 2005; Van Wormer, 2004).

It appears that interventions that incorporate step-count monitoring and recording, as well as goal setting are effective in helping aid participants' walking activity (Croteau, 2004; Dinger et al., 2005; Hultquist et al., 2005; Speck & Loney, 2001; Vallance et al., 2007). Speck and Looney (2001) found that participants (n=49) who kept a daily record of their step-counts had significantly higher step-counts at the end of a 12-week pedometer-based intervention compared to participants who did not keep a record of their daily step-counts. Participants who took part in a minimal contact pedometer-based lifestyle intervention that incorporated goal setting and self-monitoring techniques significantly increased their physical activity during the course of the 8-week intervention (Croteau, 2004).

Likewise, Dinger et al. (2005) found a 6-week minimal contract pedometer intervention to be effective in increasing walking activity in 36 insufficiently active women. At baseline, all participants were given a pedometer, step log sheets, and brochures containing information on how to increase physical activity. Participants were instructed to keep a daily log of their step-counts. At the end of each week participants mailed their weekly log count information to the researchers. Each week participants received brief email messages that were underpinned by the transtheoretical model of behaviour change. These messages contained strategies to help increase physical activity. Participants also set weekly goals to help increase their step-count.

Vallance et al. (2007) found that pedometer use by itself or in conjunction with breast-cancer specific physical activity print materials was effective in significantly increasing physical activity compared to verbal advice alone for physical activity in 370 breast cancer survivors. Participants in both pedometer conditions were instructed to wear their pedometer on a daily basis and to keep a record of their daily step-counts during the course of the intervention. This intervention was effective in increasing physical activity over the 3-month intervention period. However, this increase was not evident at the 6-month follow up period.

Pedometer step-count feedback was helpful in aiding walking activity in an intervention carried out by Hultquist et al. (2005). Fifty eight low-active women took part in this intervention. Participants were randomly allocated to one of two conditions. Participants in the first condition were instructed to take a 30-minute walk on all or most days of the week. These participants wore a sealed pedometer and kept an activity log in which they recorded the time that their pedometer was worn on a daily basis and the time they began and completed an individual walk. Participants in the second condition were encouraged to walk 10,000 steps per day and were instructed to keep a log of daily step-counts and the duration that their pedometer was worn on a daily basis. Participants in this condition wore both a sealed and a non-sealed pedometer for the duration of the 4-week intervention. At post-intervention, participants in the 10,000 steps group had a significantly higher step-count than participants in the 30-minute group.

The following two studies carried out in healthcare settings were effective in increasing walking activity through a pedometer-based intervention (Pickering & Eakin, 2003; Stovitz et al., 2005). Stovitz et al. (2005) found an association between pedometer use and an increase in daily steps accumulated. Ninety four primary care patients were randomly allocated to either the intervention (pedometer) or control condition. Participants in both groups received brief physician advice for physical activity as well as a handout on the benefits of physical activity, and three follow up phone calls from a health educator during the 9-week intervention period. Participants in the intervention group were given a pedometer for the duration of the intervention and were told to record their daily steps. All participants were encouraged to increase their daily walking via telephone counseling. Daily walking significantly increased for participants in both groups, however, participants in the pedometer group increased the frequency of walking short trips compared to the control group. Participants in the pedometer group had increased their steps by an average of 41% by the conclusion of the intervention. A limitation of this study is that there was no follow-up period to examine the long term effect that pedometer use had on walking activity. Also, there was no control comparison group.

Pickering and Eakin (2003) found a minimal contact pedometer intervention to be effective in significantly increasing physical activity in 35 low-active women recruited from a family planning clinic. At baseline, participants received brief physical activity counseling from a practice nurse and were given a pedometer, a log sheet for recording daily step-counts, and a 10,000 Steps brochure that provided information on how to increase one's step-count. Participants were instructed to wear their pedometer for the duration of the 14-day intervention and to record their daily step-counts during this period. At post-intervention, there was significant increase in participants' physical activity. This increase was no longer evident at the 8-week follow up period. However, at the 20-week follow up period a number of participants were classified as being sufficiently active. The main limitation of this study was the small sample size which limited statistical power, and the absence of a control group.

There is a growing body of research-based evidence for the efficacy of pedometer-based interventions in helping aid health-related gain (i.e., weight loss, blood pressure management) (Bravata et al., 2007; Chan et al., 2004; Clarke et al., 2007; Engel & Lindner, 2006; Johnson et al., 2006; Panton et al., 2007; Richardson et al., 2008). A meta-analysis carried out by Bravata et al (2007) found that physical activity interventions that incorporated pedometer use as an intervention tool yielded both a significant increase in physical activity engagement and a significant decrease in body mass index and blood pressure for participants. Richardson et al (2008) undertook a meta-analysis of pedometer-based walking interventions for weight loss. They found that such interventions resulted in a modest amount of weight loss. Compared to short-term interventions, long-term interventions resulted in more weight loss. Panton et al (2007) reported an association between increased physical activity via pedometer step-counts and a reduction in body mass index and hip circumferences in a sample of 35 obese women who took part in a 2-week pedometer-based intervention. However, increased physical activity did not lower chronic disease risk factors in this sample. An 8-week physical activity and dietary program that used pedometers to help increase physical activity in a sample of 93 women resulted in both a significant increase in physical activity and a reduction in weight loss at post-intervention (Clake et al., 2007).

The following studies (Chan et al., 2004; Engel & Lindner, 2006; Johnston et al., 2006) found a pedometer-based intervention aided health-related gain in previously low-active individuals and for those who had type 2 diabetes. Chan et al. (2004) found an association between an increase in daily step counts and a reduction in weight and resting heart rate in previously low-active adults who take part in a pedometer-based intervention. One hundred and six low-active individuals took part in this study. Participants were recruited from five workplaces and had jobs that were moderately to highly sedentary (e.g., clerical and data entry work). During the 12-week intervention, participants met in workplace based groups with a facilitator and set daily goals. The intervention was successful with the majority of participants increasing their daily step-count by an average of 3,000 steps per day. This increase was maintained throughout the duration of the intervention. A strength of this study was that a relatively large sample was used. Participants had low-active jobs, thus the use of a pedometer was associated with motivation to increase daily step-counts.

A limitation of the study was that there was no control group, and no follow up period to examine the long term effect that pedometer use may have had on maintaining physical activity levels.

Johnson et al. (2006) examined the role that pedometers may have in increasing the speed (intensity) of daily walking for individuals who have type 2 diabetes via the Pick up the Pace Program (PUP). Individuals who have type 2 diabetes tend to walk at a speed that is slower than normal, and which is not associated with health-gain that can be achieved from engaging in moderate-intensity walking activity. The Pick up the Pace program (PUP) was designed to increase the speed of walking in 8 adults who had type 2 diabetes. Participants were aged between 40 to 70 years of age. During the 12-week intervention, participants attended meetings and supervised sessions where they would practice their PUP walking. Participants used stop-watches to monitor the time they spent in PUP walking. Participants also wore heart monitors and accelerometers. At post-intervention, the walking speed of all participants had significantly increased. The use of a pedometer and stop-watch within the context of an educational program helped to increase walking intensity in participants with type 2 diabetes. Participants' heart rate responses to exercise improved over the course of the intervention, though did not reach statistical significance.

Engel and Lindner (2006) found that both a pedometer and combined coaching versus a coaching-only condition to be effective in achieving significant weight loss and cardiovascular fitness. The sample comprised of 57 low-active, overweight adults with type 2 diabetes. Participants were randomly allocated to either the intervention condition (pedometer and coaching) or the control condition (coaching-only). Participants in both groups received the same coaching during the course of the 6-month intervention. Coaching involved helping participants with goal setting and motivational strategies to help increase walking activity. Interestingly, participants in the control condition spent significantly more time walking compared to participants in the pedometer condition.

Pedometer-based interventions that have been carried out with older adults have been efficacious in increasing physical activity (Farmer et al., 2006; Jordan et

al., 2005; Rosenberg et al., 2009; Talbot et al., 2003). Rosenberg et al. (2009) found a short-term pedometer-based intervention to be effective in increasing walking activity in a study carried out with 12 low-active, residential-based older adults. The intervention was carried out over a 3-week period. At week 1, participants received intervention materials in addition to their pedometer. This included site-tailored maps for neighbourhood walking, and a daily step log booklet, in which participants were instructed to record their daily step-counts. All participants attended a weekly individual health counseling session during the course of the intervention. Counseling sessions involved setting goals around walking and pedometer step-counts. Daily step-count information was given to the counselor during weekly counseling sessions. At post-intervention, (3-weeks post-baseline) there was significant increase in participants daily step-counts compared to baseline step-counts. While this intervention was efficacious in increasing walking activity, findings need to be interpreted with caution. Firstly, there was a small sample, and participants were from a non community dwelling population. Thus, findings may not be able to be generalised to other populations. Also, there was no follow-up period. Thus, it is not known what long-term impact the intervention had on participants' walking behaviour.

Likewise, Talbot et al. (2003) found a home-based pedometer walking programme to be effective in significantly increasing walking activity in adults with osteoarthritis. The sample comprised 34 community-dwelling adults aged 60 and older. Participants were randomly allocated to either the intervention group (arthritis self-management education and pedometer) or the control group (arthritis self-management only). Participants in both groups attended an arthritis self-management programme (12 hours in duration) over the 12-month intervention period. Participants in the intervention group were given a pedometer to wear during the intervention phase. Participants kept an activity log in which they recorded their daily step counts. Participants in the intervention group increased their daily steps by 30% compared to their baseline step count. This increase was also evident at the 3-month follow-up period. There was also an increase in muscle strength for participants in the pedometer condition. The two main strengths of this study are that it was a randomised controlled trial with a true control comparison group. There was also a follow-period to examine the effect that the pedometer had on participants'

long-term physical activity.

The following two studies (Farmer et al., 2006; Jordon et al., 2005) found the addition of a pedometer assisted walking activity in middle-aged and older-aged individuals. Farmer et al. (2006) examined the effect that a pedometer-based intervention had on the daily steps of community-dwelling older adults. One hundred and seventy eight participants aged 55 years and older took part in the study. Participants were randomly allocated into an intervention group and a control group. Participants in the intervention group participated in the 12-week intervention first. During the intervention phase, participants wore a pedometer on a daily basis, were taught how to set goals to increase daily step-counts, and devised strategies to meet these goals. Participants kept a daily log of their step counts. Participants in the control group were placed in a wait-list and then received the same intervention 3 months later. Daily step-counts increased for all participants, including those who had one or more chronic health conditions.

Similarly, Jordon et al. (2005) examined the efficacy of pedometer use in obtaining steps per day associated with public health recommendations for weekly physical activity. The sample comprised of 111 low-active postmenopausal women aged 45 to 75 years of age. At post-intervention (6 months post baseline) pedometer use did help participants meet the recommended physical activity through planned moderate-intensity walking. These two interventions illustrated that goal setting and combined monitoring of one's daily step count can help motivate an individual to increase their walking activity.

Some studies have found the motivational effect of pedometer use to diminish over time, and some studies have indicated that pedometer use did not have any additional motivational effect in increasing physical activity (Beveridge, Elseman, Ransdell, & Shultz, 2004; Mutrie et al., 2004; Schofield, Mummery, & Schofield, 2005). Mutrie et al (2004) examined whether pedometer use acted as a tool of motivation to increase walking activity in a sample of 50 participants aged 40 years and older. Participants in the intervention condition wore unsealed pedometers, while control participants wore sealed pedometers during the 4-week intervention. Participants in both conditions set weekly goals aimed at accumulating 30 minutes of

walking on most days. At post intervention, step-counts had increased for participants in both groups, with no significant difference between groups. In this study, weekly goal setting helped participants to increase their walking activity with or without the aid of pedometer step-count information.

Likewise, pedometer feedback did not have a motivational effect in increasing walking activity in a study carried out by Beveridge et al. (2004). A crossover design was used with two groups of participants. Participants in group one wore unsealed pedometers for the first three weeks of the intervention and wore sealed pedometers for the remaining three weeks of the intervention. A reversal of this design was used for participants in the second group. Having access to pedometer step-count information did not have an additional motivational effect on physical activity, as step-counts remained the same for both groups regardless of whether one's pedometer was sealed or unsealed.

Schofield et al. (2005) compared the effectiveness of daily step-count goals with time-based prescription for increasing physical activity in low active adolescent females. At mid-intervention, participants in the pedometer condition had higher physical activity levels compared to those in the time-based condition. However, at post-intervention (week-12) there were no significant differences between the two groups. The motivational effect of pedometer use diminished with time in this study (See Table 2.4 for a summary of pedometer-based interventions).

Table 2.4. Summary of pedometer-based interventions designed to increase physical activity

Study	Participants	Study aim(s) and design	Main findings	Strengths	Limitations
Beveridge et al. (2004)	26 participants aged 18 years and older	Cross over study designed to investigate whether feedback from a pedometer motivated participants to increase their walking activity	Step-counts remained the same regardless of whether participants wore a sealed or unsealed pedometer	A cross-over design was employed	
Bravata et al. (2007)	A review of 26 studies	A review of 26 studies that incorporated pedometer use to increase physical activity	Pedometer use was associated with significant decreases in body mass index and blood pressure and significant increases in walking activity	A strict standard criteria was used to extract studies for analysis	
Chan et al. (2004)	106 participants with a mean age of 43 years (SD=9 years)	To examine the effects that a pedometer-based intervention had on physical activity	A significant increase in step counts was associated with a reduction in weight and resting heart rate		No control group or follow-up period
Clarke et al. (2007)	93 female participants aged 18 to 45 years of age	An intervention designed to increase physical activity via pedometer use in overweight , low-income mothers	A significant increase in physical activity (via step counts) was associated with a reduction in weight loss		No control group
Croteau. (2004)	34 participants aged 23 to 64 years of age	To determine the self-selected strategies participants used to increase physical activity via step-counts	The intervention was effective in increasing physical activity via an increase in daily step-counts		Small sample size, no control group and no follow-up period
Dinger et al. (2005)	36 female participants aged 27 to 52 years of age	To examine the impact that a 6-week minimal contact intervention had on walking behaviour	There was a significant increase in participants' total walking minutes		This study had a small sample size, no control group and no follow-up period
Engel and Lindner. (2006)	57 participants with mean age of 62 years	An RCT designed to investigate the impact of using a pedometer combined with coaching on time spent walking versus coaching only in low-active, overweight adults with type 2 diabetes	Physical activity increased significantly more for participants in the coaching-only condition. Participants in both conditions experienced a significant reduction in waist circumference and weight	A strength of this study is that it was carried out over a 6-month period and it had a control group	

Farmer et al. (2006)	178 participants aged 55 years and older	To determine the influence of a pedometer-based intervention on daily step-counts	Pedometer use was associated with a significant increase in physical activity, regardless of preexisting chronic health conditions	This study used a cross-over design	
Hultquist et al. (2005)	58 female participant aged 33 to 55 years of age	To compare the number of steps accumulated by participants instructed to walk 10,000 steps per day versus participants being told to walk 30-minutes per day	Participants in the 10,000 steps group had significantly higher steps counts at post-intervention compared to participants in the 30-minute group	A strength of this study is that all participants wore sealed pedometers that recorded their step-count information (participants in the 10,000 steps group wore two pedometers, one unsealed and one sealed)	
Johnson et al. (2006)	8 participants aged 40 to 70 years of age, with type 2 diabetes	To examine the role that pedometers may have in increasing the speed /intensity of daily walking	Walking speed significantly increased for all participants at post-intervention		This study had no control group and no follow-up period
Jordan et al. (2005)	111 female participants aged 45 to 75 years of age	To quantify pedometer steps associated with recommended physical activity levels	Pedometer use was associated with meeting recommendations for weekly physical activity	Participants were allocated into groups that aimed at achieving different frequencies of weekly activity	No control group or follow-up period
Mutrie et al. (2004)	50 participants aged 40 years and older	To examine whether pedometer use acted as a tool of motivation to increase walking	Step-counts increased for participants in both groups (sealed and unsealed), with no difference between the groups		No true control group or follow-up period. A short intervention period
Panton et al. (2007)	35 female participants aged 30 to 65 years of age	To evaluate the effect that pedometer use had on physical activity	An increase in pedometer step-counts was associated with a reduction in body mass index and hip circumference		No control group or follow-up period. A short intervention period
Pickering and Eakin. (2003)	35 female participants aged 18 years and older	To examine the role that pedometers can have in promoting physical activity	At post-intervention there was significant increase in physical activity		This study had two follow-up periods, though, no control group
Richardson et al. (2008)	Meta-analysis of 9 pedometer-based studies	To examine the effect that pedometer use had on weight loss	Pedometer use was associated with weight loss. Longer interventions were more effective	Though, only 9 studies were analysed, a consistent criteria was used for inclusion purposes	

Rosenberg et al. (2008)	12 participants aged 65 years and older	To test the feasibility and acceptability of a walking intervention	There was significant increase in step-counts at post-intervention		No control group or follow-up period. Also a small sample, though, this was a pilot study
Schofield et al. (2005)	85 female high school students	To compare the effectiveness of daily step-count targets with a time-based prescription for increasing physical activity	At mid-intervention, participants in the pedometer condition were engaging in significantly more physical activity, this increase was not evident at post-intervention	The study had a control group	No follow-up period
Speck and Looney. (2001)	49 adult female participants	To examine whether keeping a daily record of step counts would increase physical activity	Participants who kept a record of their daily step-counts had significantly higher step-counts at post-intervention compared to participants who did not keep a record of their step-counts		No control group or follow-up period
Stovitz et al. (2005)	94 participants aged 18 years and older	An RCT to examine whether the addition of a pedometer to brief physician counseling could help patients increase their physical activity	Participants in both groups increased their walking activity. Participants in the pedometer condition significantly increased their step-count during the course of the intervention	This study had a control group	No follow-up period
Talbot et al. (2003)	34 participants aged 60 years and older with osteoarthritis of the knee	An RCT designed to examine the effect that pedometer use had on physical activity and functional status	Step-counts significantly increased for participants in the pedometer condition, and this increase was still evident at the 3-month follow-up period	This study had a control group and a follow-up period that examined the long-term effects the intervention had on participants' physical activity	
Vallance et al. (2008)	370 breast cancer survivors aged	An RCT designed to examine the long-term effects that pedometer use and print materials had on physical activity	Pedometer use by itself or in conjunction with print materials was effective in significantly increasing physical activity	The study had a control group and a follow-up period	

In conclusion, this section identified and discussed barriers and motives that can effect physical activity participation in older adults. This included a review of telephone-based interventions and pedometer-based interventions designed to increase physical activity. The next section of this review will examine and discuss the effect that physical activity can have on depressive symptomatology in low-active older adults.

2.4.1 Physical Activity and Depression: Background

Depression and dementia are the two most prevalent and disabling psychological disorders of older adulthood (Almeida, Norman, Hankey, Jamrozik, & Flicker, 2006). Depression is a psychological disorder that is characterised by feelings of melancholy, hopelessness, anxiety and personal inadequacy (Kaplan & Saddock, 1998). Depression affects all aspects of an individual's life, resulting in loss of interest and engagement in usual activities (Gallo & Coyne, 2000). The World Health Organization has hypothesized that at a global level by the year 2020 depression will be the second leading cause of morbidity and disability (World Health Organization, 2009). It is estimated that one in ten men and one in five women will experience an episode of depression during their lifetime (Jackson, Morrow, Hill, & Dishman, 1994; Mental Health Foundation, 2004). It is estimated that 15 to 20% of adults aged 65 years and older will experience an episode of depression (Jones, 2003).

There is controversy over actual prevalence rates for depression in older adults (Roberts, Kaplan, Shema, & Strawbridge, 1997). The Diagnostic and Statistical Manual IV of the American Psychiatric Association (DSM IV) (American Psychiatric Association, 1994) yields lower prevalence rates for depression in older adults. Other measures of depression that focus more on somatic (physical) symptoms report higher rates of depression in older adults (Roberts et al., 1997). One of the most validated measures that is used to screen for depression and the severity of depressive thoughts in older adults within the research setting is the Geriatric Depression Scale (GDS) (Yeasavage et al., 1983). The GDS is used on a range of elderly populations, including nondepressed and clinically depressed,

community dwelling and institutionalised older adults (Brown & Schinka, 2005; Baldwin & Wild, 2004). However, more than one measure needs to be employed when assessing for depression within a clinical setting (Kaplan & Saddock, 1998).

2.4.2 Risk Factors for Late Life Depression

The following have been identified as leading risk factors for the onset of late life depression; the existence of chronic health conditions and diseases, mobility problems, cognitive impairment, lack of independence, social isolation, relocation, economic hardship, and bereavement (Alexopoulos, 2005; Boyd, 2002; Lueckenotte, 1996; Riley, 1994). More recently, physical inactivity has also been identified as a risk factor for late life depression (Brown et al., 2005; Camacho, Roberts, Lazarus, Kaplan, & Chohen, 1991; Lampinen et al., 2000; Strawbridge, Deleger, Roberts, & Kaplan, 2002).

There is a strong association between late life depression and the existence of a chronic health condition or related functional disability (Alexopoulos, 2005). It is estimated that 85% of depressed older adults have a coexisting medical condition (Riley, 1994). For older adults, depression can worsen the outcome of preexisting chronic health conditions (Boyd, 2002; Lueckenotte, 1996). Late life depression is also a risk factor for increased morbidity and mortality (Berke, Gottlieb, Moudon, & Larson, 2007).

A longitudinal study (Roberts et al., 2007) examined the relationship between depressive symptoms as measured by the Diagnostic and Statistical Manual IV of the American Psychiatric Association (American Psychiatric Association, 1994) and demographic factors, (i.e., gender, age, socioeconomic status), social support, and life events in a sample of 2,730 adults aged 46 to 102 years of age. Healthy functioning, physically active older adults in this sample were at no more risk for depression than younger adults. Depression in this sample of older adults was associated with physical health problems and related disability.

There is controversy in relation to whether a sedentary lifestyle causes depression through an increased risk for noncommunicable diseases and conditions, including functional disability, or whether depression independent of physical inactivity limits future physical activity engagement in depressed individuals (Jackson et al., 2004; Kritz-Silverstein et al., 2001; Riley, 1994). Empirical findings from both longitudinal and cross-sectional studies have found an association between a sedentary lifestyle (insufficient physical activity) in later life and an increased risk for late life depression (Almeida et al., 2006; Farmer et al., 1988; Lampinen et al., 2000). Likewise, empirical findings indicate that regular moderate intensity physical activity participation in later life is associated with lower scores on depression measures in both depressed and nondepressed older adults (Cassidy et al., 2004; Galper et al., 2006; Kritz-Silverstein et al., 2001), including those who had preexisting chronic health conditions (Brown et al., 2005; Harris et al., 2006).

Mixed findings exist in relation to whether physical activity engagement can protect against future depression. On one hand, Strawbridge et al. (2002) found physical activity to be a protective factor for future depression in a cross-sectional study of 1,947 adults aged 50 to 94 years of age. On the other hand, Cooper-Patrick et al. (1997) found no association between physical activity and a reduced risk for future depression in a longitudinal study that was carried out with 973 physicians. Likewise, Krtiz-Silverstein et al. (2001) found that physical activity did not protect against future depressed mood in a cross-sectional study involving 944 individuals aged 50 to 89 years of age who were not depressed at baseline.

With increasing evidence for the effectiveness of physical activity in maintaining good mental health status, it has been suggested that physical activity and exercise interventions may be more beneficial than antidepressant medications in the treatment and management of depression for older adults (Blake, Mo, Malik, & Thomas, 2009; Kerse et al., 2008). Antidepressant medications can have adverse side effects and a higher relapse following termination of medication. In comparison, physical activity and exercise-based interventions are less likely to have 'side effects' and can be undertaken on a regular long term basis. Blake et al. (2009) and Penninx et al. (2002) have stressed that physical activity is doubly beneficial for the treatment and management of late-life depression. Physical activity engagement not only

benefits psychological health, it also positively affects individuals' physical health status. There is also no negative stigma attached to engaging in regular physical activity (Blake et al.).

2.4.3 The Effects of Physical Activity on Depressive Symptomatology

A number of studies that have employed a physical activity intervention with clinically depressed adults have found an association between physical activity engagement and a reduction in depressive symptomatology, or an increase in positive mood (Bartholomew, Morrison, & Ciccolo, 2005; Dimeo, Bauer, Varahram, Proest, & Halter, 2001; Dunn et al., 2005; Harris et al., 2006). Bartholomew et al. (2005) found that a single 30-minute moderate-intensity treadmill exercise session resulted in a significant increase in positive wellbeing and vigor scores for insufficiently active individuals who had a diagnosis of major depressive disorder, compared to control participants with the same diagnosis who undertook a 30-minute period of quiet rest.

Dimeo et al. (2001) also found aerobic exercise to be beneficial in reducing depressive symptomatology in 12 individuals who had a diagnosis of major depressive disorder. Participants engaged in a daily 30-minute treadmill walking session over a 10-day period. At the conclusion of the intervention there was a statistically significant reduction in participants' depressive symptomatology as measured by Hamilton Rating Scale for Depression (HAM-D) (Zerssen et al., 1974). Participants' baseline physical activity status was not documented.

Dunn et al. (2005) found that aerobic exercise undertaken over a 12-week period that was consistent with public health recommendations for physical activity was effective in significantly reducing depressive symptomatology in insufficiently active individuals who had a diagnosis of mild to moderate major depressive disorder. Though, participants who engaged in a lower amount of exercise (half the recommended dose of daily physical activity) did not experience a significant reduction in depressive symptomatology as measured by the Hamilton Rating Scale (HRSD) (Hamilton, 1968; Knesevich et al., 1977).

A longitudinal study (Harris et al., 2006) spanning a 10-year period examined the associations between physical activity, exercise coping, and depression in a sample of 424 individuals who had a clinical diagnosis of unipolar depression. At each of the four time points (baseline, 1-year, 4-years and at 10-years) engagement in more physical activity was associated with reduced concurrent depression. Physical activity counteracted the effects of medical conditions and negative life events on depression, but appeared unable to protect against future depression.

While the studies reported above (Bartholomew et al., 2005; Dimeo et al., 2001; Dunn et al., 2005; Harris et al., 2006) provide convincing evidence for the effectiveness of physical activity in reducing or significantly reducing depressive symptomatology, these studies also have limitations that need to be taken into account. Bartholomew et al. (2005) examined the effect that physical activity had on mood state at only one time point. Participants who had co-existing medical conditions were excluded from the study. Also, each participant was paid \$100 at the completion of their involvement in study. Dimeo et al. (2001) had a small sample size and no control group. Both these factors can limit the generalisability of the findings. The Bartholomew et al. (2005), Dimeo et al. (2001), and Dunn et al. (2005) studies did not have a follow-up period. Thus, the long-term effect of the aerobic exercise on depressive symptomatology is not known. Harris et al. (2006) did not measure frequency and intensity of physical activity in their study. Also, measures were only administered at four time points over a 10-year period, thus, it is not known what impact physical activity engagement and life events that happened outside of these time points had on participants' depressive symptomatology.

The following two studies examined the effect that physical activity and exercise in conjunction with antidepressant medication had on depressive symptomatology in middle and older aged adults who had a diagnosis of depression (Blumenthal et al., 1999; Mather, Rodriguez, Guthrie, McHarg, & McMurdo, 2002). Blumenthal et al. (1999) undertook a randomised controlled trial to assess the effectiveness of aerobic exercise compared with antidepressant medication for the treatment of major depressive disorder in individuals aged 50 years and older. Participants' baseline physical activity was not documented. One hundred and fifty six participants were

randomly allocated into one of three conditions; (1) an aerobic exercise condition, (2) an antidepressant medication only condition, and (3) a combination of aerobic exercise and antidepressant medication. Participants in conditions one and three attended thrice weekly supervised exercise sessions during the course of the 16-week intervention. Participant in conditions two and three were administered sertraline medication by a psychiatrist during the course of the intervention. At postintervention, participants in all three conditions showed significant reductions in depressive symptomatology as measured by both the Hamilton Rating Scale (HAM-D) (Hamilton, 1960) and the Beck Depression Inventory (BDI) (Beck et al, 1961). There were no significant differences between the effects of medication versus exercise, and no additive effect of medication and exercise combined on depressive symptomatology. Exercise was as equally as effective as medication in significantly reducing depressive symptomatology in this sample of clinically depressed middle and older-aged participants. Possible limitations of this study include the following; the intervention was carried out over a short-term period (i.e., 16-weeks), different outcomes may have been obtained if the study was carried out over a longer period. The study had no true control group to compare the effects of the three intervention conditions. Participants in the exercise condition engaged in group exercise sessions, thus, the ongoing social contract that participants had with each other may have had a beneficial effect on mood.

Mather et al. (2002) undertook a randomised controlled trial to determine the efficacy of exercise as treatment for depression in conjunction with antidepressant medication versus a social contact condition for participants who had a clinical diagnosis of depression. Eighty-six insufficiently active participants aged 53 to 78 years of age took part in this study. Participants were randomised to one of two conditions; (1) an exercise class condition or (2) a health education class condition for the duration of the 10-week intervention. Participants in the exercise condition attended a twice weekly exercise class, and participants in the social contact condition attended a twice weekly health education class. Depression was assessed at baseline, post-intervention (week-10) and at the 34-week follow up period via the Hamilton Rating Scale for Depression (HRSD; Hamilton, 1960) and the Geriatric Depression Scale (GDS; Yesavage, 1988). At postintervention, participants in the exercise condition experienced a significant reduction in depressive symptomatology

compared to participants in the social contact condition. This reduction in depressive symptomatology was still evident at the 34-week follow up period for participants in the exercise condition. A main strength of this study was that there was a follow-up period to examine if the intervention had a long-term effect on participants' depressive symptomatology. Another strength of this study was that there was a social contact group. Mather et al. argued that social contact can have a strong, beneficial effect on depressed older adults' psychological functioning. A possible limitation of this study is that there was no true control group. Also, participants were taking antidepressant medication. Thus, the effect that antidepressant medication may have had on depressive symptomatology also needs to be taken into account.

The following studies found either aerobic or resistance exercise to have an antidepressant effect on depressive symptomatology in individuals aged 60 years and older (McNeil et al., 1991; Penninx et al., 2002; Singh et al., 2001). Singh et al. (2001) found that 10-weeks of supervised high-intensity progressive resistance training (PRT) coupled with 10-weeks of unsupervised home-based PRT was effective in reducing depressive symptomatology in 32 insufficiently active participants who had a diagnosis of either minor or major depression, compared to control participants at both post-intervention (week-20) and at the 26-month follow-up period. Participants in the control social condition attended 10-weeks of health education lectures. Depression was assessed by the Beck Depression Inventory (BDI).

In contrast, Penninx et al. (2002) found that participants' depressive symptomatology significantly decreased after they had been allocated to an aerobic exercise condition compared to either a resistance exercise or a control condition. Four hundred and thirty eight insufficiently active adults aged 60 years and older took part in this randomised controlled trial. Participants had osteoarthritis of the knee and a clinical diagnosis of either high or low depression. Participants were randomly allocated into one of three conditions: (1) an aerobic exercise program (a 3-month supervised walking program and then a 15-month home-based walking program), (2) a resistance exercise program (a 3-month supervised program and then a 15-month home-based program), and (3) or a control health education condition

(that involved attending monthly education sessions on topics related to arthritis for a 3-month period, then receiving monthly telephone calls designed to provide health updates for months 4 to 18). Depression was assessed by a short version of the Center for Epidemiological Studies Depression Scale (CED-D) (Radloff, 1977). The following randomised controlled trial (McNeil et al., 1991) carried out with 30 individuals who had a diagnosis of clinical depression found that either exercise (a supervised session of 30-minutes of walking 3 times per week for the duration of the intervention) or social contact (receiving two 30-minute home visits per week during the intervention phase) over the 6-week intervention period resulted in a significant reduction in participants' depressive symptomatology as measured by the Beck Depression Inventory (Beck & Beamesderfer, 1974). Participants in the control wait-list condition did not experience a change in depressive symptomatology during the course of the intervention. Only participants in the exercise condition had a significant decrease in somatic symptoms as measured by the BDI at post-intervention. Participants' baseline physical activity was not documented.

The three studies reported above (McNeil et al., 1991; Penninx et al., 2002; Singh et al., 2001) provide some evidence for the effectiveness of either aerobic or resistance physical activity in significantly reducing depressive symptomatology, however, these studies also have limitations that need to be taken into account. A possible limitation of the Singh et al. (2001) study was in relation to how physical activity was measured. During the main intervention phase, muscle strength was assessed, though, at the 26-month follow up period physical activity information was based on self-report information, collected predominantly via telephone. Depression was assessed based on the use of only one measure (e.g., the Beck Depression Inventory). A main limitation of both the Penninx et al. (2002) and the McNeil et al. (1991) studies is that neither study had a follow up period. Also, in the case of the McNeil study, participants' baseline physical activity was not stated. Thus, it is not known how physically active or inactive participants were to begin with (See Table 2.5 for a summary of the physical activity and exercise interventions).

Table 2.5. Summary of interventions designed to examine the effect that physical activity and exercise had on depressive symptoms

Study	Participants	Study aim(s) and design	Main findings	Critique
Bartholomew et al. (2005)	40 participants with a diagnosis of major depressive disorder, aged 18 to 55 years of age	Randomised controlled trial (RCT). Intervention participants engaged in a single bout of 30-minutes of moderate intensity aerobic exercise. Control group undertook a 30-minute period of quiet rest	Participants in the intervention condition reported a significant increase in positive feeling, compared to the control group, as assessed by psychometric measures.	The effect that physical activity had on mood state was only measured at one time point. Participants with co-existing medical conditions were excluded from the study. No follow-up period to examine the long-term effects of the intervention
Blumenthal et al. (1999)	156 participants with a diagnosis of major depressive disorder, aged 50 years and older	An RCT designed to examine the effect of exercise versus medication on depressive symptomatology. Three conditions; (1) exercise only, (2) medication only, (3) combined exercise and medication	All three groups showed significant reductions in depressive symptoms. No significant differences between the effects of medication versus exercise	No true control group to compare the effects of the three conditions. Participants in the exercise conditions engaged in group exercises. This ongoing social contact may have had a beneficial effect on mood
Dimeo et al. (2001)	12 participants with a diagnosis of major depressive disorder, mean age=49 years of age	Participants engaged in 30-minutes of daily treadmill walking for 10 days	A significant reduction in depressive symptomatology at post intervention	No control group and no follow up period. Also, a small sample
Dunn et al. (2005)	80 participants with a diagnosis of major depressive disorder, aged 20 to 45 years of age	An RCT designed to examine the effect that three different doses of exercise had on depressive symptomatology	Aerobic exercise consistent with public health recommendations for physical activity was effective in significantly reducing depressive symptomatology, compared to a lower dose of physical activity	No follow-up period.
Harris et al. (2006)	424 participants with a diagnosis of unipolar depression, aged 18 years and older	A longitudinal study spanning 10-years examined the associations between physical activity, exercise coping and depressive symptomatology	Engagement in physical activity was associated with reduced concurrent depression at each of the four time points	The frequency and intensity of physical activity was not measured. Measures were administered at only four time points over the 10-year period

Mather et al. (2002)	86 participants with a diagnosis of depression, aged 53 to 78 years of age	An RCT designed to examine the effect of exercise versus social contact on depressive symptomatology	Participants in the exercise condition experienced a significant reduction in depressive symptomatology compared to participants in the social contact condition	There was no true control group. Also, participants were taking antidepressant medication. The effect that the medication had on participants' depressive symptomatology is not known
McNeil et al. (1991)	30 participants with a diagnosis of depression, mean age 72.5 years	An RCT designed to examine the effect that physical activity versus social contact had on depressive symptomatology. Three conditions; (1) exercise only, (2) social contact only, (3) control condition	Participants in both the exercise and social contact conditions experienced a significant reduction in depressive symptomatology compared to those in the control condition.	No follow-up period was employed. Participants' baseline physical activity was not stated.
Penninx et al. (2002)	438 participants with a diagnosis of depression and osteoarthritis of the knee. Participants were aged 60 years and older	An RCT designed to examine the effect of aerobic exercise versus resistance exercise on depressive symptomatology	Depressive symptomatology significantly decreased for participants in the aerobic condition compared to participants in the resistance exercise condition	This study did not have a follow-up period.
Singh et al. (2001)	32 participants with a diagnosis of either minor or major depression, aged 60 years and older	An RCT designed to examine the effect of progressive resistance training versus social contact on depressive symptomatology	Depressive symptomatology significantly decreased for participants in the exercise condition compared to participants in the social contact condition	At the 26-month follow-up period, physical activity was based on self-report information, which can be open to bias and inaccurate reporting

In conclusion, this section of the review examined the effect that physical activity and exercise can have on depressive symptomatology in both depressed and nondepressed individuals, including older adults. The next section will examine the rationale for undertaking a process evaluation of a physical activity intervention, as well as examining interventions that have employed a process evaluation.

2.4.4 Process Evaluation of Physical Activity Interventions: Definition and Rationale

A process evaluation of a particular programme/intervention involves documenting and describing how each specific component was implemented (Steckler & Linnan, 2002). A process evaluation of a programme also assesses the extent to which outcome measures (i.e., increasing physical activity, changing dietary behaviour) were achieved by the use of specific programme components (Helizer, Yoon, Wallerstein, & Garcia-Velarde, 2000). It also involves obtaining participants' subjective evaluations concerning how they perceived each programme component (Draper, Kolbe-Alexander, & Lambert, 2009; King et al., 1998).

A process evaluation of a specific programme can provide salient information regarding why a particular programme was successful or not in achieving its desired aims (Cunningham, Michielutte, Dignan, Sharp, & Boxley, 2000). This information can help refine a current intervention, to ensure its continued future success. This information can also aid the design of new interventions (Pate et al., 2003). Over the past decade there has been an increase in the use of process evaluation techniques. This increase has been associated with a growing complexity in both behavioural and social intervention programmes (Stecker & Linnan, 2002). Thus, it is necessary to know the extent to which specific components of a particular programme have been successful or not in achieving and maintaining desired outcome behaviours.

2.4.5 Participant Evaluations of Physical Activity Interventions

This section will provide a review of physical activity interventions that have employed a process evaluation format. A process evaluation of these interventions can provide information concerning 'why' and 'how' certain intervention components were perceived to be helpful or unhelpful in facilitating and supporting participants' physical activity (refer to Table 2.6 for a summary of the studies).

To date, one main Green Prescription study (Elley et al., 2007) has examined participants' attitudes and experiences toward receiving a Green Prescription. A subgroup of 15 participants took part in this qualitative study after completing their involvement in a randomised controlled trial. The randomised controlled trial (Elley et al., 2003a) was designed to examine the effectiveness of the Green Prescription intervention in increasing physical activity in sedentary adults. Four main themes emerged from participants' dialog concerning their Green Prescription experience. The first theme was centered on tailoring. Participants discussed how their Green Prescription was tailored to meet their individual needs (i.e., a personal approach that took into account personal factors such as the existence of a medical condition). The second theme was centered on barriers and involved participants talking about the barriers they encountered while completing their Green Prescription (i.e., external barriers, such as the weather and internal barriers such as procrastination). The third theme that emerged was related to internal motivators. Participants discussed a range of internal motivators that helped facilitate their physical activity (e.g., enjoying outdoor activities, sleeping better after being active, feeling a sense of achievement after engaging in physical activity). The final theme was related to the role that participants perceived significant others to have had in facilitating and supporting their physical activity (i.e., the salient role that their primary care physician had in prescribing the physical activity and the ongoing external support that was received via telephone counseling from their patient support counselor). Participants also discussed why certain intervention components were not helpful for them. For example, one respondent stated that she found some aspects of the telephone counseling to be patronizing. This respondent stated that the telephone counseling interrupted and distracted her from her work. The participant feedback obtained from this study has provided further evidence for the perceived importance of physician endorsement and prescription in facilitating participants' physical activity.

The perceived helpfulness (and unhelpfulness) of the ongoing telephone-based support for physical activity was articulated in some participants' accounts.

A process evaluation was undertaken for the original Community Healthy Activities Model Program for Seniors (CHAMPS) physical activity intervention that was carried out with older adults (Sepsis et al., 1995). Participants were asked to rate how helpful each of the eleven components of the CHAMPS intervention were in assisting them to initiate and adhere to their physical activity program. Participants rated the following intervention components as being helpful; the attention they received from CHAMPS staff, the telephone calls from CHAMPS staff, and the introductory meeting for the intervention. Chances to win prizes and receiving a T-shirt were rated as the least helpful components of the intervention, and these two components were removed from the revised CHAMPS intervention. The participant feedback that was obtained from the original CHAMPS program was used to modify a revised CHAMPS program.

The revised Community Healthy Activities Model Program for Seniors program (CHAMPS II) (Gillis et al., 2002) extended on some of the components that were used in the original CHAMPS intervention (Sepsis et al., 1995). At postintervention participants were invited to complete a process evaluation survey which was designed to identify the components of the intervention that participants' perceived as being helpful in assisting them to become and remain physically active. The survey was self-administered. The rating scale ranged from (1) 'not at all helpful' to (5) 'extremely helpful'. At postintervention, a subgroup of participants was invited to take part in focus group interviews based on their post-intervention physical activity scores. A focus group approach was used to aid the findings of the process evaluation survey. This focus group approach allowed participants to discuss and elaborate their views and experiences of the CHAMPS II intervention in a way that a survey/questionnaire format does not allow. A focus group approach allowed participants to share personal experiences of the intervention and to discuss and elaborate in depth why they found aspects of the intervention to be helpful or unhelpful for them.

A process evaluation of the following two interventions that were designed to increase physical activity in low-active older adults aged 65 years and older found that participants wanted to become physically active and that the specific intervention components that were employed in these two interventions helped participants to initiate and maintain their physical activity (Hopman-Rock & Westhoff, 2002; Kolt et al., 2006b). The long-term telephone-based support and supplementary print materials that participants received during the course of their involvement in the TeleWalk intervention were perceived to be helpful in aiding and maintaining participants' physical activity (Kolt et al., 2006b). The two intervention components that were used in the intervention carried out by Hopman-Rock and Westhoff (2002) consisted of a weekly education class related to the importance of successful ageing, taught by a peer educator and a weekly exercise class was led by a professional exercise instructor. Participants perceived both components as being helpful in aiding their physical activity. As part of the process evaluation, participants were also asked why they participated in the intervention. Thirty five percent of participants stated that they wanted to exercise more, 28% wanted to acquire health-related information, and 12% participated for social reasons. These three factors may be used to help increase recruitment and adherence in future physical activity interventions that are designed for older adults. In terms of intervention outcome, there was a significant increase in participants' physical activity at post-intervention. At four to six months post-intervention, 60% of participants reported that they were still engaging in the exercises they had been taught in class.

Mattfeldt-Beman et al. (1999) undertook a process evaluation of a weight-management intervention for individuals who were classified as being overweight and moderately obese. Three hundred and eight participants, aged 30 to 54 years of age took part in the intervention. The intervention aimed to change dietary intake and increase physical activity. At post-intervention, 281 participants took part in the process evaluation by completing a questionnaire that was designed to evaluate participants' perceptions of the effectiveness of the intervention. Statistical analysis was undertaken to examine if participant ratings differed as a result of demographic factors (i.e., gender and age). It was found that older-aged participants (those aged 50 years and older) were more likely to attend the scheduled exercise sessions compared to younger aged participants. Compared to male participants, female

participants who did not lose weight or did not adhere to the program were more likely to express dissatisfaction. Participants who adhered to the program were more likely to exercise regularly, incorporate exercise into their daily routine, and were more likely to use self-monitoring strategies. Mattfeldt-Beman et al. stressed that findings from their evaluation can be used to inform the design of future weight-loss programmes. For example, in the case of younger participants, exercise classes need to be scheduled at a time that is convenient for those who work or have caregiving responsibilities. Also, future interventions need to focus on teaching participants self monitoring and problem solving skills. Mattfeldt-Berman et al. stressed that such components may be outside the traditional area of dietetics.

The following two studies (Draper et al., 2009; Phongsavan et al., 2008) provide research-based evidence for the importance of undertaking a process evaluation of an intervention that was designed for a specific population. Phongsavan et al. (2008) undertook a process evaluation of an intervention that was designed to promote physical activity in adults who were diagnosed with anxiety disorders. Participants had a medical diagnosis of either generalised anxiety disorder, social phobia, or panic disorder. Participants were recruited from an outpatient anxiety clinic where they were attending cognitive behavioural group therapy (CBGT). Participants were randomised to either a intervention exercise-enhanced CBGT (CBGT+EX) condition or a comparison education-enhanced CBGT (CBGT+ED) condition. Thirty three participants (response rate 72%) from the intervention exercise condition took part in the process evaluation. Overall, participants who were in the intervention exercise condition perceived the physical activity intervention to be beneficial for them. Participants felt that the program increased their awareness and knowledge about the importance of physical activity. Participants stated that they were satisfied with the program and felt comfortable with the physical activity trainer.

Draper et al. (2009) undertook a retrospective evaluation of a community-based physical activity health promotion programme. The Community Health Intervention Programmes (CHIPs) comprised of a series of four programmes that were designed to provide physical activity and health promotion information and activities for children and adults living in disadvantaged communities in the Western

Cape of South Africa. CHIPs staff, stakeholders, program leaders, and members took part in the evaluation. Data was collected through naturalistic observation, structured interviews, focus groups, and through open-ended questionnaires. Overall, the intervention was deemed a successful, suitable intervention by the individuals who were interviewed. The intervention was perceived to be successful because it combined social development and health promotion components, as a community development model was employed. The content and activities that comprised the intervention was perceived to be culturally appropriate. The information gained from an evaluation of both these interventions (Draper et al., 2009; Phongsavan et al., 2008) highlights the importance of designing an intervention to meet the specific needs of special populations.

The following two physical activity interventions highlighted the importance that social contact had in aiding participants' physical activity during the course of an intervention (Lauzon et al., 2008; Openacker & Boen, 2008). Lauzon et al. (2008) undertook a process evaluation of a pedometer-based physical activity intervention that was carried out at five different workplaces. The intervention was designed to help individuals increase their physical activity via pedometer use. Intervention components were centered on electronic communications and weekly small group meetings, in which participants discussed their progress or relapse. During these meetings participants would engage in group walking activities. Overall, participants stated that their pedometer was a practical and helpful tool for increasing awareness of one's physical activity. Participants felt that their pedometer motivated them to become and remain physically active. Participants perceived group meetings as being an enjoyable and motivating intervention component.

Openacker and Beon (2008) undertook a process evaluation of a coaching program that was designed to increase physical activity and enhance mental health via the use of two different support modes: face-to-face or telephone-based support. Participants were randomly allocated into one of the two conditions. Participants in both conditions were given the same resources, information, and counseling, though in different modalities (via telephone or face-to-face). The process evaluation that was undertaken at post-intervention found that most participants' perceived the two different forms of social contact to aid their physical

activity (See Table 2.6 for a summary of the process evaluation studies).

Table 2. 6. Summary of process evaluation studies of physical activity interventions

Study	Participants who took part in the process evaluation component	Type of physical activity intervention	Findings of the process evaluation
Draper, et al. (2009)	285 participants aged 18 to 55 years and older	A series of four interventions based on age groupings, designed to provide physical activity and health promotion advice and activities.	The intervention combined social development and health promotion components, and was deemed to be culturally appropriate
Elley et al. (2007)	15 participants aged 40 to 79 years	A qualitative sub-study to a larger randomised controlled Green Prescription trial. Participants talked about their experiences and attitudes toward receiving a Green Prescription	Four themes emerged. The Green Prescription was perceived to be an individually tailored intervention that accommodated for individual differences
Gillis et al. (2002)	80 participants aged 65 years and older	Community-based intervention designed to increase physical activity in low-active older adults	Personal attention from staff and ongoing telephone support were perceived to be the most helpful intervention components
Hopman-Rock and Westhoff (2002)	71 participants aged 65 years and older	Intervention designed to provide health education and exercise instruction	Health education component was viewed as being 'understandable'. Exercise components was viewed as being helpful
Kolt et al. (2006b)	63 participants aged 65 years and older	Randomised controlled trial designed to increase physical activity in low-active older adults via telephone-based counselling	Telephone support and supplementary print materials were perceived to be helpful in aiding and maintaining participants physical activity
Lauzon et al. (2008)	68 participants. Mean age 44.9 years	Work-place physical activity intervention designed to increase physical activity via pedometer use	Pedometers were perceived to be helpful in motivating and sustaining one's physical activity. Group meetings were viewed as helpful

Mattfeldt-Beman et al. (1999)	281 participants aged 30 to 54 years of age. Participants had high-normal blood pressure and mild obesity	Intervention designed to change dietary intake and increase physical activity	Participants felt that weekly weigh ins, calorie counting and incorporating exercise into daily activities were helpful components. Group exercise was rated as the least helpful component. It was suggested that future interventions need to focus on teaching self-monitoring and problem solving skills
Openacker and Boen (2008)	66 participants. Mean age 39.9 years (SD=9.9 years)	Randomised trial designed to increase physical activity via two modalities: face-to-face or telephone-based counselling	Both support modalities were perceived to be helpful in increasing physical activity
Phongsavan et al. (2008)	33 participants. Mean age 39.0 years (SD=11.9 years)	Randomised controlled trial designed to promote physical activity in participants diagnosed with anxiety disorders	Participants felt that the program increased their awareness and knowledge about the importance of physical activity.
Sepsis et al (1995)	98participants. Mean age 76 years (SD=7 years)	Intervention designed to increase physical activity participation in community-based physical activity programmes for both community-dwelling and residential-care older adults	Participants rated the following as helpful: attention from staff, telephone-based support and introductory meeting. Least helpful components: chances to win prizes and receiving a T-shirt.

In conclusion, this review of the literature has examined and discussed the positive effect that physical activity can have on both the physical and psychological health of older adults. The salient role that primary care physicians can have in promoting and prescribing physical activity was also examined and discussed. The rationale and effectiveness of the New Zealand Green Prescription programme was also examined. The barriers and motives that can affect physical activity initiation and adherence in older adults were identified and discussed. This review also provided a rationale for, and a review of physical activity interventions that have employed a process evaluation approach. The following chapter will examine how New Zealand primary care physicians counsel for physical activity, with a specific focus on their views and experiences of the Green Prescription programme.

Chapter 3: Physical Activity Prescription in General Practice: What do Primary Care Physicians Think?

Preface

The previous chapter discussed the health-related benefits of physical activity and provided a rationale for a need to counsel older adults for physical activity. The aim of this chapter is to examine how New Zealand primary care physicians counsel for physical activity, with a specific focus on their views and experiences of the Green Prescription programme. As well, this chapter will examine physicians' views on Green Prescription counseling for depression. Physicians' views on the role that pedometers can have in health promotion will also be examined. Fifteen primary care physicians took part in this qualitative study. A semi-structured, open-ended questionnaire was developed for this study. All interviews were audiotaped and transcribed. Data were analysed using a general inductive approach.

Introduction

Substantial epidemiological evidence indicates that insufficient physical activity is a significant risk factor for increased morbidity and mortality (Bauman, 2003; Boreham et al., 2000; Warburton et al., 2006). Engagement in regular (moderate-intensity) physical activity provides both physical and psychological health benefits, which includes lowering risk factors for cardiovascular disease, hypertension, type 2 diabetes, some cancers, osteoporosis, falls and related hip fractures (in older adults), as well as depression and anxiety (Chodzko-Zajko, 2009; Nelson et al., 2007). For older adults, engagement in regular physical activity can contribute to prolonged independence in the tasks of daily living, as physical, cognitive, and psychological functioning is maintained or improved (DiPietro, 2001; McMurdo, 2000).

There is some evidence that physical inactivity is a risk factor for depression (Brown et al., 2005; Camacho et al., 1991; Lampinen et al., 2000; Strawbridge et al., 2002). Prospective cross-sectional studies have concurred that healthy, physically active, normal functioning older adults are at no greater risk for depression than younger or middle aged adults (Fukukawa et al., 2004; Kritz-Silverstein et al., 2001; Strawbridge et al., 1997). Depression in older adults appears to be associated with physical health problems and related functional disability (Robters et al., 1997). There is an association between depression in later life and the existence of at least one chronic health condition (Alexopoulos, 2005; Riley, 1994). Empirical findings have demonstrated an association between dose-response physical activity or exercise engagement and a reduction in depressive symptomatology in adults, including older adults who have diagnosed depression (Blumenthal et al., 1999; Dimeo et al., 2001; Dunn et al., 2005; Harris et al., 2006; Mather et al., 2002; Motl, et al., 2005; Singh et al., 2001).

Despite the physical and psychological health-related benefits of physical activity, physical inactivity is ranked as the second highest risk factor for increased mortality in New Zealand (Ministry of Health, 2004). A recent population-based

survey found over one half (52%) of the adult New Zealand population to be sedentary, achieving less than the national recommended level of physical activity per week that is required for health-related gain (Sport and Recreation, 2008a). Data from this survey indicated that 66% of older adults did not meet national physical activity guidelines (of achieving 150 minutes of physical activity over a 7-day period).

To help increase physical activity on a nationwide basis in New Zealand, the Green Prescription programme was developed and launched in the late nineties, in the wake of the U.S. Surgeon General's groundbreaking report on the benefits of physical activity engagement (Pringle, 1998). This intervention was designed as a preventive public health initiative, in which primary care physicians (general practitioners) and practice nurses prescribe physical activity to sedentary, or low-active individuals, and for those who have chronic health conditions and can benefit from engaging in physical activity (Pringle, 1998; Sport and Recreation, 2006). The Green Prescription is based on the U.S. Surgeon General's recommendation of 30-minutes of moderate activity on 5 or more days of the week.

The Green Prescription is administered in the same way as drug treatment, via a prescription. The actual prescription states the type physical activity the individual is to engage in, including the frequency and intensity of the activity. A Green Prescription runs for a 3-month period, during which time the individual receives a monthly phone call from a patient support counselor, who also has a faxed copy of the individual's Green Prescription. The patient support counselor is employed by a nonprofit regional sports trust. The telephone counseling that is provided is based on the transtheoretical model of behaviour change (Prochaska & Marcus, 1994), and is aimed to provide the individual with ongoing external support. The patient support counselor helps the individual set realistic goals and helps problem solve barriers to physical activity engagement. During one's involvement in the Green Prescription, an individual has access to certain discounted physical activity programmes and exercise facilities (Sport and Recreation New Zealand, 2006).

Physical activity counseling has consistently been shown to be understood and undertaken (at least on a short-term basis) by adults in the primary care setting (Calfas et al., 1996; Elley et al., 2003a; Kolt et al., 2007; Pinto et al., 2005). Research indicates that primary care physicians are viewed by their patients as being credible sources of information regarding health promotion advice (Kennedy & Meeuwise, 2003; Lawlor et al., 1999; Tulloch et al., 2006). Research carried out by Elley et al. (2003a) found that two thirds of adult New Zealanders were likely to consider health promotion advice by their primary care physician. Research indicates that older adults are more likely to consider and comply with physical activity advice when it is suggested by their primary care physician compared to younger age groups (Kerse et al., 1999; Kerse et al., 2005).

A number of randomised controlled trials have demonstrated that the Green Prescription is a feasible way to incorporate physical activity counseling in the primary practice setting (Elley et al., 2003a; Kerse et al., 2005; Lawton et al., 2008; Swinburn et al., 1998). These studies have demonstrated that combined verbal and written advice for physical activity is more effective in increasing physical activity in sedentary or low-active adults, compared to verbal advice alone. The Green Prescription has also been found to be an efficacious and safe way of increasing physical activity in sedentary individuals, including older adults over a 12-month period (Elley et al., 2003a; Kerse et al., 2005).

It is estimated that 80% of New Zealand adults and 90% of those aged 65 years and older visit their primary care physician at least once a year (Croteau et al., 2006). Thus, primary care physicians interact with the majority of the adult population, including sedentary and insufficiently active adults on a regular basis. Therefore, physicians within the primary care setting are in a unique position to influence the knowledge and behaviour of low-active and sedentary adults regarding health promotion, especially in the context of physical activity counseling (Kennedy & Meeuwise, 2003; Tulloch et al., 2006).

Despite the potential for physical activity counseling in general practice, research shows that New Zealand primary care physicians prescribe physical activity at half the prevalence of their counterparts in countries such as Australia and the

United States (Croteau et al., 2006). Population survey data show that 13% of New Zealanders reported receiving physical activity advice from their primary care physician in the previous 12 months, and 3% reported receiving a Green prescription in the previous 12 months (Croteau et al.).

Another avenue for helping to increase physical activity is through the use of pedometers. A pedometer is an inexpensive, relatively simple measuring device that provides instant, objective feedback concerning how many steps an individual has taken (Van Wormer, 2004). Emerging research shows that pedometers can have a role in health promotion, as pedometers can be used as a tool of motivation in relation to increasing physical activity, though increasing walking activity (Croteau, 2004; Pickering & Eakin, 2003; Stovitz et al., 2005; Vallance et al., 2007). A number of studies have demonstrated that pedometers are a cost effective way of increasing physical activity in previously low-active individuals (Chan et al., 2004; Hultquist et al., 2005; Picking & Eakin, 2003; Stovitz et al., 2005), including low-active older adults (Farmer et al., 2006; Jordan et al., 2005; Rosenberg et al., 2009; Talbot et al., 2003), and individuals who have chronic health conditions, such as type 2 diabetes (Engel & Lindner, 2006; Johnston et al., 2006), osteoarthritis (Talbot et al., 2003), and for those who are overweight or obese (Clarke et al., 2007; Panton et al., 2007).

A recent meta-analysis (Bravata et al., 2007) reported that interventions that have incorporated pedometer use have yielded both a significant increase in participants' physical activity and significant decreases in their body mass index and blood pressure. However, there is a gap in the current literature in relation to how health professionals, such as primary care physicians view the role that pedometers can have in helping increase physical activity.

There is limited research into how New Zealand primary care physicians counsel for physical activity, as well as their views and experiences of the Green Prescription intervention. Hence, this study has six main aims; (1) to identify and examine why and how general physical activity advice is imparted in primary care settings, (2) to identify the benefits and barriers to Green Prescription use as perceived by primary care physicians, (3) to examine whether physicians

administered Green Prescriptions for preventive or management purposes, (4) to examine physicians' views on Green Prescription counseling for depression, (5) to identify older adults barriers to Green Prescription counseling, and (6) to examine physicians' views on the role of pedometers in health promotion.

Method

Participants

Participants were 15 primary care physicians (10 female and 5 male) from the Auckland region of New Zealand. Participants ranged in age from 36 to 64 years of age (mean age = 50.8 years, SD = 7.1 years). Participants had been practicing in general practice settings between 1 and 30 years (mean = 22.1 years, SD = 10.3 years). Eight of the physicians had trained in New Zealand, two in the United Kingdom, two in Europe, two in Asia, and one had completed her training in South Africa. In most cases, internationally trained physicians had completed New Zealand equivalency training and examinations.

Measure

A structured, open-ended questionnaire was constructed for the interviews (See Appendix D). This questionnaire acted as a guide for the interviewer, and ensured that all participants were asked the same questions. The questionnaire was designed to allow for discussion and elaboration. Questions contained in the questionnaire schedule were divided into nine specific topic areas: (1) questions relating to physical activity advice in the general practice setting, (2) questions on pedometers, (3) Green Prescription questions, (4) questions relating to Green Prescription use with older adults, (5) Green Prescription use for mental health and depression, (6) general Green Prescription questions, (7) a question relating to the media and health promotion, (8) questions pertaining to physicians own physical activity and exercise engagement, and (9) physician demographic questions. The questionnaire was developed for this study and was based on relevant literature (see Table 3.1 for main questions).

Procedure

Participants were recruited through the aid of the University of Auckland's General Practitioner (primary care physician) Database. Recruitment of participants was based on geographical location. An equal number of potential participants from North, East, West, and South Auckland were sent a letter of invitation and an information sheet detailing the study and providing the researchers' contact details. A total of 80 letters of invitation were mailed out to potential participants to obtain 15 positive responders. Those who were interested in participating replied by fax and an interview time was arranged. Participants were interviewed in their place of work (the general practice setting). Interviews took between 20 and 30 minutes to complete, and all interviews were audio taped for later transcription and data analysis. The study was approved by the Auckland University of Technology Ethics Committee (AUTEC) (ethics approval number: 06/185).

Table 3.1 Interview schedule for physician interviews

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1. Firstly, I'm interested in finding out how you give out exercise/physical activity advice to your patients?
 2. Tell me how you prescribe physical activity or exercise through the Green prescription scheme?
 3. As a GP (primary care physician) what barriers do you encounter when thinking about writing a Green Prescription for a patient?
 4. What actual barriers do you encounter with patients when you write out a Green Prescription for them?
 5. How do you deal with these barriers?
 6. There are differing thoughts in relation to whether a Green Prescription is designed more to prevent a condition or to manage a condition, what are your thoughts?
 7. Overall, what do you feel are the benefits of Green prescriptions use?
-

Note. Only seven questions are shown in the interview schedule in Table 3.1. See Appendix E for a full copy of the interview schedule.

Data Analysis

A qualitative methodology was employed for this study. All interviews were audio taped and transcribed. Data (e.g., transcripts) were analysed using a general inductive thematic approach based on Auerbach and Silverstein's (2003) approach to thematic analysis. The first step in the data analysis involved reading and re-reading the transcripts (e.g., raw text) several times under six topic areas: (1) general physical activity advice within the primary care setting, (2) physicians' use of the Green Prescription programme, (3) Green Prescription counseling for depression, (4) physicians' barriers to Green Prescription use, (5) older adults' barriers to Green Prescription use, and (6) the role of pedometers in health promotion. The second step involved focusing on repeating ideas within a particular topic area. This process involved focusing on text where several of the physicians' used similar words or experiences to convey the same idea. From a focus on repeating ideas, coding and specific themes (e.g., an organisation of repeating ideas that is given a specific name that communicates what participants' are trying to convey) emerged from the raw data. Coding and subsequent themes were verified by two researchers experienced in the area of physical activity and primary care interventions. This process helped reduce individual researcher bias. Auerbach and Silverstein refer to this process of verification as the justifiability and transparency of the data analysis. It means that other researchers know the process by which data were analysed and how themes were coded.

Results

Data were examined under the six broad headings mentioned above. For each topic area, themes are outlined and direct quotes are included that illustrate specific points, or that highlight expressed views or experiences encountered. Table 3.2 provides a recap of topic areas and associated themes.

General physical activity advice within the primary care setting

Preexisting conditions, was the only main theme that emerged regarding why general physical activity advice is given in daily consultations. This theme illustrated how

physicians prescribe physical activity as a form of secondary prevention, as physicians were more likely to provide physical activity advice to patients who had preexisting conditions, such as hypertension, diabetes, and heart conditions. Being overweight was seen as a risk factor for future health problems, though having a sedentary lifestyle was not. This was demonstrated by comments such as:

Participant 11

For somebody who's hypertensive or overweight, diabetic. High risk team of people.

Participant 14

A concern regarding their weight, and if they have comorbidities, we definitely touch on that briefly.

Participant 11

Sometimes if they come in for a pill repeat, and if I think they are highly overweight, then I go through it with them as part of the consultation.

Participant 9

I do try and encourage physical activity for a number of reasons: for stress management, for weight control, for blood pressure control.

Physicians' use of the Green Prescription programme

Three main themes emerged in relation to physicians use of the Green Prescription programme in the primary practice setting: (i) Perceived benefits of the Green Prescription scheme, (ii) Green Prescription use for prevention and management purposes, and (iii) Infrequent or non-use of the Green Prescription programme.

(i) Perceived benefits of the Green Prescription intervention

Physicians identified two main benefits to Green Prescription counseling: a nonmedication approach to a healthier lifestyle, and support benefits of physical activity. A majority of physicians emphasised that one of the most salient benefits of Green Prescription use is that it is a drug-free process. Also stressed was the thought that Green Prescription engagement does not have negative side effects as many drugs do. Some physicians discussed how a Green Prescription gives importance to physical activity as a valid treatment for health gain, as it is presented in the same format as prescription medication. The following quotes highlight these points:

Participant 8

The great thing about it is that you are not stuffing some medicine into them.

Participant 1

It officialises the fact that you think that exercise is a treatment by putting it on a bit of paper. Gives your stamp of approval to it, it means it's important to us.

Participant 4

It shows them that you think exercise is important. So reinforcing that not just pills are going to make people better.

Both prolonged and specialised physical activity support and counseling that patients received from the Green Prescription patient support counselor was seen as beneficial by most physicians, as they viewed the patient support counselor as having both the time and skills to fully support patients in initiating and maintaining their physical activity or exercise. Some physicians discussed how time constraints can hinder such counseling in the practice setting. Physicians also stressed how the specialised support also related to patient safety and monitoring, which was seen as beneficial for older patients. The following quotes illustrate this point:

Participant 1

I think one of the big benefits would be that patients get much better exercise advice and more prolonged support than they can get from a GP (primary care physician).

Participant 13

I see the Green Prescription as really important, to have that support, that is really important for helping people make the behaviour change that is necessary for it to become an ongoing lifestyle rather than just a short term change.

Participant 3

People do it in a grade and methodological fashion. It's safe.

(ii) Green Prescription use for prevention and management purposes

A Green Prescription was issued for primary preventive purposes when there was an awareness of a family history for certain conditions. Also, if a patient was overweight, a Green Prescription was viewed by some physicians as a preventive measure, to lessen the chance of diseases (e.g., diabetes) occurring. Patients who had high blood pressure were also seen as ideal candidates for a Green Prescription intervention. The following quotes demonstrate this:

Participant 2

I'm dealing with people who might get problems. People who have a family history of diabetes, or who are hypertensive, or are starting to get obese. Pushing hard for them to exercise, you're going to prevent things from happening.

Participant 15

For diabetes prevention for those at risk. Patients at risk for ischemic heart disease, or maybe hypertension, or high cholesterol. It's worthwhile for a Green Prescription and exercise programmes.

Physicians also addressed how they administer Green Prescriptions to help manage certain conditions, as a form of secondary prevention. A Green Prescription was seen as helpful in managing pain for patients who had conditions such as arthritis. Physicians also discussed how they have issued Green Prescriptions for weight control management for patients who have diabetes. The following quotes convey that physicians have found physical activity and exercise as a helpful and valid form of treatment:

Participant 2

I'm dealing with people who've already got problems. To treat conditions like diabetes, or to help people manage them.

Participant 3

It can be useful to manage symptoms like pain and arthritis.

Participant 7

If they are overweight, they'll lose weight, that's got to be helping them with their current condition.

(iii) Infrequent or non use of the Green Prescription programme

Infrequent or non use of the Green Prescription programme was predominantly related to physicians using other forms of physical activity advice. A few physicians commented that they did not have to administer a Green Prescription to give out physical activity advice. Such physicians commented that they use the same verbal (but not written) format as the Green Prescription. The ongoing support that patients receive outside of the consultation from a Green Prescription support counselor was not mentioned in the following accounts:

Participant 12

I don't need to give a Green Prescription to give advice about physical activity. I'm not a great Green Prescription writer, but I do give advice.

Participant 3

I do the same sort of thing it suggests. But I don't have a bit of paper that's green, that's called the Green Prescription. So the concepts and the content I tend to use, but not the bit of paper. I've tended to use the concepts and the verbal side of doing it, rather than the written side.

Participant 2

I think the idea is great if you've got loads of time. But I think what I say sticks just as well as the Green Prescription. I give them my own advice and talk to them about it, and bring it up at each consultation.

Green Prescription counseling for depression

The one main theme that emerged regarding Green Prescription use for the management of depression, related to the perceived physical benefits of increased physical activity. All physicians emphasised the importance of physical activity engagement, because of the natural chemical processes that occur from such activity. Physicians tended to discuss how patients could help themselves, by engaging in physical activity to release endorphins, to enhance positive mood. The following accounts demonstrate this:

Participant 12

We know that exercise is very good for depression, from the natural endorphins to socialisation.

Participant 13

It increases the endorphins, it seems to have a physical effect, as well as an emotional effect.

Participant 2

I think there's nothing like getting out in fresh air and going for a little bit of a walk. Because you know it increases endorphins, you feel better.

Participant 6

You say, "now if you want to get better faster, what you want to do is increase your own endorphins."

Participant 15

I tell them that, "exercise alone will raise your serotonin and that will make you feel better, if you do it every day."

Some physicians also discussed how they have used Green Prescription counseling in conjunction with antidepressant medication to manage patients with depression. Physical activity engagement in general, as well as through the Green Prescription,

was viewed by some physicians as helping lessen the need for drug treatment, or lessening the dosage of antidepressant medication. The following quotes highlight these points:

Participant 8

The more exercise they do the less their depression, and the less medication. I've never regretted giving a patient with depression an exercise prescription, they definitely do better.

Participant 15

It's clearly shown, if they exercise they get a much better clinical response, and that relates to serotonin lift when they exercise. So serotonin uptake of the medication of fluoxetine.

Physicians' barriers to Green Prescription counseling

The majority of physicians stated that time constraints were the most salient barrier for them in relation to administering Green Prescriptions. Physicians discussed how patients presented with multiple problems or conditions, and how this left little or no time for physical activity counseling, or specifically administering a Green Prescription. Interestingly, no physicians stated that a Green Prescription was an ineffective form of treatment:

Participant 7

Time, because patients generally have quite complex problems, and multiple problems.

Participant 11

There was a time barrier to discuss physical activity with them. Ten or fifteen minutes for the consultation, not a lot of time.

Some physicians successfully dealt with the time barrier in a number of ways. Some physicians mentioned that in some cases their practice nurse also administered Green Prescriptions. Some physicians delegated the more time consuming tasks (such as choosing an activity) to the Green Prescription support counselor. The following quotes illustrate this:

Participant 13

I actually will hand some of these patients onto the nurse, and say, "look could you

also look at diet, exercise, Green Prescription”.

Participant 13

Sometimes we had nurses who were keen and supportive.

Participant 1

Time is the main barrier, just one more thing to do. I delegate a lot of the time consuming part to the Green Prescription people.

Participant 13

It is important, so you generally squeeze it in. I tended to run over time.

Older adults' barriers to Green Prescription counseling

Physicians identified two major barriers to older adults' engagement with the Green Prescription: (i) The existence of chronic health conditions, and (ii) Transport constraints.

(i) The existence of chronic health conditions

Some physicians mentioned that existing chronic health conditions needed to be taken into consideration before an individual engaged in physical activity or exercise.

The following quotes demonstrate this:

Participant 8

There are the barriers of their medical condition. They have arthritis, various things like that. I think it might be unwise for them to partake in that without lots of caution.

Participant 4

You have to be careful about what health conditions they've got.

Several physicians also problem solved barriers relating to their patients' chronic health conditions and ability to safely (and painlessly) engage in physical activity. For example, two physicians mentioned that walking would be a suitable physical activity for most of their older patients to engage in. This is illustrated in the following quotes:

Participant 14

It would be comorbidities. If not safe, then encourage them to walk on their own, on their comfort level.

Participant 9

Their ability to be able to partake in exercise programmes. A lot of the advice I would be saying to these people is that you know that walking is probably one of the

better things that they can do.

The following quote illustrates how a particular condition (osteoarthritis) acted as a barrier to walking for a patient and how in turn their physician came up with an alternative physical activity for them to engage in:

Participant 8

You have to find some different form of exercise for them. Like a lot of people with osteoarthritis can't do the walking because it's too painful. That's why swimming is good.

The following two quotes illustrate how barriers to physical activity for some older adults are centered around fear of injury, especially if they have a chronic health condition, or have had a heart attack or stroke in the past. These quotes also demonstrate how physicians deal with this salient (and sometimes common) dilemma:

Participant 12

The only barrier is their perception that they shouldn't be exercising. People who may have had a heart attack, or a bit of a stroke, or something. They get a bit nervous as they regain their confidence. So it's talking to people, saying 'just listen to your body and to start slow and work up'.

Participant 4

It's usually trying to say to them, "this isn't a barrier to you exercising, because a lot of people have sore backs, or have got high blood pressure, and are a bit short of breath". They will say, "I can't exercise because of this", and you have to turn it around and say, "No this is the very reason that you have to exercise".

(ii) Transport constraints

The majority of physicians emphasised how lack of transport was a salient barrier for some older adults in relation to getting to organised Green Prescription programmes or activity venues (e.g., Tai Chi class, the local swimming pool). Some physicians mentioned that for some older adults taxis are the only available mode of transport. This raised the issue of how cost can also be a barrier to physical activity engagement. One physician mentioned the use of mobility vouchers for discounted taxis, to try and counteract this barrier. The following quotes demonstrate these issues:

Participant 7

I think transport is the biggest one for the older patients. It's hard to actually physically get them there.

Participant 19

They don't have transport to go to these things. It's not in the area. They can't drive because of vision, or a heart condition, or stroke.

Participant 4

I usually get them mobility vouchers for cheaper taxis. But mostly they don't want to use them because they still have to pay something.

One physician discussed how she tried to deal with the transport barrier. She explained how patients can try and share transport, if they live close to someone else who is participating in the same programme. The following quote illustrates this:

Participant 7

I try and suggest that they buddy up. If they do get there, they can reach out to the coordinator, because often the coordinator knows where other people live. Maybe able to say, "well look we know somebody else who lives on the same street". But again whether or not they do that, because some patients are really not socially into big groups.

Two physicians discussed how they dealt with potential transport issues. One physician mentioned that a patient could participate in some type of physical activity close to home. While, another physician mentioned the importance of tailoring a Green Prescription to meet the specific needs and requirements of individual patients. The following quotes demonstrate this:

Participant 11

I didn't expect them to go to a gym if they had transport problems, because they could just do the physical activity where they live.

Participant 15

As long as you've engineered your programme to suit them personally, you should have dealt with these barriers before writing one.

The role of pedometers in health promotion

Two main themes emerged in relation to the role that physicians perceived

pedometers to have in health promotion: (i) motivation by awareness, and (2) cost factor.

(i) Motivation by awareness

All physicians gave accounts of pedometers being motivational devices that provide individuals with objective awareness of their activity levels, as they provide instant feedback on one's step counts, which in turn can help to increase motivation to engage in walking activity. The following quotes convey these thoughts:

Participant 9

They raise people's awareness of how much they are walking each day.

Participant 14

It gives them a better idea of how much they are actually doing. I think they can certainly help motivate people.

Participant 10

It can encourage them, because they know what they do, because they have confirmation of their work.

In the following quotes, three of the physicians stressed how the objective feedback that pedometers provide in relation to actual steps taken, can help motivate individuals to become more active, as their step count information informs them about how much daily walking they are actually engaging in. The following quotes highlight this:

Participant 11

I think it might encourage them once they see how little they move.

Participant 12

It would give them some idea of how much activity they're really taking, rather than what they thought they are taking.

Participant 13

It's a good way for them to see what they are actually doing, because often its less than they realise.

Two physicians discussed how pedometers can be used to change the behaviour of individual patients in relation to increasing one's walking activity, by setting goals to

increase step counts. The following quotes convey this:

Participant 13

Pedometers can be useful for some people if they are used as part of a self management plan, where you actually help somebody set a few goals.

Participant 3

Pedometers are good for giving people goals for how many steps they should do a day. So they can be part of a behaviour modification package. They can keep the patient on target, on goal.

(ii) *Cost factor*

This theme involved physicians discussing how cost could be a factor in pedometer access for some patients. A few physicians mentioned that they would endorse pedometers if they were donated to their practices. These points are highlighted in the following quotes:

Participant 10

If they were free, I would give them.

Participant 4

If somebody would provide me with pedometers that were of good quality and didn't cost the patient or me, and then yes, I would definitely would.

One physician discussed how she loaned pedometers to a few of her patients. This physician then went on to discuss how a pedometer lending system could be beneficial, with the aim that patients could borrow a pedometer for a few weeks to help them to increase their daily walking. This is illustrated in the following quotes:

Participant 13

I bought a couple from Diabetes New Zealand and lent them out to patients. I hadn't done it very often because I wasn't confident in getting them back.

Participant 13

It would perhaps be easier now to have a practice system where you could lend them out for a week to a month or whatever seems appropriate for someone to just to get them started.

Another physician made a similar comment about a possible lending system, as stated below:

Participant 2

Maybe we should give them out to people for a month and then pass them on.

Table 3.2 provides a summary of the main topic areas and the themes that emerged from these topics.

Table 3.2: Topic areas and themes

Topic Area	Theme
General physical activity advice within the primary care setting	Preexisting conditions
Physician use of the Green Prescription intervention	Perceived benefits of the Green Prescription programme
	Green Prescription use for prevention and management purposes
	Infrequent or non-use of the Green Prescription
Green Prescription counseling for depression	Perceived physical benefits of increased physical activity
Physicians barriers to Green Prescription use	Time constraints
Older adults barriers to Green Prescription counseling	Chronic health conditions
	Transport issues
The role of pedometers in health promotion	Motivation by awareness
	Cost factors

Discussion

This qualitative study was designed to examine primary care physicians' views and experiences of counseling for physical activity, with a specific focus on their use of the Green Prescription programme. In the present study, the majority of physicians discussed how they would counsel a patient in general for physical activity if the patient had either a preexisting chronic health condition or if the patient had a weight problem (i.e., overweight). Also, physicians were more likely to administer a Green Prescription as a form of secondary prevention for patients with preexisting conditions such as diabetes, hypertension, and cardiovascular disease. This finding is consistent with previous studies which have found physicians are more likely to prescribe or recommend physical activity or exercise engagement as a form of management for patients who have preexisting chronic health conditions (Bull et al., 1997; Eakin et al., 2007a; Van der Ploeg et al., 2007; Wee et al., 1999). It has been argued (Lawlor et al., 1999; van Sluijs et al., 2004) that some physicians believe that physical activity prescription or advice is likely to be more effective when it is linked to an existing condition.

While it is beneficial to use physical activity counseling, including Green Prescriptions, as a form of secondary prevention to manage conditions, there also needs to be a focus on physical activity counseling for primary preventive purposes. For example, sedentary individuals can benefit from a Green Prescription, as they are currently disease free, but are at risk for future noncommunicable diseases and conditions because of their inactive lifestyle (Croteau et al., 2006; Wee et al., 1999).

In the present study, some physicians also administered Green Prescriptions as a form of primary prevention for patients who were overweight. Overweight and obese patients are at risk for developing health-related problems in the near future (Croteau et al., 2006; Eakin et al., 2007a). This finding is consistent with annual Sport and Recreation surveys which monitor Green Prescription use (Sport and Recreation New Zealand 2008b; Sport and Recreation New Zealand, 2007a; Van Aalst & Daly, 2005a). These surveys have shown that Green Prescriptions are issued for weight management purposes more than for any other condition.

In this study, a non medication approach to a healthier lifestyle was identified as a salient benefit of the Green Prescription scheme as patients did not encounter negative side effects that drug use entails. Physicians discussed how a Green Prescription validates the importance of physical activity as a treatment for health gain. This was related to physical activity advice being in a prescription format like pharmaceutical treatment. Research shows that the Green Prescription format can be understood by individuals, because the use of a prescription is a well understood interaction between doctor and patient (Swinburn et al., 1997). Prescriptions are viewed by individuals as being sources of medical help. A written prescription for physical activity also acts as a tangible reminder for the patient to engage in activity (Gribben et al., 2000; Pfeiffer et al., 2001; Swinburn et al., 1998).

The prolonged and specialised support that patients receive from the Green Prescription patient support counselor was identified by physicians as being another benefit of the Green Prescription programme. In annual Sport and Recreation surveys, individuals (primary care patients) have stated that the advice, support, and encouragement that they have received from their support counselor has helped to

keep them active and complete their Green Prescription (Van Aalst & Daly, 2004; Sport and Recreation, 2008). This finding is also consistent with a recent qualitative study that was undertaken to examine patients' views and experiences of receiving a Green Prescription (Elley et al., 2007). Some patients in the Elley et al. study viewed their patient support counselor as a 'significant other,' someone who had some influence over their behaviour. For example, some patients felt motivated to comply with their Green Prescription because of the ongoing telephone support they received from their patient support counselor.

Physicians that infrequently administered Green Prescriptions or did not use the Green Prescription programme were more likely to use other (predominantly verbal) forms of physical activity advice, a finding consistent with previous research (Gribben et al., 2000; Swinburn et al., 1997; Van Aalst & Daly, 2005a). Such verbal advice appears to be general in content (e.g., mentioning to patients to engage in some physical activity) rather than specific advice (e.g., discussing type, frequency, intensity, and duration of activity) (Bull et al., 1997). Research has consistently shown that combined verbal and written advice for physical activity engagement is more beneficial as individuals are more likely to adhere to such advice than the use of verbal advice alone (Elley et al., 2003a; Gribben et al., 2000; Lawton et al., 2008). Physicians have also indicated that a written component adds authority to their verbal advice (Swinburn et al., 1997).

Time constraints of the consultation were cited as the most salient barrier to Green Prescription use by physicians, a finding consistent with that of earlier studies (Gribben et al., 2000; Swinburn et al., 1997). One physician mentioned that she delegated the more time consuming tasks, such as choosing an activity to the Green Prescription patient support counselor. In some practices, practice nurses also assisted in the administering of Green Prescriptions. These two methods to reduce time demands are important given that both New Zealand and international literature consistently cites time constraints as physicians' most salient barrier to physical activity counseling. (Kennedy & Meeuwisse, 2003; Lawlor et al., 1999; McKenna et al., 1998; Van Aalst & Daly, 2005a). Also, in relation to time constraints, some research shows that in some cases it can be less time consuming for a physician to outline the Green Prescription programme and administer a Green Prescription, compared to starting a patient on a new medication (Wynard, 2006).

The majority of physicians in the present study identified the existence of chronic health conditions as being a barrier toward Green Prescription counseling for older adults. This finding is consistent with the literature on barriers toward physical activity and exercise participation for older adults. As a group, some older adults tend to believe that engaging in physical activity can worsen one's present condition(s), or cause new injury (Guerin et al., 2008; Newson & Kemps, 2007; Schutzer & Graves, 2004). In the present study, several physicians discussed how they help their patients problem-solve barriers that are connected to specific conditions. For example, it was mentioned that walking could be a suitable, safer activity for some older adults. Another physician mentioned that swimming compared to walking was a suitable and appropriate physical activity for individuals who have osteoarthritis. Swimming or some form of water activity was seen not only as a suitable form of physical activity, but also as a form of pain management for patients who have osteoarthritis.

Lack of transport was identified as another barrier that could prevent some older adults from engaging in physical activity. This was in relation to being unable to get to organised Green Prescription programmes and other physical activity or exercise venues. Physicians discussed how they tried to problem solve this barrier. One physician mentioned the use of mobility taxi vouchers, another mentioned sharing transport/car pooling with others who lived in the same area. Two physicians highlighted the importance of tailoring a Green Prescription to meet the needs of individual patients. This related to prescribing physical activity that could be undertaken close to home, and thus did not require transport. This helps highlight how the Green Prescription is an individually tailored physical activity intervention, designed to accommodate for an individual's needs (Elley et al., 2007).

In the present study, physical activity engagement in general, as well as prescribed physical activity through the Green Prescription programme, was viewed as beneficial in the treatment and management of depression by all physicians. Physicians stressed that this was related to the release of natural mood enhancing chemicals (i.e., endorphins). Some physicians discussed how they use Green

Prescription counseling in conjunction with antidepressant medication. This combined treatment mode has been studied in randomised controlled trials and longitudinal studies on depression (Blumenthal et al., 1999; Mather et al., 2002; Singh et al., 2001). There is some research-based evidence that indicates that physical activity or exercise is just as effective as antidepressant medication in significantly decreasing depressive symptomatology in individuals who have a diagnosis of depression (Blumenthal et al., 1999). Empirical findings indicate that regular moderate intensity physical activity engagement in later life is associated with significant decreases in depressive symptomatology in both depressed and non depressed older adults (Brown et al., 2005; Cassidy et al., 2004; Galper et al., 2006; Harris et al., 2006; Kritz-Silverstein et al., 2001).

The physicians in the present study discussed how pedometers were motivational devices that could be used to encourage people to become more active, as they provide objective information regarding an individual's activity level. This information regarding step counts was seen as important because it could make people aware how little activity they were engaging in. There is a growing body of research-based evidence regarding the motivational effect that pedometers can have in increasing physical activity, and physical activity interventions that have incorporated pedometer use to help increase physical activity in low-active individuals, including low-active older adults have been successful on both a long and short-term basis in increasing physical activity (Chan et al., 2004; Croteau, 2004; Farmer et al., 2006; Jordan et al., 2005; Talbot et al., 2003; Van Wormer, 2004; Mutrie et al., 2004).

Participant feedback of a pedometer-based intervention highlighted that participants felt that their pedometer was a practical tool for increasing their awareness of how active or inactive they were (Lauzon et al., 2008). In the present study, a few physicians mentioned that cost could be a barrier to pedometer access for some individuals. These physicians mentioned that they would endorse pedometer use if their practices were given free pedometers. Two physicians mentioned that a pedometer loan system could be beneficial in relation to helping individuals initiate an increase their daily walking activity.

Strengths and Limitations

A main strength of this study is that a qualitative methodology was employed. This type of data analysis allowed for physicians to voice their views and experiences of counseling for physical activity through the Green Prescription programme, thus allowing a range of issues to be derived from the data. A possible limitation of this study is that only a small number of physicians were interviewed. Thus, generalising findings to the larger physician population may be problematic.

Conclusions

In conclusion, the physicians in this study acknowledged the health-related benefits of physical activity. A nonmedication approach to a healthier lifestyle and the ongoing specialised support that comprise the Green Prescription programme were seen as beneficial. Some physicians were using Green Prescriptions as a form of primary prevention for overweight patients. Such patients are at higher risk for future health problems because of their excess weight. However, physicians were more likely to administer Green Prescriptions for patients who had preexisting chronic health conditions. There is a need to focus on how to implement Green Prescription counseling as a form of primary prevention, rather than just a secondary treatment for chronic disease management. Physicians cited time constraints in the consultation as the most salient barrier to Green Prescription use. Some physicians identified ways to counteract this barrier, such as delegating the more time consuming tasks to the Green Prescription support counselor. It was suggested that practice nurses could assist in the administering of Green Prescriptions. Physicians discussed how older adults' barriers toward Green Prescription counseling were centered on the existence of chronic health conditions, and transportation constraints, in relation to being unable to attend organised Green Prescription physical activity classes or exercise venues. Physical activity in general, and physical activity prescribed through the Green Prescription, were seen as beneficial in the treatment and management of depression. Pedometers were viewed as helpful devices that could be used to encourage more walking activity, although, physicians felt that patients should be provided with free pedometers. Future research in the form of a population-based study designed to identify the circumstances under which

physicians counsel for physical activity (e.g., patient characteristics), and prevalence of physical activity counseling, including Green Prescription use would be beneficial within a New Zealand context. The following chapter will identify and examine the perceived barriers and motives participants' experienced during their involvement in the Healthy Steps Green Prescription programme.

Chapter 4: Barriers and Motives for Physical Activity Participation in Older Adults

Preface

The previous chapter examined how New Zealand primary care physicians counsel for physical activity, with a specific focus on their views and experiences of the Green Prescription programme. The aim of this chapter is to identify perceived barriers and motives for physical activity participation as experienced by participants during the course of their involvement in two different types of physician-initiated Green Prescription interventions: the regular time-based Green Prescription and a pedometer-based Green Prescription. This chapter will examine differences for perceived barriers and motives based on intervention allocation (i.e., time-based or pedometer step-count Green Prescription) and intervention outcome (i.e., an increase in physical activity at post intervention), while controlling for demographic variables. At the 12-month follow-up period in the substantive Healthy Steps study, 80 participants completed “The Healthy Steps: Barriers and Motivators to Physical Activity Questionnaire.” This questionnaire was designed to assess participants' perceived barriers and motives for physical activity. To ensure that interventions such as the Green Prescription are successful on a long-term basis and confer health-related benefits, it is important to identify and accommodate for older adults' perceived barriers and motives for physical activity initiation and adherence.

Introduction

Convincing evidence demonstrates that regular (moderate-intensity) physical activity engagement confers health benefits throughout the lifespan (Bauman, 2003; Boreham et al., 2000; Nelson et al., 2007; Taylor et al., 2004; Wong et al., 2003). For older adults (65 years and older), regular physical activity engagement helps to facilitate healthy ageing by lowering the risk of disease, disability, and dependency in later life (Bruce, Fries, & Hubert, 2008; McMurdo, 2000; Nelson et al., 2007; U.S. Department of Health and Human Services, 1996). Regular physical activity engagement can help prevent, delay, or manage lifestyle-related diseases and conditions such as cardiovascular disease, type-2 diabetes, hypertension, some cancers, and depression (Bauman & Owen, 1999; DiPietro, 2001; Warburton et al., 2006).

Research indicates that the primary health care setting is an ideal place to implement a physical activity intervention programme for older adults (Kerse et al., 2005; Kolt et al., 2007; Pinto, Goldstein, DePue, & Millan, 1998). Primary care physicians are the main medical contact for this age group. As a group, older adults view their physician as a credible source of health care information, and as such, are more likely to comply with the advice and instruction they receive from their physician (Kerse et al., 1999). Physical activity interventions that have been carried out in primary care settings have been successful in increasing the physical activity levels of previously sedentary or low-active older adults (Armit et al., 2005; Armit et al., 2009; Elley et al., 2003a; Kerse et al., 1999; Kolt et al., 2007; Pfeiffer et al., 2001; Lawton et al., 2008; Petrella, et al., 2003; Pinto et al., 2005).

As an initiative to address low levels of physical activity on a nationwide basis in New Zealand the Green Prescription programme was developed (Pringle, 1998). The Green Prescription is a primary care physical activity intervention that is based on the U.S. Surgeon General's recommendation of achieving 30 minutes of moderate intensity physical activity on five or more days of the week. Patients who have a stable medical condition are ideal candidates for a Green Prescription (Sport and Recreation New Zealand, 2006a).

The Green Prescription has been found to be both an effective and safe way for older adults to engage in physical activity. Results from a randomised controlled trial (Kerse et al., 2005) have shown that over a 12-month period participants aged 65 years and older who had been given a Green Prescription had significantly increased their leisure time physical activity levels at three months and maintained this increase over a 12-month period. There was also a significant improvement in intervention participants' perceptions of health-related quality of life, with these participants perceiving that their general health and wellbeing had improved over the 12-month period. In comparison to the control group, the rate of hospitalisations also decreased for the intervention group. Blood pressure, injuries, and falls remained stable for the intervention group compared to the control group.

Despite the benefits of physical activity engagement, sedentary behaviour increases with age in most industrialised countries (McMurdo, 2000; Newson & Kemps, 2007; Yeom, Fleury, & Keller, 2008). As a result, most older adults engage in less physical activity (less than 2.5 hours of physical activity within a seven day period) than is recommended for health benefit (Jackson, Morrow, Hill, & Dishman, 2004). A recent population-based study (Mummery et al., 2007) found a quarter of older New Zealanders (aged 65 years and older) to be sedentary, while 51% of older adults reported engaging in regular physical activity. The most recent data from the 2007/2008 Active New Zealand Survey indicates that 66% of older adults did not meet the national physical activity guidelines (of engaging in 30 minutes of moderate intensity physical activity on five or more days of the week) and 24% of older adults were sedentary (Sport and Recreation New Zealand, 2008a).

During the past decade, research has been undertaken to identify barriers and motives for physical activity initiation and adherence as experienced by older adults (Booth, Owen, Bauman, Clavisi, & Leslie, 2000; Guerin et al., 2008; Kalavar et al., 2004; Kaplan, Newsom, McFarland, & Leining, 2001; Kolt et al., 2004; Kolt et al., 2006a; Newson & Kemps, 2007; Resnick & Spellbring, 2000; Schutzer & Graves, 2004). There is a growing body of research evidence demonstrating that in later adulthood physical activity engagement is associated and determined by many physical (health-related), social, psychological, and environmental factors (Dishman,

1994; Phillips, Schneider, & Mercer, 2004; Jones, 2003). These factors need to be taken into account when designing and implementing physical activity interventions for this age group, especially if public health interventions such as the Green Prescription are to be successful (on a long-term basis) and bring about both physical and psychological health gain for older adults (Belza et al., 2004; Booth, Bauman, Owen, 2002; Lees et al., 2005).

Most of the existing research on perceived barriers and motives for physical activity participation (engagement) in older adults has used questionnaire and survey research methods, as well as qualitative methodologies in the form of face-to-face interviews and focus group interviews (which provide rich data, though because of their small sample size, limit the generalisability of findings). Further research is required that focuses specifically on how perceived barriers and motives for physical activity engagement (initiation and maintenance) exist within the context of a (specific) older adult physical activity intervention. Such information can provide practical knowledge in relation to what components of a particular intervention enhanced as well as impeded physical activity engagement in this population. This, in turn, can guide future intervention and programme design (Booth et al., 2002; Lees et al., 2005). Within a New Zealand context, further research is required to examine how older adults participate in a specific physical activity intervention (such as the Green Prescription programme) and how aspects of the intervention (i.e., telephone support, print materials, use of a pedometer) as well as demographic factors (i.e., gender, age, existence of chronic health conditions, weight status) were perceived as supporting or impeding their physical activity engagement.

The present investigation was a sub-study of the larger Healthy Steps study. The Healthy Steps study was a randomised controlled trial investigating the use of pedometer step-count versus time-based Green Prescriptions with low-active, community-dwelling older adults (Kolt et al., 2009). A number of studies have demonstrated that pedometer use can increase physical activity over a short-term period (Chan et al., 2004; Dinger et al., 2005; Vallance et al., 2007; Stovitz et al., 2005). Pedometer-based interventions that have been carried out with older adults have been efficacious in increasing physical activity (Farmer et al., 2006; Jordan et al., 2005; Rosenberg et al., 2009; Talbot et al., 2003). A pedometer can be used as a

motivational aid to increase physical activity. A pedometer provides instant, ongoing feedback of physical activity in the form of step-counts. This information can help individuals become aware of how active or inactive they are. This in turn can motivate, encourage and support individuals to increase their walking activity or other physical activities that result in increased step-counts (Croteau, 2004; Lauzon et al., 2008).

The aim of this study was twofold: first, to determine if perceived barriers and motives for physical activity differed based on allocation to either the pedometer-based or time-based Green Prescription; and second, to identify perceived barriers and motives that were associated with intervention outcome (i.e., an increase in physical activity at post-intervention) while controlling for the demographic variables of gender, age, weight status, and chronic health conditions.

Method

Participants

Eighty participants were recruited from the larger Healthy Steps study. To be eligible to participate in the Healthy Steps study, potential participants were aged 65 years or older, able to speak and write English, able to walk, not blind (in order to read pedometer display screen), have no health conditions that could constrain or contraindicate physical activity engagement, not have received a Green Prescription in the past two years, and be classified as low-active (i.e., engaging in less than 150 minutes of physical activity per week). Potential participants also had to be residing in the Auckland, New Zealand region over the 12-month period of the study.

For the present investigation, criteria for selection were based on the randomisation of grouping from the larger Healthy Steps study. That is, 40 participants from the control group (those who received a time-based Green Prescription) and 40 participants from the intervention group (those who received a pedometer step-count Green Prescription) were invited to participate. Participants in the present study ranged in age from 65 to 91 years or age, with an average age of

73.1 years (SD = 5.7). There were 32 male participants and 48 female participants.

The Healthy Steps Study

The Healthy Steps intervention was a randomised controlled trial designed to assess the effectiveness of a pedometer step-count versus time-based Green Prescription in increasing physical activity in low-active, community-dwelling older adults. During their involvement in the larger Healthy Steps study, participants were given a prescription for physical activity (the Green Prescription) from their primary care physician. There were two versions of the Green Prescription. The time-based Green Prescription consisted of a participant receiving the conventional Green Prescription, in which the participant was instructed to engage in their prescribed activity for a set period of time on most or all days of the week. The pedometer-based Green Prescription consisted of the same format as the time-based Green Prescription, although participants in the pedometer condition were encouraged to accumulate physical activity through the number of steps recorded on their pedometer.

During the 3-month intervention phase of their Green Prescription, participants received three telephone counseling calls from a trained physical activity counselor. These calls were designed to provide ongoing support for physical activity engagement. For example, phone calls were designed to help participants problem-solve barriers for physical activity and monitor participant progress. Telephone counseling for participants in the pedometer condition focused on goal setting in relation to accumulating more pedometer-based steps. Participants in the pedometer condition were encouraged to keep a daily log of their step counts. As part of their involvement in the larger Healthy Steps study participants completed measures that assessed their physical activity levels, gait and balance, blood pressure, and depressive symptomatology at baseline, postintervention (3 months), and at follow up (12 months after their initial enrollment in the Healthy Steps study).

Measures

Participants completed the Healthy Steps: Barriers and Motivators to Physical Activity Questionnaire (See Appendix F). The questionnaire was constructed for this study to identify perceived barriers and motives for physical activity participation in

older adults. Questionnaire construction was guided by literature pertaining to perceived subjective and objective barriers and motives for physical activity engagement in older adults. Questions contained in the present questionnaire were adapted and modified from existing questionnaires that were used in the following studies which sought to identify barriers and motives for physical activity engagement in older adults (Kolt et al., 2006b; Kalavar et al., 2004; Sport and Recreation New Zealand, 2003). The TeleWalk study (Kolt et al., 2006b) investigated the effect that a telephone-based counselling intervention had on physical activity participation and health-related quality of life in low-active older adults in New Zealand. The study carried out by Kalavar et al. (2004) was designed to identify barriers and motives for physical activity participation in a sample of older Asian Indian adults living in the United States. Sport and Recreation New Zealand Obstacles to Action Survey (Sport and Recreation New Zealand, 2003) was a population-based survey that was designed to identify and quantify barriers to physical activity engagement in the New Zealand adult population.

The Healthy Steps: Barriers and Motivators to Physical Activity Questionnaire consisted of three separate sections. Section one contained questions relating to perceived motives, section two contained questions relating to perceived outcome benefits (subjective feelings that may result after engaging in regular physical activity), and the final section consisted of questions relating to perceived barriers to physical activity engagement. Responses were recorded on a five point Likert scale that ranged from (1) strongly disagree to (5) strongly agree (see Appendix F). Demographic information pertaining to participants' gender, age, number of chronic health conditions, and weight and height for body mass index analysis were extracted from the Healthy Steps database. This database contained all data that was collected for the larger investigation.

Procedure

At the 12 month completion of their involvement in the larger Healthy Steps study, the first 80 participants who completed the larger study were mailed out an information sheet detailing the present study. A total of 106 information sheets were mailed out (to the first 106 participants who completed the Healthy Steps study) to obtain 80 positive responders (response rate = 75.5%). Potential participants were contacted by telephone a week after they had received the information sheet to

ascertain if they wanted to participate in the present study. If the individual chose to participate in the present study, verbal consent was obtained (as per ethics approval regarding verbal consent) and the questionnaire on 'Barriers and Motivators to Physical Activity' was administered via a telephone interview. The person conducting the telephone interview read out each question and recorded each participant's responses straight to the individual questionnaire for that participant. Questionnaires were coded by ID numbers that were used as part of participant identification for the larger Healthy Steps study. The telephone interview took between 15 and 25 minutes to complete. This study was approved by the Auckland University of Technology Ethics Committee (AUTEC) reference number: 07/89.

Statistical Analysis

Data were analysed with SPSS version 15.0 (SPSS Inc, Chicago, Illinois) with an alpha level set at 0.05 (95% confidence level). The Healthy Steps: Barriers and Motivators to Physical Activity Questionnaire contained many questions that were related to each other, thus a factor analysis of this data set was ideal, as this procedure allowed related (highly correlated) items to be grouped together to make common themes. This allowed the data to be more manageable so that tests of statistical inference such as analysis of variance could be undertaken (Pallant, 2001). This factor analysis procedure was undertaken to establish which items (questions) correlated strongly with each other to form a factor (a common theme or category) (Aron & Aron, 1994). Principal components analysis with varimax rotation was carried out on the Barriers and Motivators questionnaire. Pallant's (2001) guide for SPSS data analysis was used to guide the factor analysis procedure.

The first step in this process involved assessing the suitability of the data for factor analysis. Sample size and the strength of the inter-correlation among items (questions) were taken into account in determining whether a factor analysis could be undertaken with this data. Stevens (2002) argued that it is no longer necessary to have a large sample size for factor analysis as long as the inter-correlation (strength) of the relationship between items (questions) is high. In the case of the present study, there was an adequate inter-correlation among items (range .266 to .537). A score of $p < 0.05$ on Bartlett's test of sphericity, and a Kaiser-Meyer-Olkin (KMO)

score of 0.6 or above is seen as valid criteria for undertaking a factor analysis with a particular data set. In relation to the present data, all sections had a p value that was less than 0.05, and KMO scores that were 0.6 and greater.

The second step involved factor extraction. A principal components factor extraction technique was used. Kaiser's criterion and a scree test were used to determine what factors to retain for further analysis. In relation to Kaiser's criterion, factors with an eigenvalue of 1.0 or higher were retained for further analyses. In relation to the scree test plot, factors above the elbow/break in the plot were retained for further analyses.

The third step involved factor rotation and interpretation. An orthogonal factor solution with varimax rotation was undertaken. For example in relation to the motives section, only three components were selected for factor rotation (according to the findings of both Kaiser's criteria and the scree test plot results). The output provided by SPSS provided a rotated component matrix. This meant that three components were presented in the output data and individual items (e.g., questions) were loaded onto one of the three components. A factor loading of 0.3 or above for each item was the cut-off criterion for factor loadings, as a factor loading of at least 0.3 demonstrates that a correlation exists between an item and factor category (Aron & Aron, 1994; Pallant, 2001; Tabachnick & Fidell, 2007). For example, for motives factor one, four questions loaded onto component one (items 5, 11, 2 and 8).

To undertake analyses of variance, factor scores were then calculated by summing together each of the items/questions that made up an individual factor/category. For example, to obtain the factor scores for motives factor 1, the four items that comprised motives factor 1 were summed together and divided by four. This created a new variable which became motives factor 1. Factor scores were then used to undertake analysis of variance tests. Cronbach alpha coefficients were calculated for each factor to establish the reliability of the questionnaire.

Each of the three main sections of the questionnaire (motives, perceived outcome benefits and barrier sections) were ranked separately. Descriptive statistics were undertaken for this analysis. This involved obtaining the mean score for each

item/question for both groups of participants (e.g., increase group and nonincrease group). Mean scores ranged from zero to five. The higher the ranking for each item, the greater the perceived motive or barrier for physical activity. Percentages were also obtained for each item to correspond with perceived ratings in terms of how strongly participants agreed with items they found to be perceived barriers or motives for physical activity.

For the motives section, the item that was ranked highest as a motive for physical activity for participants in the increase group as well as for participants in the nonincrease group was ranked number one. The item that was ranked lowest as a motive corresponded to receive a ranking of 14 (e.g., there were a total of 14 items in the motives section of the questionnaire). The same format was used for the perceived outcome benefits section (the item that the each of the two groups perceived as being the most beneficial outcome of physical activity engagement was ranked as number one, with least beneficial item receiving a ranking of 12). In relation to the barriers section, the item that each group perceived as the most salient barrier for physical activity engagement received a ranking of one, while the item that was perceived as the least restrictive, received a ranking of 26. Responses for each item were summed and divided by the number of responses for that item, creating a mean score for each individual item.

A one-way analysis of variance (ANOVA) was conducted to explore between group differences for perceived barriers and motives based on factor scores for the following:

Intervention Allocation: time-based or pedometer step-count Green Prescriptions.

Intervention Outcome: based on whether participants total weekly walking physical activity had increased by 30 minutes at postintervention compared to their baseline score regardless of allocation to either the time-based or pedometer step-count Green Prescription. Initially, the criterion that determined whether participants had adequately increased their weekly total walking physical activity at post-intervention was based on reaching the national physical activity guidelines. These guidelines state that an individual should engage in a

minimum of 30 minutes of moderate intensity physical activity on five or more days of the week (Ministry of Health, 2006). This would have meant that Healthy Steps participants were engaging in a minimum of 150 minutes of total walking physical activity at post-intervention. When using this criterion only 14% (n = 11) participants who took part in the present study met these criteria, while 86% (n = 69) did not meet this criteria. Hence, unbalanced conclusions would have been drawn from that analysis. Thus, it was determined that a 30-minute increase in weekly total walking physical activity at post-intervention was adequate change as participants were either low-active or sedentary at baseline. It has been argued that in the case of low-active and sedentary older adults, some physical activity is better than no physical activity engagement (Fentem, 1994).

The Auckland Heart Study Physical Activity Questionnaire (AHS) (Jackson, 1989) was used to measure physical activity in the Healthy Steps study. The sub category of total walking physical activity was used as the criteria to determine if an individual's physical activity level had increased at postintervention in the present study. This subset category of physical activity took into account the total amount of walking activity that was undertaken within the main categories of: domestic, leisure, and occupational physical activity (Elley, Kerse, Swinburn, Arroll, & Robinson, 2003c).

Allocation-Based Outcome: Based on whether participants' total walking physical activity had increased by 30 minutes at post-intervention compared to their baseline score in relation to intervention allocation to either the time-based or pedometer-based Green Prescription, resulting in four categories:

- (1) Time-based increase group, (2) time-based nonincrease group (3) pedometer-based increase group, and (4) pedometer-based nonincrease group.

Demographic Variables: This included the following four demographic variables: gender, age, number of chronic health conditions, as well as body mass index (BMI). For the purpose of the present study, participants were placed into one of two age categories: 65 to 75years (n = 55, 68.8%) and 76 years and

older (n = 25, 31.2%). Previous research that has been undertaken with older adults has also divided this population into similar age categories (e.g., young-old and mid-old) (Abrams, Trunk, & Merrill, 2007; Li & Liang, 2007; Yates, Karasik, Beck, Cupples, & Kiel, 2007).

Chronic health conditions were divided into three categories based on previous findings that have shown that physical activity engagement can be effected by the number of health-related conditions (Baker & Johnston, 2000; Guerin, Mackintosh, & Fryer, 2008; Resnick & Spellbring, 2000; Stewart et al., 1989) The three categories are as follows: zero conditions (n = 7, 8.8%), one to two conditions (n = 50, 62.5%) and three or more conditions (n = 23, 28.8%).

Participants were placed into weight categories based on calculation of individuals' body mass index (BMI). BMI was calculated by weight in kilograms divided by height in meters squared. Normal BMI ranges from 18.5 to 24.9. A BMI between 25.0 and 29.9 is categorised as being overweight. A BMI of 30 or above is categorised as being obese (Ministry of Health, 2008). This resulted in the emergence of three categories: normal weight (n = 15, 18.8%), overweight (n = 41, 51.3%), and obese (n = 24, 30.0%).

In each ANOVA, each individual factor (e.g., Motives factor one) acted as the dependent variable and intervention allocation, intervention outcome, allocation-based outcome and the demographic covariates acted as the independent variable in each individual analysis. When more than two groups were being compared, a Tukey post hoc test was undertaken to establish were the significant differences lay.

Results

To establish the internal consistency reliability of the Barriers and Motivators Questionnaire, Cronbach's alpha coefficients were calculated for each factor. A Cronbach alpha coefficient measures how well a set of items/questions measure a single construct (e.g., motives for physical activity). A Cronbach alpha coefficient increases when items are highly correlated with each other (e.g., they are measuring

the same construct) (Pallant, 2001). The Cronbach alpha coefficient of a scale (or factor) should be .70 or above to be deemed reliable (Aron & Aron, 1994; Pallant, 2001). However, with short scales (scales that have twelve or less items) Cronbach alpha values of .50 can be common, and is seen as acceptable (Briggs and Cheek 1996) (See Table 4.3 for Cronbach alpha coefficients for factor items).

Table 4.1. Cronbach alpha coefficients for factor items

Factor	Cronbach Alpha Coefficient
Motives Factor 1: Enjoyment	.66
Motives Factor 2: Health and Medical	.67
Motives Factor 3: Engagement-Based	.52
Perceived outcome benefits Factor 1: Personal benefits	.85
Perceived outcome benefits Factor 2: Physical benefits	.70
Barriers Factor 1: Personal Barriers	.73
Barriers Factor 2: Perceptual Barriers	.53
Barriers Factor 3: Time Constraints	.72

Descriptive Findings

The rank order of barriers and motives for physical activity engagement for participants is shown in Table 1. Barriers and motives were ranked according to intervention outcome. Participants were grouped into either the (1) increase group or the (2) nonincrease group based on whether their total weekly walking physical activity had increased by 30 minutes at postintervention (three months post baseline) compared to their baseline total walking physical activity score, regardless of intervention allocation. Barriers and motives for physical activity tended to differ based on intervention outcome. Over the course of the 12-month programme 46% of participants had increased their total walking physical activity by 30 minutes at post-intervention (n = 37), while, 54% of participants had not (n = 43).

Participants in the increase group perceived the following item as been a strong motive for physical activity: *“The Green Prescription was enjoyable and I had fun doing my prescribed activity.”* In comparison, participants in the nonincrease group perceived the following item as being a strong motive for physical activity: *“The phone support I received helped to keep me motivated.”* The

following item was the lowest ranked motive for participants in the increase group: *“The Green Prescription provided me with an opportunity for social interaction or a way to meet new people.”* Participants in the nonincrease group perceived the following item as the least important motive for physical activity: *“I wanted to be physically active to alleviate pain.”* (See Table 4.2).

Across both outcome groups, participants rated the following item as being the highest ranked benefit of completing the Green Prescription: *“I felt that the Green Prescription helped to improve my health”*. Participants across both outcome groups rated the following item to be the least beneficial outcome for them: *“I have lost weight.”* (See Table 4.3).

In relation to perceived barriers, participants in the increase group ranked the following item as being a strong barrier for physical activity: *“The weather kept me from being physically active.”* Participants in the nonincrease group ranked the following item as being a strong barrier for physical activity: *“I experienced pain.”* Across both outcome groups, the following items were perceived to be the least salient barriers for physical activity: *“I don’t like to sweat”* and *“I don’t like people seeing me being physically active.”* (See Table 4.4).

Table 4.2. Rank order of motive items for physical activity based on intervention outcome

	Increase Group (N = 37)				Nonincrease Group (N = 43)			
	Rank	Mean	Agree %	Strongly Agree %	Rank	Mean	Agree %	Strongly Agree %
Motive Items								
The Green Prescription was enjoyable and I had fun doing my prescribed activity	1	4.1	83.7	6.1	10	3.8	87.1	3.2
I wanted to be physically fit	2	4.0	100	0	6	4.0	90.0	6.5
I liked being active	3	4.0	95.9	0	7	4.0	90.3	6.5
I liked doing something I was good at	4	4.0	98.0	0	9	3.9	95.5	3.2
I wanted to be physically active to alleviate pain	5	3.9	44.9	0	14	3.0	29.0	9.7
I wanted to be physically active to keep my joints mobile	6	3.9	89.8	2.0	3	4.1	89.6	12.9

	Increase Group (N = 37)				Nonincrease Group (N = 43)			
I wanted to be physically active to keep healthy	7	3.9	93.9	6.1	5	4.1	87.1	12.9
I liked getting out of the house	8	3.9	87.8	0	8	4.0	87.1	3.2
I wanted to be physically active for medical reasons	9	3.8	81.6	4.1	4	4.0	67.7	16.1
I wanted the challenge	10	3.8	77.6	0	12	3.6	58.1	0
My family/friends/colleagues wanted me to be physically active	11	3.4	57.1	0	11	3.6	74.2	0
The phone support I received helped to keep me motivated	12	3.3	51.0	2.0	1	5.0	74.2	3.2
I had someone to walk/exercise with	13	2.8	38.8	2.0	13	2.3	54.8	0
The Green Prescription provided me with an opportunity for social interaction or a way to meet new people	14	2.4	18.4	0	2	4.6	35.5	0

Table 4.3. Rank order of perceived outcome benefit items for physical activity based on intervention outcome

	Increase Group (N = 37)				Nonincrease Group (N = 43)			
Perceived Outcome Benefit Items								
I felt that the Green Prescription helped to improve my health	1	3.8	79.6	4.1	1	3.7	80.6	3.2
I feel better about myself	2	3.6	63.3	2.0	2	3.5	58.1	0
I feel happier	3	3.4	51.0	2.0	6	3.3	38.7	0
I have maintained my weight	4	3.4	57.1	0	4	3.4	61.3	0
I feel more in control of my life	5	3.3	63.6	2.0	9	3.2	38.7	0
I have more energy	6	3.3	51.0	0	3	3.4	51.6	0
I feel more relaxed	7	3.3	57.1	0	7	3.3	48.4	0
I have a new or renewed self confidence	8	3.2	38.8	0	5	3.3	38.7	0
I now sleep better	9	3.3	38.8	2.0	10	3.2	35.5	0
I feel fitter	10	2.8	57.1	2.0	8	3.3	51.6	0
I feel that my memory has improved	11	2.8	10.2	0	11	2.4	12.9	0
I have lost weight	12	2.8	36.7	0	12	2.4	29.0	0

Table 4.4. Rank order of barrier items for physical activity based on intervention outcome

	Increase Group (N = 37)				Nonincrease Group (N = 43)			
Barrier Items								
The weather kept me from being physically active	1	3.5	63.3	0	2	3.0	61.3	0
I found it hard to stick to a routine	2	2.9	42.9	2.0	5	2.8	41.9	3.2
I always felt too tired	3	2.9	42.9	0	6	2.6	38.7	0
I experienced pain	4	2.8	32.6	2.0	1	3.3	42.6	0
I had no one to do physical activities with	5	2.8	30.6	0	8	2.5	22.6	0
My health problems kept me from being physically active	6	2.7	32.7	2.0	3	3.0	22.6	3.2
I did not feel motivated	7	2.7	26.5	2.0	4	3.0	38.7	6.5
I had no time due to family responsibilities	8	2.5	22.4	0	9	2.4	22.6	0
I had no time due to work	9	2.4	14.3	2.0	7	2.5	22.6	0
I found my neighbourhood to be	10	2.4	14.3	0	10	2.4	16.1	0

	Increase Group (N = 37)				Nonincrease Group (N = 43)			
unsafe for walking								
I find physical activity uncomfortable	11	2.4	14.3	2.0	12	2.3	6.5	3.2
I don't like feeling out of breath	12	2.4	18.4	0	15	2.2	6.5	0
I felt too old to be physically active	13	2.3	10.2	0	14	2.2	6.5	0
I could not find the time to be physically active	14	2.2	10.2	0	20	2.0	3.2	0
Housework kept me from being physically active	15	2.2	8.2	0	21	2.0	3.2	0
Physical activity takes too much effort for me	16	2.2	8.2	0	13	2.3	9.7	0
Fear of injury kept me from being physically active	17	2.2	10.2	0	11	2.4	16.1	0
It was of no interest to me	18	2.1	2.0	0	18	2.0	0	0
Others discouraged me from being physically active	19	2.1	4.1	0	19	2.0	0	0
I felt too out of shape to start being physically active	20	2.1	2.0	0	22	2.0	0	0
I couldn't afford it	21	2.0	2.0	0	16	2.0	1.0	0
I had no facilities in my area	22	2.0	2.0	0	17	2.0	2.0	0
I felt too out of shape to continue being phys' active	23	2.0	2.0	0	23	2.0	1.0	0
I felt too overweight to be physically active	24	2.0	2.0	0	24	2.0	1.0	0
I don't like to sweat	25	2.0	2.0	0	25	2.0	2.0	0
I don't like people seeing me being physically active	26	2.0	0	0	26	2.0	0	0

Note. The higher the ranking, the greater the motive or barrier for physical activity. Mean scores ranged from zero to five. Percentages (%) correspond to participants agreeing or strongly agreeing to items they found to be motives or barriers for physical activity.

Factor Analysis

Motives for Participation in Physical Activity

Three factors were obtained for the motive items. A label was given to each factor based on the common theme that grouped the items (highly correlated questions) together. Factor one related to participants being active for *Enjoyment Reasons* (e.g., “*I liked being active*”). Factor one accounted for 17% of the total variance. Factor two was related to participants being active for *Health and Medical Reasons* (e.g., “*I wanted to be physically active to keep my joints mobile*”). Factor two

accounted for 17% of the total variance. Factor three was labeled *Engagement-Based Reasons* and consisted of items that related to how participants engaged in physical activity for the purpose of wanting to be physically active (e.g., “*I wanted to be physically fit*”). This factor accounted for 15% of the total variance. (See Table 4.5).

Perceived Outcome Benefits of Physical Activity Participation

Two factors were obtained for the perceived outcome benefits of physical activity participation items. Factor one was related to the perceived *personal benefits of physical activity participation* (e.g., “*I have a new or renewed confidence in myself*”). One item from this section was excluded as it had a factor loading that was below .3. This factor accounted for 32% of the total variance. Factor two related to the perceived *physical benefits* of physical activity participation (e.g., “*I feel fitter*”). This factor accounted for 19% of the total variance. (See Table 4.6).

Barriers to Participation in Physical Activity

Three factors were obtained for barrier items. Factor one demonstrated how *Personal Barriers* can impede physical activity engagement (e.g., “*I did not feel motivated*”). This factor accounted for 16% of the total variance. Factor two centered on the theme of *Perceptual Barriers* for physical activity engagement (e.g., “*I felt too old to be physically active*”). This factor accounted for 16% of the total variance. The final factor related to how *Time Constraints* can act as a barrier to physical activity engagement (e.g., “*I had no time due to family responsibilities*”). This factor accounted for 13% of the total variance (See Table 4.3). Eleven items (questions) from the barriers section were excluded as they had a factor loading that was below .3. In cases where items loaded onto more than one factor, a particular item (question) was placed into a particular factor (category) based on both its numerical loading and question content (See Table 4.7).

Table 4.5 Factor loadings of themes for motives for physical activity engagement

	Factor Loadings		
	1	2	3
Motive Items			
Factor 1: Enjoyment Reasons			
The phone support I received helped keep motivated	.66		
I liked being active	.58		
I liked doing something I was good at	.53		
I wanted to be physically active	.58		
Factor 2: Health and Medical Reasons			
I wanted to be physically active to alleviate pain		.67	
I wanted to be physically active to keep healthy		.63	
I wanted to be physically active for medical reasons		.58	
I wanted to be physically active to keep my joints mobile		.42	
Factor 3: Engagement-Based Reasons			
I wanted to be physically fit			.50
The Green Prescription provided me with an opportunity for social interaction or a way to meet new people			.47
I liked getting out of the house			.45
I wanted the challenge			.45
I had someone to walk/exercise with			.43
My family/friends/colleagues wanted me to be physically active			.43

Table 4.6 Factor loadings of themes for perceived outcome benefit items for physical activity engagement

	Factor Loadings		
	1	2	3
<u>Perceived Outcome Benefit Items</u>			
Factor 1: Personal Benefits			
I feel more in control of my life	.89		
I have a new or renewed self confidence	.87		
I feel better about myself	.83		
I feel happier	.75		
I feel that my memory has improved	.62		

	Factor Loadings
Factor 2: Physical Benefits	
I have more energy	.76
I feel fitter	.73
I feel more relaxed	.60
I have maintained my weight	.55
I felt that the Green Prescription helped to improve my health	.53
I have lost weight	.50

Table 4.7 factor loadings of themes for barriers for physical activity engagement

	Factor Loadings		
Barrier Items	1	2	3
Factor 1: Personal Barriers			
I did not feel motivated	.71		
I found it hard to stick to a routine	.69		
Physical activity takes too much effort for me	.66		
I experienced pain	.62		
I always felt too tired	.60		
My health problems kept me from being physically active	.47		
Factor 2: Perceptual Barriers			
Others discouraged me from being physically active		.83	
I felt too old to be physically active		.64	
It was of no interest to me		.53	
Fear of injury kept me from being physically active		.45	
I found my neighbourhood to be unsafe for walking		.36	
Factor 3: Time Constraints			
I had no time due to work			.85
I had no time due to family responsibilities			.76
Housework kept me from being physically active			.60
I could not find the time to be physically active			.52

Analyses of Variance

The following section documents the analysis of variance tests that were carried out to explore between group differences for perceived barriers and motives based on factor scores. For each analysis, factor scores acted as the dependent variable and allocation, intervention outcome, allocation-based outcome and demographic variables acted as independent variables.

Motives for Participation in Physical Activity

Intervention Allocation

Analysis of variance for motives factor 1: enjoyment reasons ($F(1,78) = 1.7, p = .18$), motives factor 2: health and medical reasons ($F(1,78) = .05, p = .82$) and motives factor 3: engagement-based reasons ($F(1,78) = 0.0, p = 1.00$) indicated that there were no significant differences for perceived motives for physical activity participation in relation to intervention allocation (See Table 4.8).

Table 4.8 Means and standard deviations for intervention allocation based on motives for participation

Factor	Time-Based	Pedometer-based	<i>p</i>-Value
Motives Factor 1: Enjoyment	3.9 ± .24	3.8 ± .36	.18
Motives Factor 2: Health and Medical	3.7 ± .41	3.7 ± .55	.82
Motives Factor 3: Engagement-Based	3.4 ± .35	3.4 ± .37	1.00

Note. Mean ± Standard Deviation

Intervention Outcome

Analysis of variance indicated that there were no significant differences for motives factor 1: enjoyment reasons ($F(1, 78) = .19, p = .66$), motives factor 2: health and medical reasons ($F(1, 78) = .30, p = .59$) or motives factor 3: engagement-based reasons ($F(1, 78) = 2.1, p = .16$) and intervention outcome (See Table 4.9).

Table 4.9 Means and standard deviations for intervention outcome based on motives for participation

Factor	Increase Group	Nonincrease Group	p-Value
Motives Factor 1: Enjoyment	3.8 ± .33	3.9 ± .29	.66
Motives Factor 2: Health and Medical	3.7 ± .45	3.7 ± .51	.59
Motives Factor 3: Engagement-Based	3.4 ± .36	3.5 ± .37	.16

Note. Mean ± Standard Deviation

Allocation-Based Outcome

There were no significant differences for motives factor 1: enjoyment reasons ($F(3, 76) = .08, p = .97$), motives factor 2: health and medical reasons ($F(3, 76) = .13, p = .95$), or motives factor 3: engagement-based reasons ($F(3, 76) = 1.3, p = .29$) in relation to allocation-based outcome and perceived motives for physical activity participation (See Table 4.10).

Table 4.10 Means and standard deviations for allocation-based outcome based on motives for participation

Factor	Time-Based Increase Group	Time-Based Nonincrease Group	Pedometer-Based Increase Group	Pedometer-Based Nonincrease Group	p-Value
Motives Factor 1: Enjoyment	3.8 ± .40	3.9 ± .24	3.8 ± .22	3.8 ± .32	.97
Motives Factor 2: Health and Medical	3.7 ± .31	3.7 ± .49	3.6 ± .62	3.7 ± .53	.95
Motives Factor 3: Engagement-Based	3.3 ± .42	3.4 ± .36	3.4 ± .25	3.5 ± .39	.29

Note. Mean ± Standard Deviation

Demographic Variables

Gender

There were no significant differences for motives factor 1: enjoyment reasons ($F(1,78) = .09, p = .77$), motives factor 2: health and medical reasons ($F(1,78) = .32, p = .57$), or motives factor 3: engagement-based reasons ($F(1,78) = .42, p = .52$) in relation to perceived motives for physical participation and gender (See Table 4.11).

Table 4.11 Means and standard deviations for gender based motives for participation

Factor	Males	Females	<i>p</i>-Value
Motives Factor 1: Enjoyment	3.8 ± .30	3.8 ± .32	.77
Motives Factor 2: Health and Medical	3.7 ± .57	3.7 ± .41	.57
Motives Factor 3: Engagement-Based	3.4 ± .38	3.4 ± .37	.52

Note. Mean ± Standard Deviation

Age

There were no significant differences for motives factor 1: enjoyment reasons ($F(1, 78) = 2.4, p = .12$), motives factor 2: health and medical reasons ($F(1, 78) = .01, p = .94$) or motives factor 3: engagement-based reasons ($F(1, 78) = .81, p = .37$) in relation to age and perceived motives for physical activity participation (See Table 4.12).

Table 4.12: Means and standard deviations for age based motives for participation

Factor	65-75 Years	76 years and older	<i>p</i>-Value
Motives Factor 1 : Enjoyment	3.8 ± .34	3.9 ± .21	.12
Motives Factor 2: Health and Medical	3.7 ± .51	3.7 ± .42	.94
Motives Factor 3: Engagement-Based	3.5 ± .38	3.4 ± .35	.37

Note. Mean ± Standard Deviation

Chronic Health Conditions

Analysis of variance indicated that there was a significant difference for motives factor 2: health and medical reasons and the existence of chronic health conditions, whereby participants with three or more chronic health conditions were motivated to engage in physical activity for health and medical reasons compared to those participants who had no chronic health conditions ($F(2, 77) = 4.3, p = .02$). There were no significant differences for motives factor 1: enjoyment reasons ($F(2, 77) = 1.5, p = .24$), or motives factor 3: engagement-based reasons ($F(2, 77) = 0.09, p = .92$) and perceived motives for physical activity in relation to the existence of chronic health conditions (See Table 4.13).

Table 4.13 Means and standard deviations for chronic health conditions based motives for participation

Factor	Zero Conditions	One to two Conditions	Three or More Conditions	<i>p</i> -Value
Motives Factor 1 : Enjoyment	3.8 ± .24	3.8 ± .32	3.9 ± .31	.24
Motives Factor 2: Health and Medical	3.3 ± .47	3.7 ± .48	3.9 ± .42	.02*
Motives Factor 3: Engagement-Based	3.4 ± .30	3.4 ± .41	3.5 ± .33	.92

Note. * $p < .05$

Mean ± Standard Deviation

Body Mass Index

There were no significant differences for motives factor 1: enjoyment reasons ($F(2, 77) = 1.5$, $p = .24$), motives factor 2: health and medical reasons ($F(2, 77) = 0.1$, $p = .99$) or motives factor 3: engagement-based reasons ($F(2, 77) = 2.7$, $p = .70$) in relation to perceived motives for physical activity participation and body mass index (See Table 4.14).

Table 4.14 Means and standard deviations for body mass index based motives for participation

Factor	Normal Weight	Overweight	Obese	<i>p</i> -Value
Motives Factor 1 : Enjoyment	4.0 ± .22	3.8 ± 1.8	3.9 ± .28	.24
Motives Factor 2: Health and Medical	3.7 ± .38	3.7 ± 4.7	3.7 ± .57	.99
Motives Factor 3: Engagement-Based	3.6 ± .37	3.4 ± .40	3.4 ± .37	.70

Note. Mean ± Standard Deviation

Perceived Outcome Benefits of Physical Activity Participation

Intervention Allocation

Analysis of variance for perceived outcome benefits factor 1: personal benefits ($F(1,78) = 0.5$, $p = .82$) and perceived outcome benefits factor 2: physical benefits ($F(1,78) = 0.5$, $p = .83$) indicated that there were no significant differences for these two factors in relation to perceived outcome benefits for physical activity participation and intervention allocation (See Table 4.15).

Table 4.15 Means and standard deviations for intervention allocation based on perceived outcome benefits for participation

Factor	Time-Based	Pedometer-Based	<i>p</i> -Value
Perceived outcome benefits Factor 1: Personal benefits	3.2 ± .61	3.2 ± .57	.82
Perceived outcome benefits Factor 2: Physical benefits	3.4 ± .49	3.4 ± .51	.83
Note. Mean ± Standard Deviation			

Intervention Outcome

There were no significant differences for perceived outcome benefits factor 1: personal benefits ($F(1, 78) = 1.4, p = .24$) or perceived outcome benefits factor 2: physical benefits ($F(1, 78) = .28, p = .60$) in relation to intervention outcome and perceived outcome benefits for physical activity (See Table 4.16).

Table 4.16 Means and standard deviations for intervention outcome based on perceived outcome benefits for participation

Factor	Increase Group	Nonincrease Group	<i>p</i> -Value
Perceived outcome benefits Factor 1: Personal benefits	3.1 ± .67	3.2 ± .49	.24
Perceived outcome benefits Factor 2: Physical benefits	3.4 ± .55	3.5 ± .51	.60
Note. Mean ± Standard Deviation			

Allocation-Based Outcome

There were no significant differences for perceived outcome benefits factor 1: personal benefits ($F(3, 76) = .82, p = .49$) or perceived outcome benefits factor 2: physical benefits ($F(3, 76) = 1.5, p = .22$) in relation to allocation-based outcome and perceived outcome benefits for physical activity (See Table 4.17).

Table 4.17 Means and standard deviations for allocation-based outcome for perceived outcome benefits for participation

Factor	Time-Based Increase Group	Time-Based Nonincrease Group	Pedometer-Based Increase Group	Pedometer-Based Nonincrease Group	<i>p</i> -Value
Perceived outcome benefits Factor 1: Personal benefits	3.0 ± .73	3.2 ± .44	3.2 ± .59	3.2 ± .53	.49
Perceived outcome benefits Factor 2: Physical benefits	3.3 ± .60	3.4 ± .45	3.6 ± .41	3.5 ± .51	.22

Note. Mean ± Standard Deviation

Demographic Variables

Gender

There were no significant differences for perceived outcome benefits factor 1: personal benefits ($F(1, 78) = 1.0, p = .76$) or perceived outcome benefits factor 2: physical benefits ($F(1, 78) = .86, p = .36$) in relation to gender differences for perceived outcome benefits for physical activity (See Table 4.18).

Table 4.18 Means and standard deviations for perceived outcome benefits for participation based on gender

Factor	Males	Females	<i>p</i> -Value
Perceived outcome benefits Factor 1: Personal benefits	3.2 ± .61	3.2 ± .57	.76
Perceived outcome benefits Factor 2: Physical benefits	3.5 ± .58	3.5 ± .46	.36

Note. Mean ± Standard Deviation

Age

There were two significant differences for perceived outcome benefits of physical activity in relation to the demographic variable of age. Participants aged 76 years and older perceived that they received more personal benefits (perceived outcome benefits factor 1) as a result of engaging in physical activity compared to participants in the 65 to 75 year age group ($F(1,78) = 6.2, p = .02$). Older aged participants (76 years and older) also perceived to have experienced physical benefits (perceived outcome benefits factor 2) as a result of being physically active compared to younger aged participants (aged 65 to 75 years) ($F(1,78) = 5.2, p = .03$) (See Table 4.19).

Table 4.19 Means and standard deviations for perceived outcome benefits for participation based on age

Factor	65-75 Years	76 years and older	<i>p</i> -Value
Perceived outcome benefits Factor 1: Personal benefits	3.1 ± .61	3.4 ± .46	.02*
Perceived outcome benefits Factor 2: Physical benefits	3.3 ± .51	3.6 ± .47	.03*

Note. * $p < .05$
Mean ± Standard Deviation

Chronic Health Conditions

Compared to participants with no chronic health conditions, participants with three or more chronic health conditions perceived that they experienced more personal benefits (perceived outcome benefits factor 1) as a result of engaging in physical activity: ($F(2, 77) = 6.9, p = <.002$). There were no significant differences for perceived outcome benefits factor 2: physical benefits ($F(2, 77) = 2.6, p = .08$) and perceived outcome benefits for physical activity participation (See Table 4.20).

Table 4.20 Means and standard deviations for perceived outcome benefits for participation based on chronic health conditions

Factor	Zero Conditions	One to two Conditions	Three or More Conditions	<i>p</i> -Value
Perceived outcome benefits Factor 1: Personal benefits	2.8 ± .60	3.1 ± .59	3.5 ± .41	.002*
Perceived outcome Factor 2: Physical benefits	3.3 ± .64	3.4 ± .48	3.6 ± 2.52	.08

Note. * $p < .05$
Mean ± Standard Deviation

Body Mass Index

There were no significant differences for perceived outcome benefits factor 1: Personal benefits ($F(2, 77) = .97, p = .38$) or perceived outcome benefits factor 2: Physical benefits ($F(2, 77) = 1.4, p = .26$) in relation to Weight status and perceived outcome benefits for physical activity (See Table 4.21).

Table 4.21 Means and standard deviations for body mass index based on perceived outcome benefits for participation

Factor	Normal Weight	Overweight	Obese	<i>p</i> -Value
Perceived outcome benefits Factor 1: Personal benefits	3.3 ± .48	3.1 ± .63	3.2 ± .56	.38
Perceived outcome benefits Factor 2: Physical benefits	3.5 ± .47	3.3 ± .55	3.5 ± .45	.26

Note. Mean ± Standard Deviation

Barriers to Participation in Physical Activity

Intervention Allocation

Analysis of variance for barriers factor 1: personal barriers ($F(1,78) = .53, p = .47$), barriers factor 2: perceptual barriers ($F(1,78) = .08, p = .77$) and barriers factor 3: time constraints ($F(1,78) = .24, p = .63$) indicated that there were no significant differences for these three factors in relation to intervention allocation and perceived barriers for physical activity (See Table 4.22).

Table 4.22 Means and standard deviations for intervention allocation based on barriers for participation

Factor	Time-Based	Pedometer-Based	<i>p</i> -Value
Barriers Factor 1: Personal barriers	2.6 ± .60	2.7 ± .63	.47
Barriers Factor 2: Perceptual barriers	2.2 ± .33	2.2 ± .29	.77
Barriers Factor 3: Time constraints	2.3 ± .54	2.3 ± .51	.63

Note. Mean ± Standard Deviation

Intervention Outcome

There were no significant differences for barriers factor 1: personal barriers ($F(1,78) = .01, p = .98$) barriers factor 2: perceptual barriers ($F(1,78) = .27, p = .60$) or barriers factor three: time constraints ($F(1,78) = 1.2, p = .27$) in relation to intervention outcome and perceived barriers for physical activity participation (See Table 4.23).

Table 4.23 Means and standard deviations for intervention outcome based on barriers for participation

Factor	Increase Group	Nonincrease Group	<i>p</i> -Value
Barriers Factor 1: personal barriers	2.7 ± .59	2.7 ± .64	.98
Barriers Factor 2: Perceptual barriers	2.1 ± .33	2.2 ± .29	.60
Barriers Factor 3: time constraints	2.2 ± 5.0	2.3 ± .52	.27

Note. Mean ± Standard Deviation

Allocation-Based Outcome

There were no significant differences for barriers factor 1: personal barriers ($F(3,76) = .23, p = .87$) factor 2: perceptual barriers ($F(3,76) = .14, p = .94$) or factor 3: time constraints ($F(3,76) = 1.08, p = .36$) in relation to perceived barriers for allocation-based outcome (See Table 4.24).

Table 4.24 Means and standard deviations for allocation-based outcome based on barriers for participation

Factor	Time-Based Increase Group	Time-Based Nonincrease Group	Pedometer-Based Increase Group	Pedometer-Based Nonincrease Group	<i>p</i> -Value
Barriers Factor 1: Personal barriers	2.7 ± .59	2.8 ± .62	2.7 ± .62	2.6 ± .65	.87
Barriers Factor 2: Perceptual barriers	2.2 ± .37	2.2 ± .28	2.1 ± .28	2.2 ± .30	.94
Barriers Factor 3: Time constraints	2.3 ± .60	2.3 ± .47	2.1 ± .26	2.3 ± .56	.36

Note. Mean ± Standard Deviation

Demographic Variables

Gender

There were no significant differences for barriers factor 1: personal barriers ($F(1, 78) = .01, p = .93$) factor 2: perceptual barriers ($F(1, 78) = 1.3, p = .26$) or factor 3: time constraints ($F(1, 78) = .03, p = .86$) in relation to gender based differences for perceived barriers for physical activity See Table 4.25).

Table 4.25 Means and standard deviations for gender based barriers for participation

Factor	Males	Females	<i>p</i>-Value
Barriers Factor 1: Personal Barriers	2.7 ± .61	2.7 ± .62	.93
Barriers Factor 2: Perceptual Barriers	2.1 ± .28	2.2 ± .32	.26
Barriers Factor 3: Time Constraints	2.3 ± .57	2.3 ± .48	.86

Note. Mean ± Standard Deviation

Age

There were no significant differences for barriers factor 1: personal barriers ($F(1, 78) = .79, p = .38$) factor 2: perceptual barriers ($F(1, 78) = .39, p = .53$) or factor 3: time constraints ($F(1, 78) = 1.3, p = .25$) in relation to age based differences for perceived barriers for physical activity (See Table 4.26).

Table 4.26 Means and standard deviations for age based barriers for participation

Factor	65-75 Years	76 years and older	<i>p</i>-Value
Barriers Factor 1: Personal Barriers	2.7 ± .60	2.8 ± .66	.38
Barriers Factor 2: Perceptual Barriers	2.1 ± .30	2.2 ± .32	.53
Barriers Factor 3: Time Constraints	2.3 ± .51	2.2 ± .50	.25

Note. Mean ± Standard Deviation

Chronic Health Conditions

There was a significant difference for barriers factor 1: Personal barriers for physical activity engagement between participants with three or more chronic health conditions and those who reported no chronic health conditions. Participants with three or more chronic health conditions perceived there to be more personal barriers for physical activity engagement: ($F(2, 77) = 3.9, p = 0.02$). There were no significant differences for barriers factor 2: Perceptual barriers ($F(2, 77) = .67, p = .52$) or barriers factor 3 Time constraints ($F(2, 77) = .09, p = .91$) and perceived barriers for physical activity (See Table 4.27).

Table 4.27 Means and standard deviations for chronic health conditions based barriers for participation

Factor	Zero Conditions	One to two Conditions	Three or More Conditions	<i>p</i> -Value
Barriers Factor 1: Personal Barriers	2.4 ± .57	2.6 ± .58	3.0 ± .63	.02*
Barriers Factor 2: Perceptual Barriers	2.1 ± .23	2.1 ± .33	2.2 ± .28	.52
Barriers Factor 3: Time Constraints	2.3 ± .49	2.3 ± .49	2.3 ± .58	.91
Note. * $p < .05$ Mean ± Standard Deviation				

Body Mass Index

There was a significant difference for barriers factor 1: Personal barriers between obese and normal weight participants. Obese participants perceived there to be more personal barriers for physical activity engagement: ($F(2, 77) = 3.4, p = .04$). There were no significant differences for barriers factor 2: Perceptual barriers ($F(2, 77) = 2.9, p = .06$) and factor 3: Time constraints ($F(2, 77) = .20, p = .82$) in relation to perceived barriers for physical activity participation (See Table 4.28).

Table 4.28 Means and standard deviations for body mass index based barriers for participation

Factor	Normal Weight	Overweight	Obese	<i>p</i> -Value
Barriers Factor 1: Personal Barriers	2.5 ± .55	2.6 ± .60	2.9 ± .61	.04*
Barriers Factor 2: Perceptual Barriers	2.1 ± .24	2.1 ± .26	2.3 ± .39	.06
Barriers Factor 3: Time Constraints	2.3 ± .62	2.3 ± .45	2.3 ± .55	.82
Note. * $p < .05$ Mean ± Standard Deviation				

Discussion

The present study had two main aims: first, to determine if perceived barriers and motives for physical activity differed based on allocation to either the pedometer-based or the time-based Green Prescription; and second, to identify

perceived barriers and motives that were associated with intervention outcome (i.e., an increase in physical activity at post-intervention) while controlling for the demographic variables of gender, age, weight status, and chronic health conditions.

Allocation

The present study reported no significant differences for barriers or motives based on allocation to either the time-based or pedometer step-count Green Prescription. The Healthy Steps study was efficacious in significantly increasing physical activity in both allocation groups (See Chapter 5). The addition of a pedometer did not provide an additional motivational effect in relation to increasing motives for physical activity.

In line with this finding, pedometer feedback did not have any additional motivational effect in increasing walking activity in a study carried out by Engel and Lindner (2006). Engel and Lindner examined the effect that a pedometer in conjunction with coaching had on time spent walking in sedentary and overweight adults with type 2 diabetes. The sample consisted of 57 adults (mean age = 62 years). Participants were randomly allocated to either the intervention condition (pedometer and coaching) or the control condition (coaching-only). Participants in both groups received the same coaching during the course of the 6-month intervention. Coaching involved helping participants with goal setting and motivational strategies to help increase walking activity. Interestingly, participants in the control condition spent significantly more time walking compared to participants in the pedometer condition. Similarly, Mutrie et al. (2004) found the addition of a pedometer in their physical activity intervention (with adults aged 40 years and older) was perceived to be an external aid or prompt for physical activity more than as a tool of motivation, as participants who wore a sealed pedometer had similar step-counts as participants who had access to their daily step-count reading. Participants in both conditions set weekly goals aimed at accumulating 30 minutes of walking on most days. It appeared that weekly goal setting helped participants to increase their walking with or without the aid of pedometer step-count information.

However, a number of studies have shown that pedometers can be a potential tool of motivation as well as a helpful aid in relation to increasing physical activity, through increasing walking activity/step-counts (Dinger et al., 2005; Pickering & Eakin, 2003; Stovitz et al., 2005; Vallance et al., 2007). Pedometer-based interventions that have been carried out with older adults have shown pedometer use to be efficacious in increasing physical activity via walking activity (Farmer et al., 2006; Rosenberg et al., 2009; Talbot et al., 2003).

Pedometer group-based interventions that have used social support mechanisms (e.g., group-based support, informational meetings, and group-based physical activities) have been effective in increasing participants' physical activity and in improving health-related gain (e.g., weight reduction, blood pressure management) (Chan et al., 2004; Croteau, 2004., Lauzon et al., 2008). It appears that pedometer interventions that allow for social contact with other pedometer wearers allow for social connections via a shared sense of purpose (i.e., increasing physical activity through step-count feedback). There is also a sharing of information relating to common barriers encountered and strategies on how to overcome such barriers to physical activity (Luzon et al).

Motives for Participation in Physical Activity

The existence of multiple chronic health conditions acted as a motive for physical activity engagement for participants who had three or more chronic health conditions compared to those who reported no chronic health conditions. This result appears consistent with the literature, whereby physical activity engagement for health and medical reasons has been reported as being a strong motive for physical activity initiation and adherence in older adults (Belza et al., 2004; Guerin et al., 2008; Kirkby et al., 1999; Newson & Kems, 2007; Schutzer & Graves, 2004).

Qualitative inquiry undertaken by Belza et al. (2004) to examine barriers and motives for physical activity participation in ethnic minority older adults living in the United States found that the existence of chronic health conditions such as arthritis, diabetes, and hypertension acted as motives for physical activity engagement, as

participation in regular physical activity was undertaken by individuals to help manage these conditions. This result is consistent with Kirkby et al. (1999) who reported that for older women the existence of chronic health conditions acted as a motive for physical activity participation, since physical activity helped to alleviate pain and keep joints mobile.

In relation to intervention outcome groups, participants in the physical activity nonincrease group were more likely to rank health and medical reasons as strong motives for carrying out their Green Prescription more so than participants in the physical activity increase group. This finding is consistent with previous work carried out by Kolt et al. (2004) who found that one of the most salient motives for older adults engaging in exercise and sport was related to the goal of keeping healthy.

The two highest ranked motives for participants who experienced an increase in physical activity during the course of their Green Prescription were related to 'the Green Prescription being enjoyable and having fun engaging in one's prescribed activity' and 'wanting to be physically fit'. These items can be viewed as intrinsic motives for physical activity participation. According to Covert and Myllykangas (2007) individuals who are intrinsically motivated are more likely to participate in a physical activity that they receive enjoyment from. In contrast, participants who did not experience an increase in physical activity ranked the following two items as being strong motives for physical activity participation; 'The phone support I received helped me to keep motivated,' and 'The Green Prescription provided me with an opportunity for social interaction or a way to meet new people'. These two items can be viewed as extrinsic motives for physical activity participation, as there is some degree of outside influence for physical activity participation (Covert & Myllykangas, 2007).

Earlier research (Kirkby et al., 1999; Kolt et al., 2004) that examined why older adults engage in exercise, sport and physical activity found that enjoyment of the activity was a strong motive for continuing with participation in that particular physical activity. It appears that a physical activity or exercise that is perceived to be

enjoyable by an individual is likely to be a strong predictor of whether an individual will continue with regular participation.

Perceived Beneficial Outcomes of Physical Activity Participation

Perceptions of beneficial outcomes as a result of physical activity participation were significantly evident for some participants. Participants who had three or more chronic health conditions and those who were aged 76 years and older perceived that they experienced more personal benefits (e.g., renewed self confidence, feeling happier) as a result of engaging in physical activity via the Green Prescription compared to participants who had no chronic health conditions and those who were in the young-old age group (65 to 75 years). Participants in the oldest age group (76 years and older) perceived that they experienced more physical benefits as a result of being active compared to participants aged 65 to 75 years of age. Perceived physical benefits related to improved health status, weight maintenance and feeling fitter. It appears that individuals in the oldest age category and those with multiple health conditions perceive they have more to gain from regular physical activity. An implication of this finding could be that individuals aged 76 and older and those who have multiple chronic health conditions could be targeted for physical activity interventions as they believe in the benefits that can be gained from engaging in such activity.

An earlier study (Resnick and Spellbring, 2000) found that older adults (mean age 81 years) who experienced both improved physical and psychological health as a result of regular physical activity engagement (via walking) were more likely to adhere to a six month walking programme regardless of age or health conditions. Specifically, these participants experienced lowered blood pressure, improved mobility, and improvements in breathing.

In terms of perceived psychological benefits, participants in the Resnick and Spellbring (2000) study experienced subjective feelings of 'happiness' and 'feeling good'. They felt they had accomplished something by engaging in the walking programme, and thus felt an 'inner satisfaction with one's self' as a result of engaging in, and completing the walking program. Qualitative inquiry undertaken by Grant

and O'Brien (2001) focused on the lived experience of one older adult (Beryl) in relation to becoming physically active in later life. At age 70, Beryl took up skydiving, which gave her a 'new lease on life.' She then joined a dancing group and the local gym. Beryl talked about experiencing a 'new freedom' when she became physically active. Similar subjective perceived benefits of participating in physical activity were also evident in the present study (i.e., 'feeling happier'; 'more in control of my life', 'having a renewed self confidence in myself', and 'feeling relaxed') as a result of engaging in the Healthy Steps Green Prescription programme for both old-old participants (>76 years) and those who had multiple chronic health conditions.

In relation to perceived psychological benefits and intervention outcome, participants across both groups felt that the Green Prescription helped to improve their health. Participants across both outcome groups also perceived to feel better about themselves as a result of being physically active and completing the Green Prescription.

In terms of perceived psychological benefits and intervention outcome, the majority of participants who experienced an increase in physical activity felt that they had more control over their lives, and felt better about themselves as a result of completing the Green Prescription. In contrast, participants in the nonincrease group were more likely to rank 'feeling more relaxed' as being a benefit of participating in the intervention.

Barriers to Participation in Physical Activity

Participants with three or more chronic health conditions perceived there to be more personal barriers for physical activity participation compared to participants who reported no chronic health conditions. Personal barriers for physical activity engagement for participants with multiple chronic health conditions were centered on health and medical factors (e.g., experiencing pain when engaging in physical activity). A recent study (Newson & Kemps, 2007) also found that health and medical factors acted as both motives and barriers for physical activity engagement in older adults. It is strongly argued (Newson & Kemps) that in some cases older adults may be motivated to engage in physical activity to help manage chronic health

conditions, though, at the same time their medical condition(s) may limit their ability to engage in regular physical activity.

Similarly, Resnick and Spellbring (2000) found that older adults who adhered to a six month walking programme had better health in general, including better functional performance than did participants who did not complete the programme. Participants who did not complete the programme were more likely to have ongoing health problems. In the present study, compared to participants who experienced an increase in physical activity those who did not experience an increase in physical activity ranked health problems (i.e., experiencing pain when engaging in physical activity) as being a barrier for physical activity participation. In line with this finding, Guerin et al. (2008) found health and medical factors to be the most salient barrier for physical activity engagement in older adults regardless of individuals being community-dwelling (and more independent) or living in assisted care facilities.

Compared to normal weight participants, obese participants perceived there to be more personal barriers for physical activity engagement. Such barriers were centered on health and medical reasons, and motivational issues. Research indicates that older adults who are obese or overweight are more likely to be inactive, as their excess weight limits their physical functioning. Daily tasks that include walking, reaching and bending become difficult to perform, and thus take more energy and effort (Bruce et al., 2008; Milner, 2005). Research shows that older adults who are obese (BMI >30) and overweight (BMI > 25-29.9) are more likely to have mobility problems and chronic health conditions (such as diabetes, osteoarthritis and cardiovascular problems) compared to their normal weight peers (BMI 18.5 to 24.9) (Milner, 2005; Shah et al., 2008; Yeom et al., 2008).

In terms of intervention outcome, “Lack of motivation” was ranked as one of the first ten perceived barriers for physical activity by participants across both outcome groups. Previous studies (Cohen-Mansfield et al., 2003; Dishman, 1994; Guerin et al., 2008) that have examined barriers and motives for physical activity in older adults have also cited poor motivation to be a barrier in initiating and/or

maintaining regular physical activity.

In the present study, participants across all groups (allocation, intervention outcome, demographical) reported fewer barriers and more motives for physical activity. Participants across both outcome groups ranked weather/seasonal climate to be one of their most salient barriers for physical activity. This finding is consistent with previous studies that have examined barriers for physical activity with older adults (Cohen-Mansfield et al., 2003; Guerin et al., 2008; Kalavar et al., 2004; Kolt et al., 2004; Lees et al., 2005; Phillips et al., 2004). It appears that seasonal weather constraints are centered on fear of injury (e.g., slipping, falling) in wet and or snowy weather (Kalavar et al., 2004). Also, extreme temperatures have been found to act as barriers for physical activity participation (Cohen-Mansfield et al., 2003; Guerin et al., 2008; Kolt et al., 2004). While the present study was not designed to ascertain how participants dealt with seasonal weather constraints, an earlier study (Belza et al., 2004) that used a focus group methodology to identify barriers and motives for physical activity participation in older adults examined this predicament. Respondents in the Belza et al. study mentioned that if they could not walk outdoors during winter, they would instead walk in shopping malls. Such an alternative walking venue can ensure that older adults can still engage in daily recreational walking.

Strengths and Limitations

A strength of the present study is that it examined perceived barriers and motives for physical activity engagement within the context of a physical activity intervention (programme) that was specifically designed for older adults. In relation to study limitations, the adequacy of the study questionnaire must be taken into consideration. The questionnaire was constructed for the purpose of the present study and therefore has not been validated in previous studies. However, the Cronbach alpha coefficients were sufficiently high to indicate that the questionnaire was a reliable measure of physical activity barriers and motives in older adults. Also, the majority of participants were from the same ethnic group and geographical location.

Conclusions

This study did not provide significant evidence for an additional motivational effect in relation to pedometer use being associated with increased motives for physical activity participation. Demographic variables relating to chronic health conditions, weight status (BMI), and age were found to significantly influence some barriers and motives for physical activity participation in this sample of previously low-active older adults. In relation to perceived barriers and motives based on intervention outcome, it appeared that participants who experienced an increase in physical activity during the course of the intervention were motivated to be physically active for enjoyment reasons, as well as to keep healthy compared to participants who did not experience an increase in physical activity. It appears that participants who experienced an increase in physical activity during the course of their Green Prescription were motivated to engage in physical activity for intrinsic reasons. In contrast, participants who did not experience an increase in physical activity appeared to engage in physical activity for extrinsic reasons.

For physical activity interventions to be successful and confer health-related benefits, the effect that demographic factors can have on physical activity engagement in older adults needs to be acknowledged. One major benefit of the Green Prescription programme is that it is an individually tailored physical activity intervention that can be accommodated for a variety of demographic variables. This in turn, can help facilitate long-term (physician approved) physical activity participation in older adults, including those who have chronic health conditions. The findings of this study have provided further evidence that health and medical factors act as both barriers and motives for physical activity participation in older adults. It is recommended that community or home-based physical activity programmes for older adults apply the findings of the current and previous studies to increase the recruitment and adherence to physical activity in older adults. Future research may also wish to further investigate the effect that pedometer use can have on physical activity engagement in a variety of sub-groups of older adults to determine its relative effectiveness in promoting long-term physical activity participation in this population. The following chapter will examine the effect that physical activity via the Green Prescription had on Healthy Steps participants'

depressive symptomatology and general mental health functioning.

Chapter 5: The Effects of Physical Activity on Depressive Symptomatology and General Mental Health Functioning in Older Adults

Preface

The previous chapter identified and examined barriers and motives that participants experienced during their participation in the Green Prescription programme. The aim of this chapter is to examine the psychological health-related benefits participants obtained from their Green Prescription. This chapter is designed to examine the effect that physical activity via the two different versions of the Green Prescription had on depressive symptomatology and general mental health functioning over a 12-month period for Healthy Steps participants. Measures were administered at the three time points. Depressive symptomatology was assessed by the Geriatric Depression Scale (GDS), general mental health functioning was assessed by the SF-36 Health Questionnaire and physical activity was measured by the Auckland Heart Study Physical Activity Questionnaire (AHS).

Introduction

The two most prevalent and disabling psychological disorders of older adulthood are depression and dementia (Almeida et al., 2006). Depression is a major public health problem, and is a debilitating disease that can affect all aspects of an individual's life, impacting on physical, emotional, cognitive, and social domains of functioning (Gallo & Coyne, 2000; Pace & Glass, 2000; Strawbridge et al., 2002). The cause of depression is unknown. Etiological theories on possible causes are centered on biological, genetic, and psychological explanations (Kaplan & Saddock, 1998; Mental Health Foundation, 2004).

Globally, depression is becoming more prevalent than heart disease. By the year 2020 depression is projected to be the second leading cause of illness and disability (World Health Organization, 2009). It is estimated that one in five women and one in ten men will experience an episode of depression during their lifetime (Jackson, Morrow, Hill, & Dishman, 2004; Mental Health Foundation, 2004). The rates of depression appear to increase in older age, with estimates suggesting that 15 to 20% of older adults experience an episode of depression (Jones, 2003; Luekenotte, 1996).

There is an association between depression in older adults and the existence of a chronic health condition and/or functional disability (Alexopoulos, 2005). Research shows that 85% of depressed older adults have a coexisting medical condition (Riley, 1994). Depression can worsen the outcome of existing chronic health conditions, especially for older adults (Alexopoulos, 2005; Boyd, 2002; Luekenotte, 1996) and appears to be a risk factor for increased mortality and morbidity in older adults (Berke et al., 2007)

Along with the existence of chronic health conditions and/or functional impairment, an insufficiently active lifestyle has also been identified as a risk factor for the onset of late-life depression (Boyd, 1992; Fukukawa et al., 2004; Lampinen et al., 2000; Luekenotte, 1996; Strawbridge et al., 2002). It is not known whether physical inactivity causes depression through an increased risk for noncommunicable diseases and conditions including functional disability, or whether depression,

independent of insufficient physical activity, limits the future physical activity levels of depressed individuals (Kritz-Silverstein et al., 2001; Jackson et al., 2004; Riley, 1994).

The physiological health-related benefits of physical activity engagement are well documented and understood (Bauman, 2003; Boreham et al., 2000; Nelson et al., 2007; Taylor et al., 2004; Warburton et al., 2006) and increasing focus has now been placed on the psychological benefits that can be conferred from physical activity. Thus, there is a focus on the role that physical activity and exercise engagement can have in the treatment and management of depression. Research in the form of cross-sectional and longitudinal population-based studies, as well as randomised controlled trials, has demonstrated that an association exists between regular physical activity engagement and/or exercise to a reduction in depressive symptomatology among adults, including older adults in both depressed and nondepressed populations (Almeida et al., 2006; Brown et al., 2005; Cassidy et al., 2004; Galper et al., 2006; Kerse et al., (in Press); Kritz-Silverstein et al., 2001; Lampinen et al., 2000).

Physical activity and exercise interventions may be more beneficial in the treatment and management of depression in older adults compared to antidepressant medication (Phillips, Kiernan, & King, 2003). Physical activity and exercise interventions are less likely to have 'side effects' and can be undertaken on a regular, long-term basis. There is also no negative stigma attached to engaging in regular physical activity (Blake et al., 2009). Antidepressant medications can have adverse side effects, and a higher risk of relapse following termination of medication. There can also be some degree of stigma attached to taking such medications (Mental Health Foundation, 2004).

Despite the health-related benefits that are conferred by regular physical activity engagement, many older adults are low-active or sedentary, engaging in less physical activity (less than 2.5 hours per week) than is required for achieving health-related gain, including mental health benefits (McMurdo, 2000; Yeom et al., 2008). Findings from two recent population-based surveys indicated that 66% of New Zealanders aged 65 years and older did not meet national physical activity guidelines

(i.e., were not engaging in 30 minutes of moderate intensity physical activity on five or more days of the week) and 24% of older adults were sedentary (Mummery et al., 2007; Sport and Recreation New Zealand, 2008a).

An important strategy developed to increase population physical activity levels in New Zealand is the Green Prescription programme. The Green Prescription is a prescription for physical activity administered by a primary care physician in the same format that drug treatment is administered. On the actual prescription the physician writes down the type, intensity and frequency of the physical activity or exercise the patient is to engage. A Green Prescription runs for a three-month period, during which time the patient receives one phone call per month from a physical activity counselor (patient support counselor) (Sport and Recreation New Zealand, 2006). Telephone counseling is based on the transtheoretical model of behaviour change (Prochaska & Marcus, 1994) and is designed to provide the patient with ongoing external support and advice.

A series of randomised controlled trials have found the Green Prescription to be an effective and safe way of increasing physical activity and in improving both physical and psychological health-status in low-active and sedentary adults, including older adults over both a short (3-months) and long-term period (12 to 24-months) (Elley et al., 2003a); Lawton et al., 2008; Pfeiffer et al., 2001; Swinburn et al., 1998). The Green Prescription has also been found to be a cost effective way of increasing physical activity and health-related gain in sedentary and low-active adults (Dalziel et al., 2006; Elley et al., 2004).

The present investigation was a substudy of the larger Healthy Steps trial. The Healthy Steps study was a randomised controlled trial investigating the use of a pedometer-based versus conventional time-based Green Prescription in increasing physical activity in low-active community-dwelling older adults. The present study was designed to examine the effect that physical activity via the two different versions of the Green Prescription had on depressive symptomatology and general mental health functioning at three time points (baseline, postintervention, and at the follow up period) while controlling for demographic variables; gender, age, number of chronic health conditions, weight status and marital status in 299 participants who took part in the larger Healthy Steps trial.

Methods

Participants

The Healthy Steps study focused on a sample of 330 community-dwelling adults aged 65 years and older. The Healthy steps participants ranged in age from 65 to 91 years of age (mean age = 74.1 years, SD = 6.1 years), with a gender distribution of 152 males and 177 female participants. To be eligible to participate in the Healthy Steps study, potential participants were aged 65 years and older, able to speak and write English, able to walk, not blind (in order to read pedometer display screen), have no health conditions that could not contraindicate physical activity engagement, not have received a Green Prescription in the past two years, and be classified as low-active (i.e., engaging in less than 150 minutes of physical activity per week). Potential participants had to be residing in the Auckland, New Zealand region over the 12-month period of the study. Two hundred and ninety nine Healthy Steps participants took part in the present study. Thirty one couples took part in the larger Healthy Steps study. To control for a cluster effect a partner from each couple was excluded from the present study (hence, data analysis for 299 of the 330 Healthy Steps participants). Participants in the present study ranged in age from 65 to 91 years of age, with an average age of 74.2 years (SD = 6.1 years). One hundred and thirty four male and 165 female participants took part in the present study.

The Healthy Steps Study

The Healthy Steps intervention was a randomised controlled trial designed to assess the effectiveness of a pedometer-based versus time-based Green Prescription in increasing physical activity in low-active, community-dwelling older adults. Along with physical activity, depressive symptomatology, health-related quality of life, blood pressure, functional assessment (gait and balance) and cost effectiveness of the intervention were also assessed. Outcome measures were administered at baseline, postintervention (end of intervention) and at follow up (12 months post baseline) (Kolt et al., 2009).

At baseline, each participant was administered a Green Prescription (a prescription for physical activity) by their primary care physician. During the three-month intervention phase of the Green Prescription, each participant received three

phone calls (one per month) from their patient support counselor. Telephone counselling was based on the transtheoretical model of behaviour change (Prochaska & Marcus, 1994). Phone calls were designed to provide ongoing, external support and advice (e.g., helping with goal setting, problem solving barriers, and monitoring patient safety). During the intervention period, the patient support counselor mailed out a series of pamphlets. Pamphlets were designed to provide information about the benefits of physical activity for health gain, and how to safely engage in physical activity.

Two different versions of the Green Prescription were compared in this study. The time-based Green Prescription consisted of a participant receiving the conventional Green Prescription, in which the participant was instructed to engage in their prescribed activity for a set period of time on most or all days of the week. The pedometer-based Green Prescription consisted of the same format as the time-based Green Prescription, though participants in this condition were encouraged to add steps throughout their day in usual activities (i.e., walking to the local shops instead of driving, taking the stairs instead of the elevator). Telephone counseling for participants in the pedometer condition focused on goal setting in relation to accumulating more steps. Participants in this condition were encouraged to keep a daily log of their step counts (Kolt et al., 2009).

Measures

Depression was assessed by the 15-item version of the Geriatric Depression Scale (GDS-15) (Yesavage et al., 1983). The Geriatric Depression Scale is a validated measure that is used to screen for depression and the severity of depressive symptomatology in those aged 65 years and older. This measure is used on a range of elderly populations, including clinically depressed and nondepressed, community-dwelling and residential-based (assisted-living) individuals; this measure is also used in clinical and research settings. The GDS-15 consists of a series of 15 questions that are designed to assess for depression along several dimensions of functioning (e.g., changes in mood, cognition and usual activities) (Brown & Schinka, 2005). Scores range from 0 to 15. A score of 0 indicates the absence of depression, a score ranging from 1 to 4 indicates normal psychological functioning, a score ranging between 5 and 8 indicates the presence of mild depression, a score between 9 and 11

indicates the presence of moderate depression, and a score ranging between 12 and 15 indicates the presence of severe depression (Yesavage et al., 1983). See Appendix J for a copy of the GDS questionnaire that was administered to participants.

General mental health functioning was assessed by the SF-36 health questionnaire. The SF-36 measures perceptions of health-related quality of life, including both physical and psychological health along eight dimensions; physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional and mental health (McHorney et al., 1993; Ware, Kosinski, & Gandek, 2000). The mental health dimension of the questionnaire comprises of a series of questions that are designed to assess role-emotional, social functioning, mental health and vitality. The mental health score can range from 0 to 100. A higher score indicates better mental health functioning. See Appendix K for a copy of the SF-36 health questionnaire that was administered to participants.

Physical activity participation was measured by the Auckland Heart Study Physical Activity Questionnaire (AHS) (Jackson, 1989). The AHS is a validated questionnaire that has been used to measure physical activity in previous Green Prescription trials and physical activity interventions that have been carried out with older adults (Elley et al., 2003a; Kolt et al., 2007). The AHS calculates energy expenditure for the categories of domestic, occupational, and leisure-time physical activity (Elley et al., 2003c). This questionnaire also measures total walking physical activity, which takes into account the total amount of walking activity that was undertaken within the categories of domestic, occupational and leisure-time physical activity. Energy expenditure is categorised as moderate or vigorous, or moderate and vigorous combined. The following categories of physical activity were used as criteria to measure physical activity changes in participants over a 12-month period; domestic moderate, occupational moderate, occupational vigorous, occupational moderate and vigorous combined, leisure moderate, leisure vigorous, leisure moderate and vigorous combined, total leisure, total walking and total moderate and vigorous physical activity.

Procedure

The Geriatric Depression Scale, the SF-36 questionnaire, and the Auckland Heart Study Physical Activity Questionnaire were administered at baseline, postintervention (at the end of the 3 month intervention period) and at follow up (12 months post baseline). These measures were administered as part of the larger Healthy Steps study by a Research Officer in the homes of all 330 participants at each of the three time points. Each participant had their own distinct identification number, and completed questionnaires were coded with the individual participant's identification number. Data was then entered into a database that was specifically created for the larger Healthy Steps study. Ethical approval was obtained by the Health and Disability Ethics Committee, Northern Y Regional Ethics Committee (Reference Number NTY/05/11/086).

Statistical Analysis

Data were analysed with SPSS version 16.0 (SPSS, Chicago, Illinois) with an alpha level set at 0.05 (95% confidence level). A one-way repeated measures analysis of variance (ANOVA) was carried out to examine whether any significant changes in GDS, SF-36 and physical activity scores over the three time points (baseline, post intervention and at the follow up period) were observed for participants in both the time-based and pedometer-based Green Prescription conditions. In each ANOVA, GDS scores, SF-36 scores, and physical activity scores respectively were treated as continuous dependent variables and allocation was treated as a categorical independent variable, demographic factors were treated as covariates. If a significant finding was obtained a Bonferroni post hoc test was carried out to establish where the significant differences lay (Pallant, 2007).

For the purpose of the present study, participants were placed into one of two age categories: (1) 65 to 75 years of age and (2) 76 years and older. Chronic health conditions were divided into three categories: (1) zero chronic health conditions, (2) 1 to 2 chronic health conditions, and (3) 3 or more chronic health conditions. Weight status was based on BMI calculations: (1) normal weight, (2) overweight, or (3) obese. Participants were placed into one of two categories for marital status: (1) spouse and (2) no spouse (See Table 5.1 for participant demographic information).

Table 5.1: Participant demographic information

	Time-Based N	(%)	Pedometer-Based N	(%)
<u>Gender</u>				
Males	64	(43)	70	(54)
Females	84	(57)	81	(46)
<u>Age (years)</u>				
65 to 75 years	86	(58)	89	(59)
76 and older	62	(42)	61	(41)
<u>Chronic Health Conditions</u>				
Zero Conditions	30	(25)	35	(27)
1 to 2 Conditions	67	(55)	64	(49)
3 or more Conditions	24	(20)	33	(25)
<u>Body Mass Index</u>				
Normal Weight	44	(31)	28	(20)
Overweight	57	(41)	73	(52)
Obese	39	(28)	39	(20)
<u>Marital Status</u>				
Spouse	80	(54)	92	(61)
No Spouse	68	(46)	59	(39)

Note. Participant demographic information is in counts (N) and percentage (%).

Results

The following section documents the repeated measures one-way analysis of variance tests that were carried out to explore between group differences for the effect that physical activity via the two different versions of the Green Prescription had on depressive symptomatology and general mental health functioning at the three time points (baseline, postintervention, and at the follow up period) while controlling for the demographic variables of gender, age, number of chronic health conditions, weight status and marital status. For each analysis, GDS scores, SF-36 scores, and physical activity scores respectively were treated as the dependent variable, and intervention allocation was treated as the independent variable, and demographic factors were treated as covariates.

Depressive Symptomatology

Repeated measures analysis of variance indicated that there was a significant within groups effect, GDS scores significantly decreased over time for participants independent of intervention allocation (Wilks' Lambda = .91, $F(2, 219) = 10.4$, $p < .0005$). However, there was no significant between groups effect, GDS scores did not significantly change over time as a result of intervention allocation (Wilks' Lambda = .98, $F(2, 219) = 1.8$, $p = .17$). There were no significant changes in GDS scores over time in relation to the demographic factors of gender (Wilks' Lambda = .99, $F(2, 197) = .21$, $P = .81$), age (Wilks' Lambda = .98, $F(2, 197) = 1.7$, $p = .18$), number of chronic health conditions (Wilks' Lambda = .99, $F(2, 197) = .21$, $p = .47$), weight status (Wilks' Lambda = .99, $F(2, 197) = .54$, $p = .59$), and marital status (Wilks' Lambda = .99, $F(2, 197) = .20$, $p = .82$) (See Table 5.2 and Figure 5.1).

Table 5.2 Means and standard deviations for Geriatric Depression Scale (GDS) scores over time

	Time-Based	Pedometer-Based
GDS Baseline	2.0 ± 1.8	1.8 ± 1.8
GDS Post-Intervention	1.6 ± 1.7	1.8 ± 1.8
GDS Follow Up	1.3 ± 1.5	1.4 ± 1.6

Note. Mean ± Standard Deviation

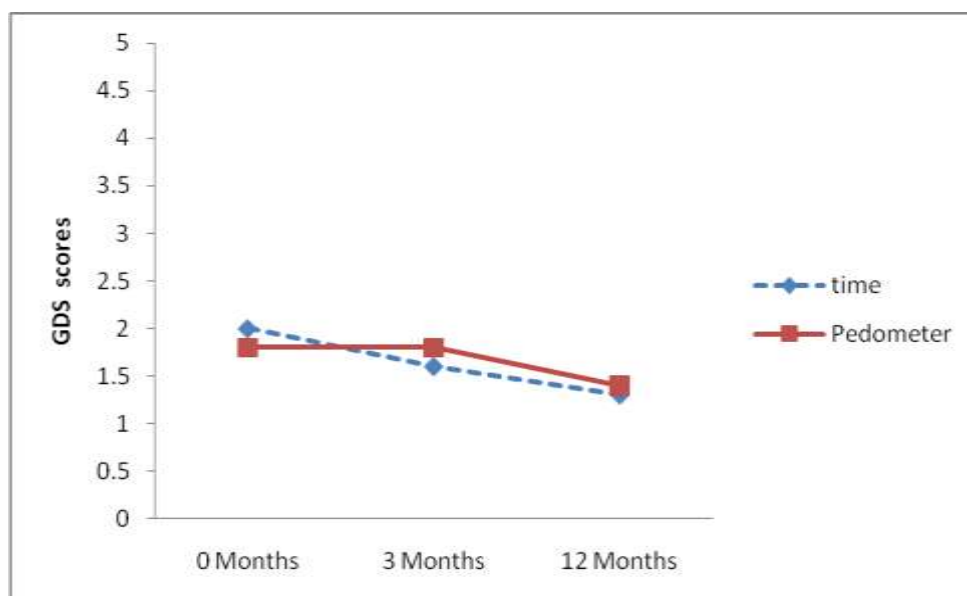


Figure 5.1. Changes in GDS scores over time.

General Mental Health Functioning

Repeated measures analysis of variance indicated that there was a significant within groups effect, SF-36 scores significantly increased over time for participants independent of intervention allocation (Wilks' Lambda = .94, $F(2, 217) = .94$, $p < .001$). However, there was no significant between groups effect, and SF-36 scores did not significantly change over time as a result of intervention allocation (Wilks' Lambda = .99, $F(2, 217) = .11$, $p = .90$). There were no significant changes in SF-36 scores over time in relation to the demographic factors of gender (Wilks' Lambda = .98, $F(2, 195) = 1.6$, $p = .21$), age (Wilks' Lambda = .99, $F(2, 195) = .96$, $p = .39$), number of chronic health conditions (Wilks' Lambda = .99, $F(2, 195) = .21$, $p = .81$), weight status (Wilks' Lambda = .99, $F(2, 195) = .83$, $p = .44$), and marital status (Wilks' Lambda = .99, $F(2, 195) = .20$, $p = .82$) (See Table 5.3 and Figure 5.2).

Table 5.3 Means and standard deviations for SF-36 Mental Health functioning scores over time

	Time-Based	Pedometer-Based
SF-36 Baseline	84.1 ± 12.8	84.9 ± 13.6
SF-36 Post-Intervention	85.8 ± 11.9	86.8 ± 12.1
SF-36 Follow Up	87.5 ± 9.3	87.7 ± 11.3

Note. Mean ± Standard Deviation

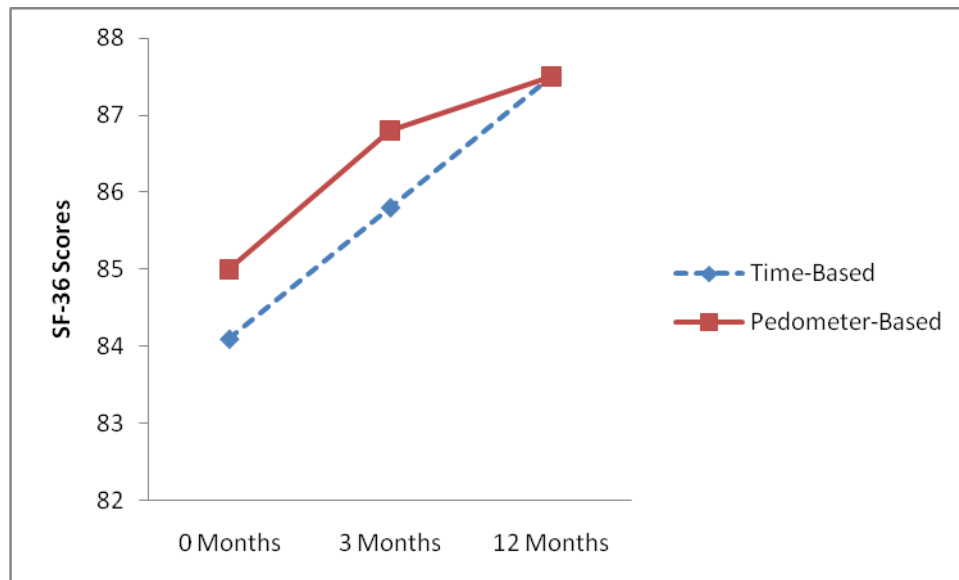


Figure 5.2. Changes in SF-36 scores over time.

Physical Activity Categories:

Domestic Moderate Physical Activity

There was no significant within groups effect for the category of domestic moderate physical activity (Wilks' Lambda = .98, $F(2, 226) = 2.6$, $p = .06$), nor was there a significant between groups effect for this category of physical activity (Wilks' Lambda = .99, $F(2, 226) = 1.4$, $p = .25$). Domestic moderate physical activity did not change significantly over time as a result of demographic factors relating to gender (Wilks' Lambda = .98, $F(2, 20) = 1.78$, $p = .17$), age (Wilks' Lambda = .99, $F(2, 204) = .38$, $p = .68$), number of chronic health conditions (Wilks' Lambda = .99, $F(2, 204) = .34$, $p = .71$), weight status (Wilks' Lambda = .97, $F(2, 204) = 2.9$, $p = .06$), and marital status (Wilks' Lambda = .97, $F(2, 204) = .41$, $p = .66$) (See Table 5.4).

Table 5.4 Means and standard deviations for domestic moderate physical activity (PA) over time

	Time-Based	Pedometer-Based
Domestic Moderate PA Baseline	366.9 ± 536.9	319.1 ± 368.2
Domestic Moderate PA Post-Intervention	349.24 ± 433.36	431.03 ± 630.94
Domestic Moderate PA Follow Up	296.9 ± 400.4	325.1 ± 367.4

Note. Mean ± Standard Deviation. Units of measurement are in minutes of physical activity per week

Leisure Moderate Physical Activity

Repeated measures analysis of variance indicated that there was a significant within groups effect, leisure moderate physical activity scores significantly increased over time for participants independent of intervention allocation (Wilks' Lambda = .86, $F(2, 225) = 19.1$, $p < .0005$). However, there was no significant between groups effect, leisure moderate physical activity scores did not significantly change over time as a result of intervention allocation (Wilks' Lambda = .99, $F(2, 225) = .79$, $p = .45$). There were no significant changes in leisure moderate physical activity scores over time in relation to the demographic factors of gender (Wilks' Lambda = .99, $F(2, 203) = 1.4$, $p = .26$), age (Wilks' Lambda = .99, $F(2, 203) = 1.6$, $p = .21$), number of chronic health conditions (Wilks' Lambda = .99, $F(2, 203) = .87$, $p = .42$), weight status (Wilks' Lambda = .98, $F(2, 203) = 2.3$, $p = .11$), and marital status (Wilks' Lambda = .99, $F(2, 203) = .35$, $p = .71$) (See Table 5.5 and Figure 5.3 e).

Table 5.5 Means and standard deviations for leisure moderate physical activity (PA) over time

	Time-Based	Pedometer-Based
Leisure Moderate PA Baseline	66.8 ± 102.3	76.5 ± 127.3
Leisure Moderate PA Post-Intervention	111.5 ± 126.5	144.8 ± 188.7
Leisure Moderate PA Follow Up	101.4 ± 147.4	125.4 ± 170.3

Note. Mean ± Standard Deviation. Units of measurement are in minutes of physical activity per week

Leisure Vigorous Physical Activity

There was no significant within groups effect for the category of vigorous leisure physical activity (Wilks' Lambda = .98, $F(2, 221) = 2.6$, $p = .08$), nor was there a significant between groups effect for this category of physical activity (Wilks' Lambda=.99, $F(2,221) = 1.3$, $p = .27$). Vigorous leisure physical activity did not change significantly over time as a result of demographic factors relating to gender (Wilks' Lambda=.96, $F(2, 199) = 3.8$, $p = .06$), age (Wilks' Lambda = .99, $F(2, 199) = 1.30$, $p = .27$), number of chronic health conditions (Wilks' Lambda = .99, $F(2, 199) = .65$, $p = .52$), weight status (Wilks' Lambda = .99, $F(2, 199) = .05$, $p = .95$), and marital status (Wilks' Lambda = .97, $F(2, 199) = .26$, $p = .07$) (See Table 5.6).

Table 5.6 Means and standard deviations for leisure vigorous physical activity (PA) over time

	Time-Based	Pedometer-Based
Leisure Vigorous PA Baseline	6.6 ± 23.8	10.1 ± 44.0
Leisure Vigorous PA Post-Intervention	8.0 ± 29.2	22.4 ± 56.6
Leisure Vigorous PA Follow Up	15.7 ± 49.9	49.9 ± 268.3

Note. Mean ± Standard Deviation. Units of measurement are in minutes of physical activity per week

Leisure Moderate and Vigorous Physical Activity

Repeated measures analysis of variance indicated that there was a significant within groups effect, with leisure moderate and vigorous physical activity scores significantly increased over time for participants independent of intervention allocation (Wilks' Lambda = .85, $F(2, 224) = 20.1$, $p < .0005$). However, there was no significant between groups effect for this category of physical activity (Wilks' Lambda = .98, $F(2, 224) = 1.8$, $p = .17$). Analysis of variance indicated that there

was a significant difference for this category of physical activity in relation to the demographic variable of gender, whereby male participants obtained significantly higher mean scores for this category of physical activity at all three time points compared to female participants (Wilks' Lambda = .95, $F(2, 201) = 5.1$, $p = .007$). There were no significant changes in leisure moderate and vigorous physical activity scores over time in relation to the demographic factors of age (Wilks' Lambda = .96, $F(2, 201) = 4.3$, $p = .06$), number of chronic health conditions (Wilks' Lambda = .99, $F(2, 201) = .62$, $p = .54$), weight status (Wilks' Lambda = .98, $F(2, 201) = 1.8$, $p = .07$, and marital status (Wilks' Lambda = .97, $F(2, 201) = 3.1$, $p = .09$) (See Table 5.7 and Figure 5.3 b).

Table 5.7 Means and standard deviations for leisure moderate and vigorous physical activity (PA) over time

	Time-Based	Pedometer-Based
Leisure Moderate and Vigorous PA Baseline	76.1 ± 102.5	84.9 ± 131.6
Leisure Moderate and Vigorous PA Post-Intervention	118.7 ± 132.3	162.8 ± 192.4
Leisure Moderate and Vigorous PA Follow Up	113.4 ± 148.9	162.2 ± 301.9

Note. Mean ± Standard Deviation. Units of measurement are in minutes of physical activity per week

Leisure Walking Physical Activity

Repeated measures analysis of variance indicated that there was a significant within groups effect with leisure walking physical activity scores significantly increasing over time for participants independent of intervention allocation (Wilks' Lambda = .92, $F(2, 221) = 9.9$, $p < .0005$). However, there was no significant between groups effect for leisure walking physical activity scores (Wilks' Lambda = .99, $F(2, 221) = 1.6$, $p = .20$). There were no significant changes in this category of physical activity scores over time in relation to the demographic factors of gender (Wilks' Lambda = .99, $F(2, 197) = .26$, $p = .77$), age (Wilks' Lambda = .99, $F(2, 197) = 1.1$, $p = .34$), number of chronic health conditions (Wilks' Lambda = .98, $F(2, 197) = 2.3$, $p = .11$), weight status (Wilks' Lambda = .98, $F(2, 197) = 1.7$, $p = .19$) and marital status (Wilks' Lambda = .99, $F(2, 197) = 1.1$, $p = .34$) (See Table 5.8 and Figure 5.3 a).

Table 5.8 Means and standard deviations for leisure walking physical activity (PA) over time

	Time-Based	Pedometer-Based
Leisure Walking PA Baseline	61.5 ± 132.7	48.1 ± 72.8
Leisure Walking PA Post-Intervention	85.1 ± 92.4	105.7 ± 158.7
Leisure Walking PA Follow Up	91.2 ± 176.9	90.2 ± 127.4

Note. Mean ± Standard Deviation. Units of measurement are minutes of physical activity per week

Total Leisure Physical Activity

Repeated measures analysis of variance indicated that there was a significant within groups effect, total leisure physical activity scores significantly increased over time for participants independent of intervention allocation (Wilks' Lambda = .86 $F(2, 225) = 17.8$, $P < .0005$). However, there was no significant between groups effect, total leisure physical activity scores did not significantly change over time as a result of intervention allocation (Wilks' Lambda = .99, $F(2, 225) = 1.2$, $p = .32$). There were no significant changes in total leisure physical activity scores over time in relation to the demographic factors of gender (Wilks' Lambda = .98, $F(2, 203) = 1.6$, $p = .20$), age (Wilks' Lambda = .98, $F(2, 203) = 2.2$, $p = .14$), number of chronic health conditions (Wilks' Lambda = .99, $F(2, 203) = .23$, $p = .79$), weight status (Wilks' Lambda = .99, $F(2, 203) = .518$, $p = .597$, and marital status (Wilks' Lambda = .98, $F(2, 203) = 1.9$, $p = .15$) (See Table 5.9 and Figure 5.3 d).

Table 5.9 Means and standard deviations for total leisure physical activity (PA) over time

	Time-Based	Pedometer-Based
Total Leisure PA Baseline	101.6 ± 151.9	107.4 ± 149.4
Total Leisure PA Post-Intervention	152.8 ± 150.4	193.1 ± 202.1
Total Leisure PA Follow Up	147.5 ± 196.4	188.4 ± 312.3

Note. Mean ± Standard Deviation. Units of measurement are in minutes of physical activity per week

Occupational Moderate Physical Activity

There was no significant within groups effect for the category of occupational moderate physical activity (Wilks' Lambda = .99, $F(2, 295) = 1.3$, $p = .27$), nor was there a significant between groups effect for this category of physical activity (Wilks' Lambda = .99, $F(2, 295) = 1.7$, $p = .19$). Occupational moderate physical activity did not change significantly over time as a result of demographic factors relating to gender (Wilks' Lambda = .99, $F(2, 233) = .33$, $p = .72$), age (Wilks' Lambda = .99, $F(2, 233) = .94$, $p = .39$), number of chronic health conditions (Wilks' Lambda =

. 97, $F(2, 233) = .43$, $p = .06$), weight status (Wilks' Lambda = .99, $F(2, 233) = 1.2$, $p = .31$), and marital status (Wilks' Lambda = .100, $F(2, 233) = .06$, $p = .95$) (See Table 5.10).

Table 5.10 Means and standard deviations for occupational moderate physical activity (PA) over time

	Time-Based	Pedometer-Based
Occupational Moderate PA Baseline	20.9 ± 133.9	15.1 ± 87.9
Occupational Moderate PA Post-Intervention	27.9 ± 193.0	33.9 ± 133.3
Occupational Moderate PA Follow Up	8.6 ± 48.5	39.3 ± 199.1

Note. Mean ± Standard Deviation. Units of measurement are in minutes of physical activity per week

Occupational Vigorous Physical Activity

Repeated measures analysis of variance indicated that there was a significant within groups effect, occupational vigorous physical activity scores significantly increased over time for participants independent of intervention allocation (Wilks' Lambda = $F(2, 296) = 4.1$, $p = .02$). However, there was no significant between groups effect, occupational vigorous physical activity scores did not significantly change over time as a result of intervention allocation (Wilks' Lambda = .99, $F(2, 296) = 1.2$, $p = .29$). There were no significant changes in this category of physical activity in relation to the demographic factors of gender (Wilks' Lambda = .98, $F(2, 233) = 2.5$, $p = .08$), age (Wilks' Lambda = .98, $F(2, 233) = 2.6$, $p = .08$), number of chronic health conditions (Wilks' Lambda = .99, $F(2, 233) = .76$, $p = .47$), weight status (Wilks' Lambda = .98, $F(2, 233) = 2.8$, $p = .07$), and marital status (Wilks' Lambda = .99, $F(2, 233) = .88$, $p = .42$) (See table 5.11).

Table 5.11 Means and standard deviations for occupational vigorous physical activity (PA) over time

	Time-Based	Pedometer-Based
Occupational Vigorous PA Baseline	.19 ± 2.1	.00 ± .00
Occupational Vigorous PA Post-Intervention	2.3 ± 14.5	.30 ± 2.6
Occupational Vigorous PA Follow Up	2.6 ± 20.6	3.5 ± 27.6

Note. Mean ± Standard Deviation. Units of measurement are in minutes of physical activity per week

Occupational Moderate and Vigorous Physical Activity

There was no significant within groups effect for the category of occupational moderate and vigorous physical activity (Wilks' Lambda = .99, $F(2, 295) = 1.6$, $p = .19$), nor was there a significant between groups effect for this category of physical activity (Wilks' Lambda = .99, $F(2, 295) = 1.6$, $p = .21$). Occupational moderate and vigorous physical activity did not change significantly over time as a result of demographic factors relating to gender (Wilks' Lambda = .99, $F(2, 232) = .14$, $p = .87$), age (Wilks' Lambda = .99, $F(2, 232) = .64$, $p = .53$), number of chronic health conditions (Wilks' Lambda = .96, $F(2, 232) = 5.1$, $p = .07$), weight status (Wilks' Lambda = .99, $F(2, 232) = .81$, $p = .45$), and marital status (Wilks' Lambda = .99, $F(2, 232) = .81$, $p = .77$) (See Table 5.12).

Table 5.12 Means and standard deviations for occupational moderate and vigorous physical activity (PA) over time

	Time-Based	Pedometer-Based
Occupational Moderate and Vigorous PA Baseline	21.1 ± 133.8	15.06 ± 87.87
Occupational Moderate and Vigorous PA Post-Intervention	34.7 ± 201.8	30.1 ± 121.0
Occupational Moderate and Vigorous PA Follow Up	10.3 ± 47.3	41.1 ± 202.1

Note. Mean ± Standard Deviation. Units of measurement are in minutes of physical activity per week

Total Walking Physical Activity

Repeated measures analysis of variance indicated that there was a significant within groups effect, total walking physical activity scores significantly increased over time for participants independent of intervention allocation (Wilks' Lambda = .87 $F(2, 224) = 17.3$, $p < .0005$). However, there was no significant between groups effect for this category of physical activity (Wilks' Lambda = .99, $F(2, 224) = .54$, $p = .59$). There were no significant changes in total walking physical activity scores over time in relation to the demographic factors of gender (Wilks' Lambda = .99, $F(2, 202) = 1.0$, $p = .36$), age (Wilks' Lambda = .98, $F(2, 202) = 1.7$, $p = .18$), number of chronic health conditions (Wilks' Lambda = .98, $F(2, 202) = 1.9$, $p = .16$), weight status (Wilks' Lambda = .99, $F(2, 202) = 1.4$, $p = .25$) and marital status (Wilks' Lambda = .99, $F(2, 202) = .99$, $p = .37$) (See Table 5.13 and Figure 5.3 c).

Table 5.13 Means and standard deviations for total walking physical activity (PA) over time

	Time-Based	Pedometer-Based
Total Walking PA Baseline	74.3 ± 137.7	63.3 ± 90.5
Total Walking PA Post-Intervention	107.8 ± 105.9	118.7 ± 172.0
Total Walking PA Follow Up	143.5 ± 190.7	149.1 ± 177.8

Note. Mean ± Standard Deviation. Units of measurement are in minutes of physical activity per week

Total Moderate and Vigorous Physical Activity

Repeated measures analysis of variance indicated that there was a significant within groups effect, total moderate and vigorous physical activity scores significantly increased over time for participants independent of intervention allocation (Wilks' Lambda = .96, $F(2, 227) = 4.5$, $p = .01$). However, there were no significant between groups effect for this category of physical activity (Wilks' Lambda = .98, $F(2, 227) = 2.7$, $p = .07$). Analysis of variance indicated that there was a significant difference for this category of physical activity in relation to the demographic variable of age, whereby participants in the youngest age category (65 to 75 years of age) obtained significantly higher mean scores for this category of physical activity at all three time points compared to participants in the oldest age category (76 years and older) (Wilks' Lambda = .97, $F(2, 226) = 3.9$, $p = .02$). There were no significant changes in total moderate and vigorous physical activity scores over time in relation to the demographic factors of gender (Wilks' Lambda = .96, $F(2, 226) = 5.2$, $p = .06$), number of chronic health conditions (Wilks' Lambda = .99, $F(2, 226) = 1.7$, $p = .19$), weight status (Wilks' Lambda = .97, $F(2, 226) = 3.1$, $p = .07$ and marital status (Wilks' Lambda = .99, $F(2, 226) = .69$, $p = .51$) (See Table 5.14 and Figure 5.3 f).

Table 5.14 Means and standard deviations for total moderate and vigorous physical activity (PA) over time

	Time-Based	Pedometer-Based
Total Moderate and Vigorous PA Baseline	454.2 ± 458.5	432.4 ± 407.9
Total Moderate and Vigorous PA Post-Intervention	482.5 ± 422.8	646.7 ± 701.8
Total Moderate and Vigorous PA Follow Up	471.4 ± 461.9	595.6 ± 547.4

Note. Mean ± Standard Deviation. Units of measurement are in minutes of physical activity per week

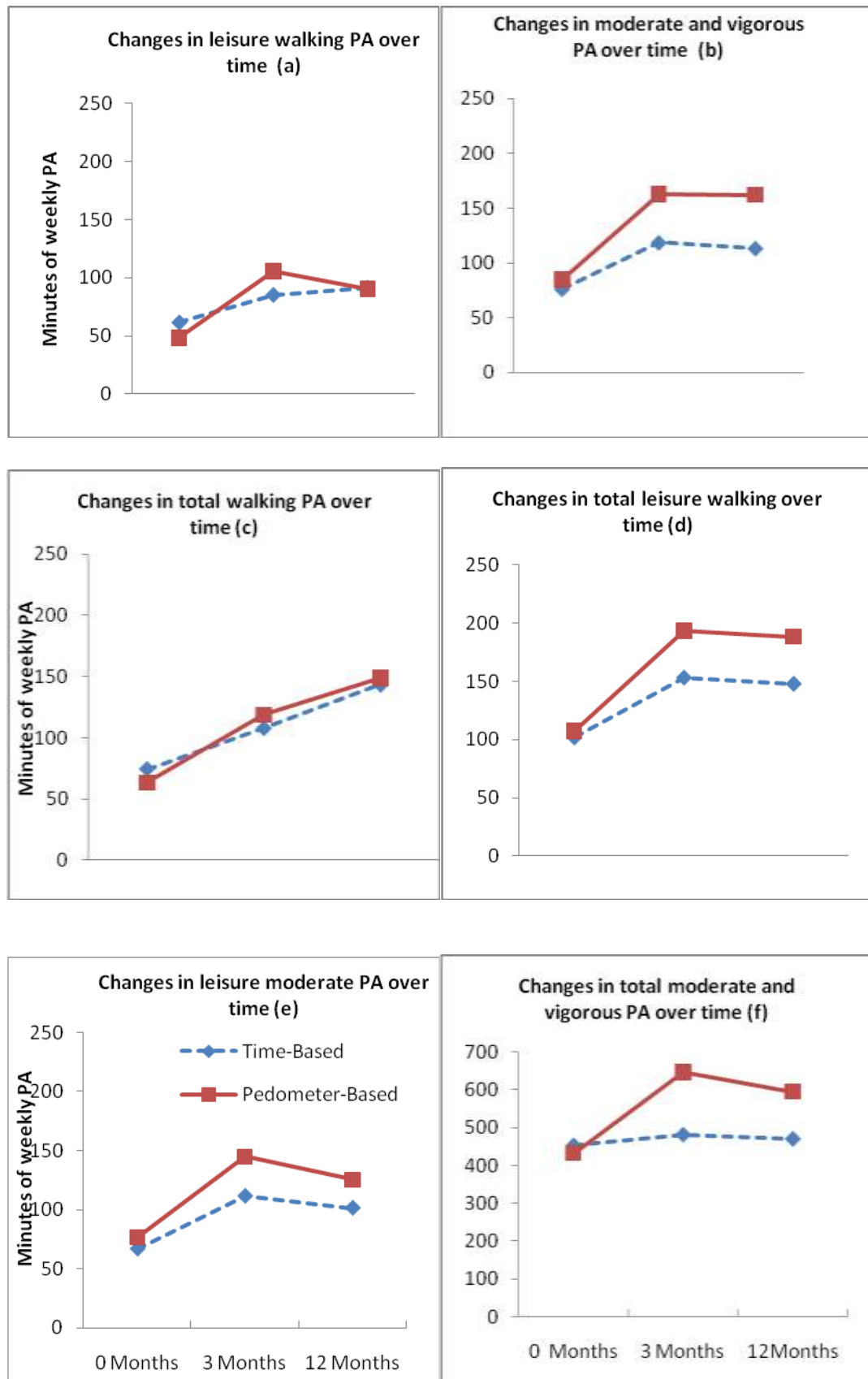


Figure 5.3 a, b, c, d, e and f reports changes in different types and intensities of physical activity (PA) over a 12-month period

Discussion

The present study examined the effects that physical activity, via the two different versions of the Green Prescription, had on depressive symptomatology and general mental health functioning over a 12-month period in a sample of 299 low-active community-dwelling older adults. Both versions of the Green Prescription were effective in significantly increasing most categories of physical activity during the course of the intervention (baseline to 3-months) and in maintaining this increase between postintervention and the follow up period (months 4 to 12). This increase in physical activity was associated with a significant decrease in depressive symptomatology as measured by the Geriatric Depression Scale, and a significant increase in mental health functioning as measured by the SF-36 health questionnaire. Demographic factors did not significantly affect the changes that were observed in depressive symptomatology or general mental health functioning found as a result of participating in the two forms of the Green Prescription in the present study.

Previous Green Prescription studies have demonstrated that the conventional time-based Green Prescription is effective in significantly increasing and maintaining physical activity in low-active individuals, including low-active older adults over both short (6 weeks) and long term periods (12-months and 24-months) (Elley et al., 2003a; Kerse et al., 2005; Lawton et al., 2008; Swinburn et al., 1998). At the same time, these studies have also found participants' perceptions of their health-related quality of life, pertaining to their physical and psychological functioning (as measured by the SF-36 health questionnaire) to significantly improve.

The first major randomised controlled trial designed to examine the long-term effectiveness of the Green Prescription programme was carried out by Elley et al. (2003a). Eight hundred and seventy eight low-active adults aged 40 to 79 years of age took part in this trial. Intervention participants received a Green Prescription and control participants received usual verbal advice for physical activity. Compared to control participants, the physical activity levels of participants in the intervention group increased significantly over a 12-month period. There was a significant increase in intervention participants' mean total energy expenditure and leisure time physical activity. Four dimensions of the SF-36 health questionnaire ('general

health,' 'role physical,' 'vitality,', and 'bodily pain') improved significantly more for participants in the intervention group compared to those in the control group. Kerse et al. (2005) undertook a sub-group analysis of data for the 270 participants aged 65 years and older who took part in the larger Elley et al. (2003a) study. At the 12-month follow up period, intervention participants' leisure-time physical activity had significantly increased compared to age-matched control participants. There was also a significant increase in the general health and vitality dimensions of the SF-36 health questionnaire for intervention participants compared to control participants.

A recent Green Prescription trial (Lawton et al., 2008) also reported a significant increase in intervention participants' physical activity and SF-36 scores over a 2-year period. One thousand and eighty nine low-active female participants aged between 40 and 74 years of age took part in this 2-year randomised controlled trial. At both 12 and 24-months, significantly more intervention participants (those who received a Green Prescription) were achieving the recommended 150 minutes of moderate-intensity physical activity compared to control participants. Compared to control participants, intervention participants experienced a significant increase in both the SF-36 physical and mental health functioning scores at 12-months. This increase was still evident at 24-months, though, it was no longer significant.

In the present study, most categories of physical activity significantly increased for participants regardless of intervention allocation. A possible reason why there were no significant differences in physical scores between the two intervention groups is that both groups of Healthy Steps participants received a Green Prescription, whereas earlier Green Prescription studies had a true control group. Thus, in line with earlier findings (Elley, et al., 2003a; Kerse et al., 2005; Lawton et al., 2008; Swinburn et al., 1998) we would expect to see an increase in participants' physical activity regardless of intervention allocation, as there evidence for the efficacy of the conventional time-based Green Prescription in significantly increasing physical activity in previously low-active individuals. The addition of a pedometer-based Green Prescription may not have had any additional motivational effect in increasing walking activity for participants in the pedometer-based condition.

As in the case of the present study, earlier Green Prescription studies also found an association between an increase in participants' physical activity and an increase in their perceptions of their health-related quality of life (Elley et al., 2003a; Kerse et al., 2005; Lawton et al., 2008). It has been argued (Kerse et al., 2005) that perceived quality of life and perceived health status (Kerse et al., 1999) are related to functional ability in older adults. Coupled with this, there is research-based evidence for the effectiveness of regular moderate-intensity physical activity in helping maintain or improve mobility, balance, and flexibility in older adults (Cambell et al., 1999; DiBrezzo et al., 2005; Norton et al., 2001), as well as reducing the risk for, or helping in the management of conditions such as type 2 diabetes, hypertension, weight problems and cardiovascular conditions (Bauman & Owen, 1999; Chodzko-Zajko et al., 2009; DiPerto, 2001; Warburton et al., 2006). Thus, older adults who participate in the Green Prescription programme are likely to experience both physical and psychological health-related benefits.

A number of studies have found an association between physical activity or exercise engagement and a reduction in depressive symptomatology and an increase in perceived psychological health status in both depressed and non depressed adults, including older adults (Blumenthal et al., 1999; Brown et al., 2005; Mather et al., 2002; Lampinen et al., 2000; McNeil et al., 1991; Mossey et al., 2000; Motl et al., 2005; Mummery, Schofield, & Caperchione, 2004; Penninx et al., 2002; Singh et al., 2000). A combination of biological/physiological and cognitive factors are hypothesised to help explain how physical activity and exercise engagement affect general psychological functioning and depressive symptomatology in individuals (Camacho et al., 1991). In relation to biological/physiological factors, mood enhancing neurotransmitters are released after an individual has engaged in certain types of physical activity (e.g., aerobic activity) (Kaplan & Sadock, 1998; Mental Health Foundation, 2004). In terms of cognitive factors, there is evidence that engaging in physical activity or exercise helps an individual feel they have mastered and accomplished something. Physical activity engagement can also help buffer stress; it can also help build self-esteem, and social networks (Mental Health Foundation, 2004; Sjosten & Kivela, 2006).

In the present study, there was an association between a significant increase in most categories of physical activity and a significant decrease in depressive symptomatology over a 12-month period for both groups of participants independent of intervention allocation. This finding is consistent with earlier longitudinal studies that examined the effect that dose-response physical had on depressive symptomatology (Brown et al., 2005; Camacho et al., 1991; Lampinen et al., 2000).

Brown et al. (2005) found an association between dose-response physical activity and a decrease in depressive symptoms independent of physical and psychological health in a population-based cohort of 10,400 women aged between 18 and 75 years of age. Participants completed three postal surveys over a 6-year period. These surveys measured physical activity (i.e., type, frequency and duration) and assessed for depression and psychological functioning at each of the three time points.

Lampinen et al. (2000) found an association between regular physical activity and a reduction in depressive symptoms, as well as a decrease in physical activity and an increase in depressive symptoms in a sample of 663 adults aged 65 years and older. This longitudinal study spanned an 8-year period. Physical activity levels and depressive symptomatology were assessed at baseline and again at the 8-year follow up period.

Camacho et al. (1991) examined the relationship between level of physical activity and subsequent depression at three time points in a longitudinal study spanning an 18-year period. Physical activity and depression were assessed at baseline, at 9 years, and at 18 years in 1,799 nondepressed respondents aged 20 years and older. Respondents who reported low-levels of physical activity at baseline were at greater risk for depression at the first follow-up period (at 9-years) compared to respondents who were sufficiently active at baseline. Respondents who had been inactive at baseline, though, had increased their physical activity by the first follow-up period were found to be at no greater risk for depression at the second follow-up period (at 18-years). Respondents who had been active at baseline, though, had decreased their activity levels by the first follow-up period were more likely to be

depressed at the second follow-up period.

While there is strong research based evidence that indicates that an association exists between physical activity engagement and a reduction in depressive symptomatology, findings still need to be interpreted with caution. Longitudinal studies such as those reported above (Brown et al., 2005; Camacho et al., 1991; Lampinen et al., 2000) only measure physical activity, depressive symptomatology, and general mental health functioning at one or two time points. Some studies only employ a single measure to assess for depression and mental health functioning. Data is usually collected via self report measures, which can be effected by incorrect reporting and social desirability bias. Also, some studies do not control for the effect that demographic factors may have on physical activity and depressive symptomatology over time (Sjosten & Kivela, 2006).

Demographic factors did not significantly affect depressive symptomatology or general mental health functioning in the present study. This finding is in contrast to earlier studies that found demographic factors, such as the existence of preexisting chronic health conditions to be associated with higher levels of depressive symptomatology (Abbot et al., 2003; Parmelee et al., 2007). However, participants in the Abbott et al. study were aged 55 years and older and participants in the Parmelee et al. study ranged in age from 48 to 91 years of age.

Strengths and Limitations

A main strength of this study is that it examined the effect that an efficacious nationwide physical activity intervention had on depressive symptomatology and general mental health functioning in a sample of low-active, community-dwelling older adults over a 12-month period. The measures that were used to measure physical activity and assess for depressive symptomatology and mental health functioning were validated measures that were administered by trained Research Officers. Also, a possible cluster effect was controlled for as data for only one individual from a spousal pair was analysed. A limitation of this study was that the majority of participants were not depressed at baseline. However, the study

demonstrated that an association existed between an increase in participants' physical activity and a decrease in depressive symptoms and an increase in mental health functioning.

Conclusions

Both versions of the Green Prescription were effective in significantly increasing most categories of physical activity during the course of the intervention (baseline to 3-months) and in maintaining this increase between postintervention and the follow up period (months 4 to 12). This increase in physical activity was associated with a significant decrease in depressive symptomatology and a significant increase in mental health functioning. Demographic factors did not significantly affect the change in depressive symptomatology or general mental health functioning in the present study. These results indicate that the Green Prescription is an effective intervention that can be used to maintain or improve mental health in low-active older adults. Future research should focus on the role that the Green Prescription can have in managing depression for older adults who have a clinical diagnosis of depression. The following chapter will provide a process evaluation of the Healthy Steps Green Prescription intervention.

Chapter 6: Process Evaluation of the Healthy Steps Intervention

Preface

The previous chapter demonstrated the efficacy of the Green Prescription in significantly increasing physical activity in previously low-active older adults who took part in the substantive Healthy Steps study. Participants were randomised to either the conventional time-based Green Prescription, which was centered around accumulating minutes of physical activity or a pedometer-based Green Prescription, which focused on accumulating pedometer steps as a goal through habitual physical activity. The aim of this chapter is to view data collected from a process evaluation of the Healthy Steps study. This will enable us to gain an understanding from participants' perspectives as to why these two different interventions helped them to become and remain physically active. At postintervention (3-months post baseline) participants were invited to complete a "Participant Satisfaction Survey." This questionnaire was designed to identify the intervention components participants' perceived as being helpful or unhelpful in facilitating their physical activity participation.

Introduction

There is convincing research-based evidence for the health-related benefits of physical activity engagement (Bauman, 2003; Boreham et al., 2000; Nelson et al., 2007; Warburton et al., 2006). Despite such evidence, however, a large number of older adults remain low-active or sedentary, engaging in less activity than is required for health-related gain (Drewnowski & Evans, 2001; Westerterp & Meijer, 2001). Engagement in regular physical activity in old age improves physical and psychological health and functioning (DiPietro, 2001; Nelson et al., 2007). Findings from empirical research have demonstrated that the primary health care setting is an ideal place to implement physical activity interventions for older adults (Kerse et al., 1999; Kerse et al., 2005; Kolt et al., 2007; Pinto et al., 2005). As a group, older adults tend to respect and value their primary care physician's advice and knowledge, and are more likely to comply with advice that has been suggested by their physician compared to other age groups (Schutzer & Graves, 2004; Pfeiffer et al., 2001).

One approach developed to increase population levels of physical activity in New Zealand is the Green Prescription programme. This programme was designed as a preventive public health service in which primary care physicians and practice nurses prescribe physical activity to low-active individuals, and for those who have chronic health conditions and can benefit from physical activity (Pringle, 1998; Sport and Recreation New Zealand, 2006). The Green Prescription is based on the U.S. Surgeon General's recommendation of achieving 30 minutes of physical activity on five or more days of the week (Pringle, 1998). A Green Prescription runs over a three-month period, during which time an individual receives ongoing telephone support counseling for physical activity from a trained physical activity counselor. This counseling is underpinned by the transtheoretical model of behavior change (Prochaska & Marcus, 1994) which focuses on individually tailoring physical activity advice and prescription (Sport and Recreation New Zealand, 2006a).

The conventional time-based Green Prescription is centered on accumulating minutes of physical activity. This approach is based on the recommendations of the

U.S. Surgeon General's report on physical activity and health benefits (Pringle, 1998; U.S. Department of Health and Human Services, 1996). This report strongly stressed the importance of engaging in 30 minutes of physical activity on five or more days of the week to confer health-related benefits. This recommendation has international standing and is the national guideline for physical activity engagement for adult populations in many countries (Sjostrom et al., 2002).

The rationale for a pedometer-based Green Prescription is centered on evidence for the health-related benefits of short bouts of physical activity, including habitual (incidental) physical activity. An individual can still confer health-related benefits by engaging in short bouts of physical activity, including habitual physical activity that accumulate to the recommended level of physical activity instead of engaging in one sustained period of activity (Boreham et al., 2000; DeBusk et al., 1990; Pescatello & Murphy, 1998; Wong et al., 2003). Short bouts of physical activity may be more achievable and sustainable for older adults. Pedometers are an ideal tool for monitoring this kind of activity. Pedometers provide an individual with objective information regarding how much physical activity they have been engaging in (Van Wormer, 2004). This, in turn, can help motivate an individual to engage in more walking or other activities that can help increase step counts (Farmer et al., 2006). Pedometers are ideal tools to help with goal setting; they require minimal contact (in relation to an intervention), they are also a cost effective way of helping increase physical activity at a population-based level (Jordan et al., 2005; Stovitz et al., 2005; Talbot et al., 2003). A meta-analysis carried out by Bravata et al. (2007) found that interventions that incorporated pedometers yielded both a significant increase in participants' physical activity and significant decreases in body mass index and blood pressure.

A number of randomised controlled trials have demonstrated the efficacy of the conventional time-based Green Prescription in significantly increasing physical activity and health-related gain over both a short and long-term period in previously low-active and sedentary individuals, including older adults (Elley et al., 2003a; Kerse et al., 2005; Lawton et al., 2008; Swinburn et al., 1998). These investigations have focused on outcome measures (e.g., physical activity levels, health-related gain) with little or no focus on participants' evaluations (i.e., subjective feedback) of their

perceptions and experiences of intervention components. Participant feedback would help identify the components that were perceived to be helpful or less helpful in encouraging and supporting physical activity participation.

Process evaluation involves documenting and describing each specific component of a programme/intervention, including how the programme was implemented with participants (Steckler & Linnan, 2002). It involves obtaining participants' subjective evaluations concerning how they perceived each programme component (King et al., 1998). It can also involve assessing the extent to which outcome measure(s) were achieved by the use of specific programme components (Helizer et al., 2000; Wickizer et al., 1993). A process evaluation of a specific programme provides salient information about why a particular programme was successful or not in achieving its desired aims (Cunningham et al., 2000).

A growing number of physical activity interventions have been subjected to process evaluations in order to identify the components of an intervention that participants perceived to be effective in helping them initiate and maintain physical activity (Draper et al., 2009; Elley et al., 2007; Gillis et al., 2002; Hopman-Rock & Westhoff, 2002; Kolt et al., 2006b; Lauzon et al., 2008; Mattfeldt-Beman et al., 1999; Opdenacker & Boen, 2008; Phongsavan et al., 2008; Sepsis et al, 1995). The focus of these investigations has provided information about 'why' and 'how' such components were perceived to be helpful by participants. Such evaluations have also identified components that participants perceived as being less helpful aids for physical activity.

Elley et al. (2007) undertook a qualitative study that examined participants' attitudes and experiences toward receiving a Green Prescription. In comparison to the present study, which is using a quantitative form of analysis (e.g., Likert scale), Elley et al. employed a qualitative methodology in the form of content analysis. This approach to data analysis allowed their participants to discuss and elaborate why they found certain intervention components to be helpful or unhelpful in aiding their physical activity. For example, some participants discussed how tailoring the physical activity prescription around their medical conditions and personal

expectations helped aid and support their physical activity participation. Participants also discussed why certain intervention components were not helpful. For example, one participant discussed why she felt the telephone counseling was patronising, and how the telephone counseling interrupted her work. The present study is designed to obtain participants' ratings of the main components of both versions of the Green Prescription (e.g., physician consultation, telephone counseling, print materials, and the addition of a pedometer) in relation to the perceived effect that these components had in aiding participants' physical activity

A fundamental benefit of qualitative inquiry is that it allows participants to voice their experiences and views about the phenomenon under study (Pitney & Parker, 2001; Sofaer, 1999). A possible limitation of qualitative methodology is that data collection is only carried out with a small number of participants. Thus, generalising one's findings to the larger participant group or larger population can be problematic. While, 878 participants took part in the Green Prescription randomised controlled trial (RCT) carried out by Elley et al. (2003a), only 15 participants from the larger RCT took part in the qualitative substudy. In cases where a large RCT is carried out, a participant evaluation based on a questionnaire/survey type of methodology can allow all participants to take part in the evaluation of an intervention. At the same time, this type of methodology can make data collection and analysis (of the participant evaluation) more manageable.

A process evaluation of the Community Healthy Activities Model Program for Seniors (CHAMPS) (Sepsis et al., 1995) and a revised Community Healthy Activities Model Program for Seniors (CHAMPS II) (Gillis et al., 2002) physical activity intervention for older adults found that the personal attention received from program staff, and ongoing telephone support were rated as being the two most helpful intervention components in relation to aiding physical activity. After a process evaluation was undertaken for the initial CHAMPS intervention, two components that were rated by participants as being the least helpful (the chance to win prizes and receiving a T-shirt) were excluded from the revised CHAMPS II intervention.

A process evaluation of an intervention also provides information regarding why certain intervention components were perceived to be less helpful by participants (Mattfeldt-Beman et al., 1999). For example in their intervention designed to change dietary intake and increase physical activity in participants who had high-normal blood pressure and mild obesity, Mattfeldt-Beman et al. (1999) found that participants rated group exercise as the least helpful intervention component. Instead, participants conveyed that a personal exercise program combined with learning how to incorporate physical activity into daily activities was a more helpful intervention component. Mattfeldt-Beman et al. (1999) also examined if participant ratings differed as a result of demographic factors. They found that the oldest participants (those aged 50 years and older) were more likely to attend scheduled exercise classes compared to younger-aged participants. This highlighted a need to schedule classes at a time that was convenient for those who worked during the day or had caregiving responsibilities. In relation to gender, compared to male participants, female participants were more likely to express dissatisfaction if they did not lose weight or did not adhere to the program. Mattfeldt-Beman et al. concluded that the findings from their evaluation highlight the need to incorporate intervention components that may be outside the realm of traditional dietetics (i.e., teaching self monitoring and problem solving skills).

To date, limited research has been carried out that has examined participants' evaluations of their Green Prescription experience. Therefore, the present study was designed to provide a process evaluation of the Healthy Steps Green Prescription intervention. The Healthy Steps study was a randomised controlled trial designed to increase physical activity in 330 community-dwelling, low-active older adults. Participants were randomised to receive either the conventional time-based Green Prescription or the pedometer step-count Green Prescription.

The aim of this study was to twofold: first, to determine if participants' evaluations of the Healthy Steps intervention differed as a result of allocation to either the time-based conventional Green Prescription or the pedometer-based Green Prescription; and second, to identify the intervention components that participants perceived as helpful in facilitating their physical activity participation.

Methods

Participants

The Healthy Steps study focused on a sample of 330 community-dwelling adults aged 65 years and older. The Healthy steps participants ranged in age from 65 to 91 years of age (mean age = 74.1 years, SD = 6.1 years), with a gender distribution of 152 males and 177 female participants. To be eligible to participate in the Healthy Steps study, potential participants were aged 65 years and older, able to speak and write English, able to walk, not blind (in order to read pedometer display screen), have no health conditions that would contraindicate physical activity engagement, not have received a Green Prescription in the past two years, and be classified as low-active (i.e., engaging in less than 150 minutes of physical activity per week). Potential participants had to be residing in the Auckland, New Zealand region over the 12-month period of the study. All 330 participants were invited to take part in the process evaluation. Two hundred and fifty nine Healthy Steps participants (139 female and 120 male participants) took part in the process evaluation (response rate = 78%). Participants who completed the process evaluation, had a mean age of 73.8 years (SD = 6.0 years).

For the purpose of the present study, participants were placed into one of two age categories: (1) 65 to 75 years of age and (2) 76 years and older. Participants were placed into one of three weight categories based on calculation of individuals' body mass index: (1) normal weight, (2) overweight, and (3) obese. Chronic health conditions were divided into three categories: (1) zero chronic health conditions, (2) 1 to 2 chronic health conditions, and (3) 3 or more chronic health conditions (See Table 6.1 for participant demographic information).

Table 6.1 Participant demographic information (N = 259)

	Time-Based N	Time-Based (%)	Pedometer-based N	Pedometer-Based (%)
<u>Gender</u>				
Males	56	(43)	64	(50)
Females	74	(57)	65	(50)
<u>Age (years)</u>				
65 to 75 years	80	(61)	86	(67)
76 and older	50	39	43	(33)
<u>Chronic Health Conditions</u>				
0 Conditions	39	(32)	29	(23)
1 to 2 conditions	66	(53)	66	(54)
3 or more conditions	19	(15)	28	(23)
<u>Body Mass Index</u>				
Normal Weight	40	(32)	27	(22)
Overweight	54	(44)	64	(51)
Obese	29	(24)	33	(27)

Note. Participant demographic information in counts (N) and percentages (%)

The Healthy Steps Study

There were two versions of the Green Prescription. The time-based Green Prescription consisted of a participant receiving the conventional Green Prescription, in which the participant was instructed to engage in their prescribed activity for a set period of time on most or all days of the week. The pedometer-based Green Prescription consisted of the same format as the time-based Green Prescription, though participants in the pedometer condition were encouraged to add steps throughout their day in usual activities (i.e., walking around the house and garden, taking the stairs instead of the elevator). There was also an emphasis on increasing pedometer step-counts through goal setting (Kolt et al., 2009).

Each participant was administered a Green Prescription (a prescription for physical activity) by their primary care physician. During the three-month intervention phase of the Green Prescription, each participant received three phone calls (one per month) from their patient support counselor. Telephone counseling was based on the transtheoretical model of behaviour change (Prochaska & Marcus, 1994). Phone calls were designed to provide ongoing, external support and advice

(e.g., helping with goal setting, problem solving barriers, and monitoring patient safety). Telephone counseling for participants in the pedometer condition focused on goal setting in relation to accumulating more steps. Participants in the pedometer condition were encouraged to keep a daily log of their step counts. During the intervention period, the patient support counselor mailed out a series of pamphlets. Pamphlets were designed to provide information about the benefits of physical activity for health gain, and how to safely engage in physical activity (See Table 6.2).

Print Materials

Table 6.2 provides a description of the pamphlets that participants received during the course of the intervention period, via post from their patient support counselor. Table 6.3 (in the results section) provides a summary of the findings of the Likert scale in relation to how helpful or motivating participants found the pamphlets to be in aiding them to become more active.

Table 6.2. Healthy Steps Pamphlet Descriptions

Pamphlet title	Purpose	Components
Healthy Weight Healthy Life	Education and advice	Benefits of physical activity for health gain. Advice on how to get started and how to be active on a daily basis. Safety tips (e.g., adequate fluid intake, sun protection, appropriate clothing and foot wear).
Stretching	Education and injury prevent	Benefits and rationale for stretching Detailed diagrams and instructions for 10 different types of stretches, including those applicable for walking activity.
Medical Conditions and Physical Activity	Education and advice	Benefits and types of physical activity applicable for health gain in relation to 10 common non-communicable conditions that can be more prevalent in old age.
Water Activities	Education and advice	Discusses benefits of water activity for health conditions. Provides examples of water activities that can be undertaken.
Walking Log for Pedometer Step Counts (for pedometer participants only)	Help set goals	Weekly activity logs for the course of the intervention period. Participant notes down daily step count and weekly goal(s).
Pedometer Information Booklet (for pedometer participants only)	Instructions and information on pedometer use	Provides rationale and benefits for pedometer use. Instructions on how to use and look after the pedometer.

Note. Only participants in the pedometer condition received a copy of the Walking log for pedometer step counts pamphlet and the Pedometer information booklet.

Measures

A Participant Satisfaction Survey was constructed for this study and was based on a previous process evaluation questionnaire (Kolt et al., 2006b). Questions contained in the present questionnaire were adapted and modified from the process evaluation questionnaire that was used in the TeleWalk study (Kolt et al., 2006b). The TeleWalk intervention was a telephone-based intervention designed to increase physical activity and health-related quality of life in low-active older adults (Kolt et al., 2007). The specific pedometer evaluation questions were adapted from a survey that was carried out for the 10,000 Steps Rockhampton physical activity intervention (Brown, Mummery, Eakin, & Schofield, 2006), an intervention aimed at increasing physical activity at a population-based level, via pedometer use.

The Participant Satisfaction Survey consisted of five sections. Section one, contained questions relating to the physician (general practitioner) consultation for the Green Prescription. Sections two and three, contained questions relating to the telephone support counseling and the print materials that participants received during course of the intervention period. Section four, pertained only to participants in the pedometer-based group, and contained questions relating to pedometer use. The final section consisted of questions relating to the overall Healthy Steps study (e.g., the administration of measures related to the larger investigation, completing falls and expenses calendars, and ascertaining participants' subjective perceptions of whether the intervention had helped them to become more active). Responses were recorded on a five-point Likert scale: (1) 'strongly agree,' (2) 'agree,' (3) 'not sure,' (4) 'disagree,' and (5) 'strongly disagree'. Each question also contained an additional sixth column that was titled 'don't recall'. Questions relating to the print material section, had a sixth column, titled 'did not receive' (see Appendix H and I). There were two versions of the process evaluation questionnaire. Participants in the pedometer-based group were given a questionnaire that had an additional 10 questions that were related to pedometer use. Aside from the additional pedometer questions, both versions of the questionnaire were identical in content and layout. The questionnaire took between 10 and 15 minutes to complete.

Procedure

Once each participant had completed their (3-month) intervention phase, an information sheet detailing the process evaluation study and the actual questionnaire (titled: Healthy Steps: Participant Satisfaction Survey) was mailed out to individual participants. The survey was administered at post intervention rather than at the 12-month follow-up period, because of concerns relating to recall issues (e.g., participants not remembering aspects of the intervention). The information sheet stated that the questionnaire was optional to complete. The information sheet conveyed that all responses would be treated confidentially, and that no one would be individually identified in any reporting of the survey (See Appendix H and I). Participants were supplied with a reply paid envelope in which to return their completed questionnaire. Participants were given a two-week period to return the completed questionnaire. If a questionnaire was not returned within a two-week period, a follow up phone call was made to firstly ensure that the participant had received the questionnaire, and then to remind the participant about completing the questionnaire, and reassuring them that their feedback would be relevant and helpful. A total of 330 questionnaires were mailed out. Two hundred and fifty nine completed questionnaires were returned (response rate = 78%). This study was approved by the Auckland University of Technology Ethics Committee (ethics reference number: 07/89).

Statistical Analysis

Data were analysed with SPSS version 16.0 (SPSS Inc, Chicago, Illinois). An alpha level was set at 0.05 (95% confidence level). Descriptive Statistics were undertaken for the analysis of the process evaluation questionnaire. This involved summing the number of responses for each of the five points of the Likert scale and calculating percentages based on the total number of responses for each question. Chi-square analyses were undertaken to test for significant differences between the two intervention groups for response ratings relating to the telephone counseling and print material components of the intervention. These two intervention components differed slightly as a result of allocation to the two different versions of the Green Prescription. Chi-square analysis was undertaken to test for any significant differences in pedometer use as a function of demographic factors.

Results

Results of the Process Evaluation

Table 6.3 summarises the results of the process evaluation, examining how each main intervention component (i.e., physician consultation, telephone support counseling, print materials, and the addition of a pedometer) was evaluated by participants in relation to the extent to which participants agreed or strongly agreed about the effectiveness of a particular component in helping to encourage and support their physical activity initiation and maintenance. The process evaluation also examined the extent to which participants perceived an intervention component to be unhelpful in aiding their physical activity.

Physician Consultation for the Green Prescription

Of the total sample, 80% of participants in the time-based group and 87% of participants in the pedometer-based group agreed or strongly agreed that their appointment with their primary care physician (general practitioner) for their Green Prescription was a positive experience. Five percent of participants in the time-based group and 4% of participants in the pedometer-based group disagreed or strongly disagreed that their physician appointment was a positive experience.

Seventy three percent of participants in the time-based group and 76% of participants in the pedometer-based group agreed or strongly agreed that their physician or (practice) nurse discussed the type of physical activity that was best suited for them, meanwhile, 12% of participants in the time-based group and 11% of participants in the pedometer-based group disagreed or strongly with this statement (See Table 6.3).

Telephone Support Counseling

Participants in both groups agreed or strongly agreed that the overall phone support they received motivated them to become and stay physically active (time-based 76%, pedometer-based 68%). There was no significant difference in response ratings for this question based on allocation group ($X^2 = 1.7, p = .89$). Eleven percent of participants in the time-based group and 10% of participants in the pedometer-based group disagreed or strongly disagreed with this statement.

A high percentage of participants in both groups agreed or strongly agreed that the physical activity advice they received from their patient support counselor was helpful and relevant for them (time-based 80% and pedometer-based 79%). Chi square analysis indicated that there was no significant difference for response ratings based on intervention group allocation ($X^2 = 5.4, p = .37$). Six percent of participants in the time-based group and 9% of participants in the pedometer-based group disagreed or strongly disagreed with this statement.

Eighty four percent of participants in the time-based group and 75% of participants in the pedometer-based group agreed or strongly agreed that the physical activity that was suggested was appropriate for them. Chi square analysis indicated that there was no significant difference for response ratings based on intervention group allocation for this question ($X^2 = 2.4, p = .17$). Three percent of participants in the time-based group and 7% of participants in the pedometer-based group disagreed or strongly disagreed with this statement. Participants in both groups agreed or strongly agreed that their patient support counselor was supportive and understanding (time-based 84%, pedometer-based 79%). There were no significant difference in response ratings between groups ($X^2 = 5.3, p = .38$). An almost equal percentage of participants in both allocation groups disagreed or strongly disagreed with this statement (time-based 5%, pedometer-based 4%).

Participants in both groups agreed or strongly agreed that an overall good standard of service and support was provided (time-based 82%, pedometer-based 78%). There was no significant difference in response ratings between groups for this question ($X^2 = 2.3, p = .80$) (See Table 6.3). An equal percentage of participants in both allocation groups disagreed or strongly disagreed with this statement (time-based 9%, pedometer-based 9%).

Print Materials

Eighty one percent of participants in the pedometer-based group agreed or strongly agreed that their Walking Log for Pedometer Step Counts booklet was helpful. Seven percent of participants in the pedometer condition disagreed or strongly disagreed with this statement. Seventy four percent of participants in the pedometer-based group agreed or strongly agreed that their pedometer Information Booklet was helpful, while, 6% of participants in the pedometer condition disagreed or strongly disagreed about the helpfulness of this booklet

An almost equal percentage of participants in both groups agreed or strongly agreed that the Healthy Weight Healthy Life pamphlet (time-based 59%, pedometer-based 60%) motivated them to become more active. There was no significant difference in response ratings between the two groups ($X^2 = 3.1$, $p = .55$). Eleven percent of participants in the time-based group and 5% of participants in the pedometer-based group disagreed or strongly disagreed about the helpfulness of this pamphlet in aiding their physical activity.

Participants in the time-based group were more likely to agree or strongly agree (60% and 65%, respectively) that both the Stretching and Medical Conditions and Physical Activity pamphlets were helpful in encouraging physical activity compared to participants in the pedometer-based group (65% and 50%, respectively). There was no significant difference in response ratings between groups regarding the helpfulness of the Stretching pamphlet in encouraging physical activity ($X^2 = 6.2$, $p = .30$). However, participants in the time-based group rated the Medical Conditions and Physical Activity pamphlet as being a more helpful aid in encouraging physical activity ($X^2 = 13.8$, $p = .005$) compared to participants in the pedometer-based group. An almost equal number of participants in both allocation groups (time-based 7%, pedometer-based 6%) disagreed or strongly disagreed about the helpfulness of the Stretching pamphlet in helping aid their physical activity. Ten percent of participants in the time-based group and 4% of participants in the pedometer-based group disagreed or strongly disagreed about the usefulness of the Medical Conditions and Physical Activity pamphlet in supporting their physical activity

Less than one-half of participants in each group rated the Water Activities pamphlet as being helpful (time-based 40%, pedometer-based 33%). Chi-Square analysis indicated that participants in the time-based condition were more in agreement that the Water Activities pamphlet was helpful in encouraging physical activity compared to participants in the pedometer step-based group ($X^2 = 16.5, p = .005$). Eighteen percent of participants in the time-based group and 8% of participants in the pedometer-based group rated the Water Activities pamphlet as being unhelpful in aiding their physical activity (See Table 6.3).

Healthy Steps Questions

An almost equal number of participants in both groups agreed or strongly agreed that they were comfortable in completing questionnaires (outcome measures) that were administered over the course of the study (time-based 99% and pedometer-based 98%), while no participants in either groups disagreed or strongly with this statement.

Of the findings, 75% of participants in the time-based group and 67% of participants in the pedometer-based group agreed or strongly agreed that they did not mind having to complete monthly falls and expenses calendars. Eight percent of participants in the time-based group and 12% of participants in the pedometer-based group disagreed or strongly disagreed with the above question.

A strong majority of participants across both groups agreed or strongly agreed that they were satisfied with the Healthy Steps programme (time-based 84% and pedometer-based 82%). Four percent of time-based participants and 6% of pedometer-based participants conveyed that they were not satisfied with the Healthy Steps programme.

Over one half of participants in each group agreed or strongly agreed that they had become more physically active as a result of participating in the Healthy Steps intervention (time-based 58% and pedometer-based 65%). Seventeen percent of time-based participants and 9% of pedometer-based participants disagreed or strongly disagreed with the above statement (See Table 6.3).

Table 6.3. Healthy Steps intervention participant feedback (N = 259) on the main components of the intervention

Questions	Agree and Strongly Agree		Not Sure		Disagree and Strongly Disagree		Don't recall		Did not receive	
	(%)		(%)		(%)		(%)		(%)	
	TB	PB	TB	PB	TB	PB	TB	PB	TB	PB
Physician consultation for the Green Prescription										
The appointment with my doctor/nurse for the Green Prescription was a positive experience	80	87	9	5	5	4	6	4	NA	NA
I felt that my doctor/nurse discussed what type of physical activity was best for me	73	76	11	7	12	11	4	6	NA	NA
Telephone support counseling										
Overall the phone support I received motivated me to be physically active	76	68	12	20	11	10	1	2	NA	NA
The advice I was given was helpful and relevant to me	80	79	12	11	6	9	2	1	NA	NA
The physical activity suggested was appropriate for me	84	75	9	14	3	7	4	4	NA	NA
The phone support person was supportive and understanding	84	79	8	15	5	4	3	2	NA	NA
A good overall level of service and support was provided	82	78	9	11	9	9	0	2	NA	NA
Print materials										
Walking log for pedometer step counts	NA	81	NA	12	NA	7	NA	0	NA	0
Pedometer information booklet	NA	74	NA	15	NA	6	NA	0	NA	5
Healthy weight healthy life pamphlet	59	60	22	23	11	5	0	7	8	5
Stretching pamphlet	60	65	25	25	7	6	0	0	8	4
Medical conditions and physical activity pamphlet	65	50	16	29	10	4	5	0	17	17
Water activities	40	33	35	49	18	8	0	0	7	10
Healthy Steps Questions										

Questions	Agree and Strongly Agree		Not Sure		Disagree and Strongly Disagree		Don't recall		Did not receive	
I was comfortable in completing the questionnaires at home visits	99	98	1	2	0	0	0	0	NA	NA
I did not mind having to complete my monthly falls and expenses calendars	75	67	9	16	8	12	8	5	NA	NA
Overall I was satisfied with the Healthy Steps Green Prescription programme	84	82	12	12	4	6	NA	NA	NA	NA
As a result of participating in this programme I am now more active	58	65	25	26	17	9	NA	NA	NA	NA

Note. Percentage of responses for the main intervention components for both the time-based (TB) and pedometer-based (PB) participants.

Pedometer Process Evaluation Questions

Participant feedback on the use of pedometers for those in the pedometer-based group is shown in Table 6.4. As can be seen from this table, 88% of participants in the pedometer condition agreed or strongly agreed that their pedometer made them aware of how active they were. Seven percent of participants indicated that their pedometer did aid their awareness of their activity levels. Eighty two percent of participants agreed or strongly agreed that their pedometer helped them to be more active, and motivated them to increase their daily step count. Eleven percent of participants disagreed or strongly disagreed with the above statement. Seventy five percent of participants agreed or strongly agreed that their pedometer motivated them to walk more. Fifteen percent of participants disagreed or strongly disagreed with the above statement. Fifteen percent of participants conveyed that their pedometer did not help them to walk more. Approximately one third of participants (36%) agreed or strongly that their pedometer was accurate in recording all of their steps. Thirty percent of participants disagreed or strongly disagreed with the above statement. Sixty nine percent of participants agreed or strongly agreed that they had no trouble in securing their pedometer to their person (item of clothing). A quarter of participants indicated that they had trouble securing their pedometer. The majority of participants (82%) agreed or strongly agreed that their pedometer was comfortable to wear. Twelve percent of participants conveyed that there pedometer was not comfortable to wear. Thirty nine percent of participants reported agreeing or strongly agreeing that their pedometer measured all of their activities. An almost equal percentage of participants (37%) disagreed or strongly disagreed with the above statement (See Table 6.4).

Table 6.4. Participant feedback on the use of pedometers for those in the pedometer condition (n= 129)

Question	Agree and Strongly Agree (%)	Not Sure (%)	Disagree and Strongly Disagree (%)	Don't Recall (%)
My pedometer made me aware of how active I was	88	5	7	0
My pedometer helped me to be more active, take more steps	82	6	11	1
My pedometer helped me to walk more	75	9	15	1

Question	Agree and Strongly Agree	Not Sure	Disagree and Strongly Disagree	Don't Recall
My pedometer was always accurate in recording my steps	36	32	30	2
I could easily secure my pedometer to my clothing	69	6	25	0
My pedometer was comfortable to wear	82	6	12	0
My pedometer measured all my activities	39	22	37	2

Note. Percentage of responses for participants in the pedometer condition. Responses are from the Process Evaluation questionnaire that was administered at post intervention (3 months post baseline).

Status of Pedometer Use at Post Intervention

Table 6.5 documents the status of pedometer use for participants in the pedometer-based group at post intervention (three months post baseline). At postintervention, 13% of participants in the pedometer-based group were wearing their pedometer on a daily basis. Thirteen percent of participants were wearing their pedometer most of the time (e.g., most days of the week). Thirty percent of participants reported wearing their pedometer occasionally (e.g., one or two times a week), while 13 % reported rarely ever wearing their pedometer. Thirty one percent of participants were not wearing their pedometer at post intervention (See Table 6.5).

Table 6.5. Status of pedometer use at postintervention

Question: Do you still wear your pedometer?	(%)
Always	13
Most of the time	13
Occasionally	30
Rarely ever	13
Never	31

Note. Percentage of responses for participants in the pedometer condition.

Demographic Factors and Pedometer Use

Table 6.6 shows how pedometer use at postintervention differed as a function of demographic factors. Three main percentage-based differences in pedometer use were evident based on the demographic variables of age, number of chronic health conditions, and weight status. As can be seen from this table, 23% of participants aged 76 years and older reported that they were still wearing their pedometer on a daily basis at post intervention, compared to 7% of participants aged 65 to 75 years. Chi square analysis indicated that there were no significant differences in pedometer use between these two age groups ($X^2 = 7.4, p = .12$). Fifteen percent of participants who reported having one to two chronic health conditions and 18% of participants who reported having three or more chronic health conditions reported wearing their pedometer 'most of the time' at post intervention, compared to 7% of participants who reported having no chronic health conditions. Chi square analysis indicated that there were no significant differences in pedometer use based on number of chronic health conditions ($X^2 = 2.9, p = .94$). Compared to 15% of normal weight participants and 13% of overweight participants, only 8% of obese participants reported wearing their pedometer on a daily basis at post intervention. However, there were no significant differences in pedometer use based on weight status ($X^2 = 3.8, p = .88$) (See Table 6.6).

Table 6.6. Pedometer use as a function of demographic factors

	Always (%)	Most of the time (%)	Occasionally (%)	Rarely ever (%)	Never (%)
<u>Gender</u>					
Males	12	16	30	17	25
Females	12	11	29	11	37
<u>Age</u>					
65-75 years	7	15	32	13	33
76 years and older	23	9	26	14	28
<u>Chronic Health Conditions</u>					
0 conditions	10	7	28	14	41
1-2 conditions	14	15	30	12	29
3 or more conditions	11	18	29	14	28
<u>Body Mass Index</u>					

	Always	Most of the time	Occasionally	Rarely ever	Never
Normal weight	15	11	30	15	29
Overweight	13	14	30	16	27
Obese	8	14	34	16	28

Note. Percentage of responses for participants in the pedometer condition. Responses are in relation to whether participants were still wearing their pedometer at post intervention in relation to demographic factors.

Discussion

This study had two main aims: first, to determine if participants' evaluations of the Healthy Steps intervention differed as a result of allocation to either the time-based conventional Green Prescription or the pedometer-based Green Prescription; and second, to identify the intervention components participants perceived as helpful in facilitating their physical activity participation. Participant ratings of intervention components significantly differed as a result of intervention allocation in relation to print materials. Overall, participant ratings of intervention components were similar across both allocation groups. The telephone counseling and physician consultation components received the highest ratings across both allocation groups. Across both allocation groups, print materials received the lowest ratings. Participants in the pedometer-based group rated the addition of a pedometer as being helpful in aiding their physical activity.

Physician Consultation

All aspects of the physician consultation for the Green Prescription were rated highly by participants in both groups, with no significant differences in evaluation ratings between allocation groups. Participants agreed that their consultation was a positive experience. The majority of participants felt that their physician provided them with appropriate suggestions regarding the type of activity they should engage in. It has been argued (Booth et al., 1997; Podl et al., 1999) that patients both expect and want to receive advice from their physician regarding physical activity.

There is evidence for the effectiveness of physician advice in facilitating physical activity in previously sedentary and low-active adults, including older adults who have taken part in physical activity interventions (Armit et al., 2009; Elley et al., 2003a; Harland et al., 1999; Kerse et al., 1999; King et al., 1998; Kolt et al., 2007; Pfeiffer et al., 2001; Pinto et al., 2005).

It has been argued (Elley et al., 2007) that individuals are more likely to consider and adhere to physical activity advice when it is imparted by their primary care physician. A study (Elley et al., 2007) that examined participants' attitudes and views of their Green Prescription experience found the physician consultation to have an important role in relation to how participants viewed physical activity prescription. Participants viewed their primary care physician as a 'significant other' in relation to the authoritative knowledge that their physician had about health promotion. A physician's advice for physical activity had an influential effect on the behaviour of some participants in the Elley et al. study. For example, one patient spoke about being more inclined to engage in physical activity because the advice was given to her by her physician.

Telephone Counseling

All aspects of the telephone counseling component were rated highly by participants in both groups. There were no significant differences in evaluation ratings between the two intervention allocation groups. Participants in both intervention allocation groups felt that the advice they were given from their patient support counselor was helpful and relevant for them and that the type of physical activity that was suggested was appropriate to their lifestyles. The telephone counseling that participants received during the course of their Green Prescription was underpinned by the transtheoretical model of behaviour change. The transtheoretical model encompasses a theory of behaviour change that is based on stages and processes of both cognitive and behavioural change in relation to an individual contemplating and adopting a new behaviour, such as engaging in regular physical activity (Prochaska & Marcus, 1994). The telephone-based support that participants received in the present study was tailored to meet their individual stage of readiness for physical activity. For

example, this type of counseling took into account lifestyle factors such as the existence of chronic health conditions, and previous level and type of physical activity.

An earlier Green Prescription study (Elley et al., 2007) also found the telephone counseling component to be helpful in aiding physical activity. Participants in the Elley et al. (2007) study discussed how they found the individual tailoring effect of the Green Prescription's telephone counseling component to be beneficial in helping them initiate and maintain their physical activity engagement. This was related to a Green Prescription being realistically matched to the individual's ability or willingness to undertake certain types of physical activity, especially in light of existing chronic health conditions, and personal factors relating to how comfortable an individual was with participating in certain types of activity (e.g., not feeling comfortable attending a gym).

The role that ongoing telephone support has in helping aid physical activity engagement has also been documented in earlier physical activity intervention studies that have been carried out with older adults (Gillis et al., 2002; Kolt et al., 2006b; Sepsis et al., 1995). Participants who took part in the TeleWalk study (Kolt et al., 2006b) were in strong agreement that the telephone support they received during the course of their intervention was helpful in aiding their physical activity engagement. The telephone counseling employed in the TeleWalk intervention was based on the Transtheoretical model of behaviour change (Prochaska et al., 1992). Hence, the telephone counseling that an individual received and the goal setting for physical activity that evolved from the telephone counseling was based on a participant's stage of change for physical activity. There was a match between what the participant felt they could do (i.e., their cognition) and what they wanted to do (i.e., desired behaviour).

Follow-up telephone support based on the transtheoretical model of behaviour change (Prochaska & Marcus, 1994) and social-learning theory (Bandura, 1976) was a component that was used in the CHAMPS (Sepsis et al., 1995) and CHAMPS II (Gillis et al., 2002) physical activity interventions. The telephone calls that participants received were designed to provide ongoing external support for physical activity based on a participant's stage of behaviour change. For example, helping the participant set goals for physical activity and problem solving barriers to physical activity when a

participant was in the 'action' stage of behaviour change. It appears that the repeated 'booster' contact that telephone-based interventions offer help support the maintenance of behaviour change (Eakin et al., 2007b).

Participants in both intervention allocation groups felt that their patient support counselor was supportive and understanding and provided a good level of service. Perceived social support through telephone counseling has been found to be a strong motivating factor in helping older adults initiate and maintain their physical activity engagement (Elley et al., 2007, Gillis et al., 2002; Kolt et al., 2006b; Sport and Recreation New Zealand, 2007b). Annual Sport and Recreation surveys (Sport and Recreation New Zealand, 2007b, Van Aaslt & Daly, 2005b) that monitor Green Prescription use reported that respondents have stated that the advice, support, and encouragement that they have received from their patient support counselor via telephone counseling has helped to keep them active and focused on completing their Green Prescription. These respondents also mentioned that they felt that someone (the patient support counselor) cared about their progress, and took the time to 'check up' on them. For some respondents, the ongoing telephone support made them feel accountable to adhering to their Green Prescription.

Likewise, participants in the Elley et al. (2007) study felt that the telephone counseling acted as an external motive for maintaining one's physical activity engagement. Participants who took part in the CHAMPS II focus group evaluations mentioned that the telephone support they received acted as a reminder for them to remain active and accountable to completing the programme (Gillis et al., 2002). Some participants felt committed to the CHAMPS II program because of the ongoing interaction between them and their phone support counselor. Some participants felt that the telephone contact helped created a bond between them and their support counselor.

Print Materials

In the case of print materials, participant evaluations differed significantly as a result of intervention allocation. Participants in the time-based group rated both the Medical

Conditions and Physical Activity, and the Water Activities pamphlets as being more helpful in aiding their physical activity compared to participants in the pedometer-based group. One possible reason for this difference could be related to the type of telephone counseling participants were receiving based on their intervention allocation. Participants in the time-based group were instructed to engage in a particular physical activity for a set period of time, the emphasis was on accumulating minutes of physical activity in a single session. Hence, the Medical Conditions and Physical Activity and Water Activities pamphlets may have been more helpful aids for encouraging and supporting physical activity for participants in the time-based condition, as these pamphlets emphasised the importance of regular time-based physical activity for health-related gain. The Water Activities pamphlet may have been perceived as less important for participants in the pedometer-based condition, as a pedometer is not waterproof and, hence, cannot be used to quantify water-based activities.

In comparison to other intervention components, print materials received the lowest evaluation ratings across both intervention allocation groups. Apart from the Medical Conditions and Physical Activity and Water Activities pamphlets, all other print materials were rated similarly by participants across both intervention allocation groups. Print materials provided supplementary support for physical activity. They contained information about the benefits of physical activity, suggestions for suitable types of physical activity to engage in, and some pamphlets provided detailed diagrams and instructions for physical activity. On the whole, print materials were still rated by participants as helping aid their physical activity. These findings are consistent with those of Kolt et al. (2006b) who reported that participants in their study rated supplementary print materials for physical activity as helpful in motivating them to become physically active. Participants in the original CHAMPS study and the revised CHAMPS II study (Gillis et al., 2002; Sepsis et al., 1995) also rated print information as being helpful in aiding their physical activity. Print materials in these earlier interventions also focused on how individuals could safely engage in physical activity, and contained tips and strategies on how to overcome barriers to physical activity to maintain one's physical activity engagement.

The effectiveness of print materials in aiding physical activity has yielded mixed findings. Ball et al. (2005) found a print-plus telephone based intervention to be more effective in increasing physical activity versus a print-based intervention alone in a sample of 66 low-active adults aged 45 to 78 years of age. In contrast, Humpel et al. (2004) found both a print plus telephone versus a print-based intervention to be effective in significantly increasing physical activity in low-active adults.

Pedometers

Overall, the pedometer-based Green Prescription was perceived to aid physical activity. Participants in the pedometer-based allocation group provided positive evaluations for the use of a pedometer-based Green Prescription. The majority of participants in the pedometer-based group indicated that their pedometer made them aware of how active they were, and as a result of this awareness made them more active by motivating them to walk more. A recent process evaluation carried out on a pedometer-based physical activity intervention (Lauzon et al., 2008) also found that participants conveyed that their pedometer helped them to become aware of how physically active they were (i.e., made them aware of how little physical activity they were engaging in). This in turn, motivated them to become more physically active, by helping them to walk more to increase their daily step-count. This finding is also consistent with a process evaluation of a study (Phongsavan et al., 2008) that was designed to increase physical activity in a sample of individuals who had a diagnosed anxiety disorder. This study incorporated the use of a pedometer to help these individuals become more active. One-half of participants in the Phongsavan et al. study conveyed that a pedometer was helpful in supporting their physical activity engagement.

Participants in earlier intervention studies that have used pedometers to aid physical activity have commented on the motivational effect that pedometer use has had in helping them increase their walking activity (Farmer et al., 2006; Mutrie et al., 2004). Research shows that a pedometer can assist an individual in regulating their physical activity, because a pedometer can be used as an environmental prompt to promote walking or other physical activity behaviour that can be monitored by way of step-

counts. Step-count feedback provides an individual with information about how much activity they have engaged in, and possibly how much more activity is required to reach a daily step-count goal (i.e., 10,000 steps) (Croteau, 2004; Van Wormer, 2004).

The telephone-based counseling that participants in the pedometer condition received focused on goal setting in relation to how participants could increase their daily step-count. In turn, participants conveyed that their walking log for pedometer step-counts encouraged and motivated them to walk more. Participants in a previous study (Lauzon et al., 2008) conveyed that a physical activity log that documented daily pedometer step-counts was motivating. Such a log was described to be motivational as it allowed individuals to monitor their progress and work toward setting goals to increase their step-count. Pedometer walking logs have also been identified as a successful method for helping participants set goals around increasing their daily step-counts in previous interventions (Chan et al., 2004; Stovitz et al., 2005).

Over one-quarter of participants in the pedometer group conveyed that they felt that their pedometer was not always accurate in recording their step-counts. Some participants in the Lauzon et al., (2008) study also conveyed that they felt that their pedometer was not always accurate in recording their steps. Participants in the Lauzon et al. study felt that pedometer accuracy was linked to not wearing their pedometer correctly in relation to where the pedometer was placed on one's body and they type of clothing one was wearing. This finding is in contrast to that of the present study in which participants conveyed that they had no problems securing their pedometer to the item of clothing they were wearing. In the present study, some participants conveyed that their pedometer did not measure all their activities (i.e., one's pedometer could not be worn during water-based activities).

The majority of physical activity interventions that have incorporated a pedometer-based component have only focused on outcome variables to do with whether physical activity levels increased as a result of pedometer use, and/or whether pedometer use resulted in health-related changes with little or no examination of whether there were demographic differences (i.e., based on gender, age, weight status) in relation to

pedometer use (Lauzon et al., 2008). Population-based interventions that have used pedometers to help increase physical activity have examined demographic differences in relation to pedometer use. These studies have found that gender, age and weight status can affect pedometer use (De Cocker, De Bourdeaudhuij, Bown, & Cardon, 2007; Eakin et al., 2007c; Tudor-Locke & Chan, 2006).

In the present study, at post intervention (3-months post baseline) less than a quarter of participants in the pedometer condition were wearing their pedometer on a daily basis. The majority of these participants were wearing their pedometer on an occasional basis. Post intervention analysis indicated that there were no significant differences in pedometer use as a function of demographic factors. In contrast to this finding, demographic differences were evident in pedometer use in the 10,000 Steps Rockhampton physical activity intervention (Eakin et al., 2007c). 10,000 Steps Rockhampton was a two-year multi-strategy, community-based physical activity intervention that facilitated physical activity through pedometer use. The theme of this intervention was centered on reaching 10,000 steps per day. Correlates of pedometer use were examined at the population-based level based on data from 2,478 respondents. Results indicated that pedometer users were more likely to be female, aged 45 years or older, and have a BMI that was greater than 30 (obese classification).

Tudor-Locke & Chan (2006) also found weight status to be a characteristic related to pedometer program adherence and completion in an intervention that was carried out to increase physical activity in individuals who had low-active occupations. Participants who were classified as being overweight (BMI between 25.0 and 29.9) or class I obese (BMI between 30.0 and 34.9) were more likely to complete the intervention compared to participants who were normal weight (BMI between 18.5 and 24.9) or class II or class III obese (BMI between 35.0 and 49.9). In the present study, normal weight and overweight participants were more likely to report wearing their pedometer 'always' at post intervention compared to obese participants. Though, this percentage-based difference was not significant it may be speculated that obese participants may have experienced more barriers toward physical activity because of their excess weight (Bruce et al., 2005; Milner, 2005). This may have resulted in them

being less inclined to use their pedometer, especially if they had low step-counts.

In the present study, at postintervention participants in the oldest age group (76 years and older) were more likely to report wearing their pedometer 'always' at post intervention compared to those aged 65 to 75 years of age. However, this difference was not statistically significant. Research shows that older adults in the young-old age category (65 to 70 years of age) compared to those in the mid-old (70 to 80 years of age) or old-old (80 years and older) age category are more likely to be physically active (Kaplan et al., 2001; Lim & Taylor, 2005). Pedometer use may have aided physical activity for participants in the oldest age category. Participants aged 76 years and older may have been more motivated to initiate and maintain their physical activity based on the feedback they received from their pedometer.

Compared to participants who reported having no chronic health conditions, participants who reported having one to two, or three or more chronic health conditions were more likely to report that they were wearing their pedometer 'most of the time' at post intervention. Though, this percentage-based difference was not statistically significant, a pedometer-based Green Prescription may have aided physical activity participation for these participants. It may be speculated that participants with chronic health conditions had more to gain from being physically active in relation to their health status. For example, being physically active for weight or pain management reasons (Belza et al., 2004; Guerin et al., 2008; Schutzer & Graves, 2004).

Strengths and Limitations

A main strength of this investigation was that it was designed to identify the differences and similarities in participants' evaluations of the Healthy Steps intervention based on allocation to two versions of the Green Prescription. However, there were limitations as well. A social desirability bias may have been evident, as participants may have felt that they needed to provide positive feedback (and may have been more likely to check the 'agree' column). To try and counteract this, it was stressed at the beginning of the questionnaire that we appreciated both positive and negative feedback

so that the intervention could be improved for future use. There may have also been recall problems, with participants not remembering some aspects of the intervention. In some cases, participants may have not received a particular pamphlet. Lastly, not all participants completed the process evaluation. It is not known how these non-responders may have rated the various intervention components. However, a high response rate was obtained.

Conclusions

Participant evaluations of intervention components were similar across both intervention allocation groups. It appears that physician endorsed and prescribed physical activity combined with ongoing telephone counseling (based on stage of change theory) and supplemented with print materials, with or without the addition of a pedometer is perceived by participants to be an effective way of encouraging and supporting physical activity. The findings of this study have provided further evidence that telephone-based counseling is perceived to be an effective component in helping older adults initiate and maintain their physical activity engagement. Print materials received the lowest ratings across both intervention allocation groups. Though, participants in both groups conveyed that print materials were a helpful aid for supporting physical activity. The only significant difference in intervention ratings between the two allocation groups was related to two of the print materials received during the course of the intervention. A difference in evaluation ratings can be attributed to the type of counseling participants received based on the type of Green Prescription they received. A pedometer-based Green Prescription was rated as being just as effective as the conventional time-based Green Prescription in aiding physical activity. Participants in the pedometer-based condition rated their pedometer as being a useful tool for supporting and encouraging physical activity. Participants conveyed that their pedometer made them aware of how active they were, and in turn motivated them to be more active. Pedometer use was not significantly influenced by demographic variables in the present study. More work needs to be carried out to determine the effectiveness of pedometer use in relation to how a pedometer can help older adults maintain regular physical activity participation over an extended period of time.

Chapter 7: Discussion, Recommendations, and Conclusions

The aim of this final chapter is fourfold: first, to discuss the main findings of the four studies; second; to discuss the main strengths and limitations of each study; third to make recommendations for future research, and fourth; provide conclusions drawn from this research. With a worldwide trend for increased life expectancy, at a micro level it is important that individuals' continue to experience good quality of life throughout their entire lifespan (McMurdo, 2000). At a macro level, many older adults have several chronic health conditions, resulting in this segment of the population having greater healthcare expenditure than other segments (Roux et al., 2008; Statistics New Zealand, 2004). An effective way of maintaining or increasing both physical and psychological health, and possibly reducing healthcare costs in later life is through regular physical activity (DiPietro, 2001; Westerp & Meijer, 2001). However, a large number of older adults are insufficiently active, engaging in less physical activity than is required for health-related gain (Drewnowski & Evans, 2001; McMurdo, 2000; Sport and Recreation New Zealand, 2008a). The primary healthcare setting has been found to be an effective setting in which to counsel older adults for physical activity (Armit et al., 2009; Kerse et al., 1999; Kerse et al., 2005; Kolt et al., 2007; Pinto et al., 2005).

The overall aim of this thesis was to provide a holistic view of the factors that can influence older adults' physical activity uptake and maintenance within the context of a physical activity intervention delivered through the primary care setting. Qualitative and quantitative research methodologies were employed for this research, as this thesis sought to obtain both participants' and practitioners' views and experiences of physical activity counseling. Findings for Study 1 were based on qualitative interviews that were carried out with 15 primary care physicians. Studies 2, 3, and 4 were substudies to the Healthy Steps randomised controlled trial, a study that was designed to increase physical activity via two different versions of the Green Prescription in 330 low-active, community-dwelling older adults.

All 15 primary care physicians who took part in Study 1 acknowledged the health-related benefits of physical activity. Some physicians were administering Green

Prescriptions as a form of primary prevention for individuals who were overweight, and thus, at risk for future health-related problems because of their inactive lifestyle. This finding is consistent with earlier research that has reported that overweight adults are more likely receive advice for physical activity engagement from their primary care physician (Croteau et al., 2006; Eakin et al., 2007a). Also, annual surveys that monitor Green Prescription use have reported that Green Prescriptions are issued for weight management purposes more than for any other condition (Sport and Recreation New Zealand 2008b; Sport and Recreation New Zealand, 2007a; Van Aalst & Daly, 2005a).

The majority of physicians in Study 1 were administering Green Prescriptions as a form of secondary treatment for chronic disease management for individuals who had preexisting chronic health conditions. Research shows that physicians are more likely to counsel their patients for physical activity after a patient presents with a condition (Bull et al., 1997; Croteau et al., 2006; Eakin et al., 2007a; Van der Ploeg et al., 2007; Wee et al., 1999). Also, there is some evidence that indicates that some physicians believe that physical activity counseling is more effective when it is directly linked to an existing condition (Gribben et al., 2000; Lawlor et al., 1999; van Sluijs et al., 2004).

These findings illustrate that physicians view physical activity, and specifically the Green Prescription programme as a form of valid medical treatment for either the prevention or management of chronic health conditions. In line with this finding, participants who took part in the barriers and motives study (Study 2) perceived that their health had improved as a result of completing the Green Prescription programme, a finding consistent with that of previous Green Prescription studies (Elley et al., 2003a; Kerse et al., 2005; Lawton et al., 2008).

Primary care physicians identified chronic health conditions as being the most salient barrier toward Green Prescription use with older adults. This finding was reinforced in Study 2, in which participants who reported having three or more chronic health conditions perceived more barriers for physical activity, compared to participants who reported no chronic health conditions. At the same time, the existence of multiple chronic health conditions also acted as motives for physical activity participation.

There is strong evidence that indicates that health and medical factors act as both barriers and motives for physical activity participation in older adults (Belza et al., 2004; Guerin et al., 2008; Kirkby et al., 1999; Kolt et al., 2004; Newsom & Kemps, 2007; Resnick & Spellbring, 2000; Schutzer & Graves, 2004). It has been argued (Newsom & Kemps, 2007) that older adults may be motivated to engage in physical activity to help manage their chronic health conditions, though, at the same time their chronic health conditions may limit their ability to engage in regular physical activity.

In relation to physicians' perceived barriers to Green Prescription use, time constraints of the consultation was the only barrier that was identified. Time constraints of the consultation have consistently been reported as one of the most salient barriers for physical activity counseling (Gribben et al., 2000; Kennedy & Meeuwisse, 2003; Lawlor et al., 1999; McKenna et al., 1998; Swinburn et al., 1997; Van Aalst & Daly, 2005a). Some physicians discussed how they dealt with this barrier. One physician mentioned that she delegated the more time consuming tasks to a patient support counselor. Two physicians mentioned that they have allowed practice nurses to administer Green Prescriptions.

Interestingly, physicians in Study 1 who did not (or no longer) prescribe physical activity through the Green Prescription programme perceived that the 'usual care' verbal advice they gave to their patients was just as effective as the Green Prescription programme. This view and practice fails to take into account the ongoing support that the patient support counselor provides for individuals through the Green Prescription Programme. For example, the prolonged and specialised support that individuals received from the Green Prescription patient support counselor was identified by some of the physicians who administer Green Prescriptions on a regular basis to be a salient benefit of the programme. Some physicians discussed how the patient support counselor had the time and skills to fully support individuals in initiating and maintaining their physical activity participation. The Green Prescription was also perceived to provide a safe way for older adults to engage in physical activity, as the patient support counselor could monitor older adults' physical activity engagement. Research also indicates that 'usual care' verbal advice for physical activity is

predominately general in content (e.g., mentioning to patients to engage in some physical activity) rather than specific advice (e.g., discussing type, frequency, intensity, and duration of activity) (Bull et al., 1997). Also, 'usual care' verbal advice does not encompass the ongoing support that individuals receive outside of a standard physician consultation if they are issued with a Green Prescription.

Overall, the prevalence of advice for either physical activity and exercise in general (e.g., 'usual care') or through the Green Prescription programme is very low in New Zealand, and tends to focus on secondary care (e.g., existence and treatment of at least one preexisting chronic health condition) (Croteau et al., 2006). A major issue still facing primary care practice in New Zealand, is that despite the evidence and acknowledgement that active prescriptions, such as the Green Prescription are an efficacious way of increasing physical activity in most segments of the adult population, the prevalence of Green Prescription use and general 'usual care' verbal endorsement for physical activity is low. Green Prescriptions tend to be issued predominantly as a form of secondary treatment, rather than as a form of primary prevention for individuals who are sedentary and low-active, and thus at risk for future health-related problems because of their inactive lifestyles (Croteau et al.).

All aspects of the telephone counseling component were rated highly by participants across both allocation groups. Telephone counseling was underpinned by the transtheoretical model of behaviour change (Prochaska & Marcus, 1994). The ongoing telephone support that participants received during the course of their Green Prescription was tailored to meet their individual stage of readiness for physical activity (i.e., in terms of frequency and intensity). Both Studies 2 and 4 highlighted the important role that the patient support counselor had in terms of providing ongoing external social support for physical activity. Findings from Study 4 indicated that participants perceived the telephone support they received from their patient support counselor as being helpful and relevant in aiding their physical activity. Earlier interventions designed to increase physical activity in low-active older adults via telephone-based counseling underpinned by the transtheoretical model of behaviour

change were effective over both a short and long-term period (Armit et al., 2009; Gillis et al., 2002; Kolt et al., 2007; Sepsis et al., 1995). Eakin et al. (2007b) have argued that the repeated 'booster' contact that telephone-based interventions provide, play a fundamental role in supporting the maintenance of behaviour change.

All 15 primary care physicians who took part in Study 1 perceived that the Green Prescription could be beneficial in the treatment and management of depression. Some physicians discussed how they use Green Prescription counseling in conjunction with antidepressant medication. For example, one physician mentioned that a lower dose of antidepressant medication could be administered if a patient was instructed to engage in daily physical activity or exercise. There is a growing body of empirical evidence that indicates that regular moderate-intensity aerobic physical activity is associated with a decrease in depressive symptomatology in both depressed and nondepressed adults, including older adults (Brown et al., 2005; Cassidy et al., 2004; Camacho et al., 1991; Galper et al., 2006; Harris et al., 2006; Kritz-Silverstein et al., 2001; Lampien et al., 2000). Consistent with the literature, Study 3 found that a significant increase in participants' physical activity was associated with a significant increase in mental health functioning (as measured by the SF-36 health measure) and a significant decrease in depressive symptomatology (as measured by the Geriatric Depression Scale) at postintervention and at the 12-month follow-up period.

Physical activity is infrequently used as a mainstream treatment for the management of depression despite empirical evidence for its effectiveness. Antidepressant medication is the most common form of treatment for depression. However, such medications can have adverse side effects (especially for older adults), and a higher relapse rate following termination of medication. In contrast, physical activity and exercise-based treatments are less likely to have 'side effects' and can be undertaken on a longterm basis. Also, physical activity benefits both psychological and physical health, and there is no negative stigma attached to engaging in regular physical activity (Blake et al., 2009; Kerse et al., 2008; Penninx et al., 2002). The Healthy Steps study provided empirical evidence for the effectiveness of Green Prescription use in

increasing mental health functioning and in decreasing depressive symptomatology in low-active, community-dwelling older adults. This finding can help inform how Green Prescriptions are used (e.g., issuing a Green Prescription for a patient who meets the diagnostic criteria for depression, or issuing a Green Prescription for someone who is showing signs of 'borderline' nonclinical depression).

In relation to the use of pedometers in health promotion, all 15 physicians who took part in Study 1 viewed pedometers as being helpful devices that could be used to encourage and facilitate more walking activity in their patients. Overall, pedometers were perceived to be motivational devices as they provided objective information regarding an individual's activity level. The objective step-count information that pedometers provided was perceived to be important, because it could make individuals aware of how little activity they were engaging in, and in turn, encourage them to engage in more walking activity. This finding is consistent with those of Study 4, which examined participants' views and experiences of pedometer use. Participants in the pedometer-based group rated the addition of a pedometer as being helpful in aiding their physical activity. The majority of participants in the pedometer-based group indicated that their pedometer made them aware of how active they were which in turn motivated them to walk more.

Study 4 demonstrated that both versions of the Green Prescription were rated by participants as being equally effective in supporting their physical activity. In relation to Study 2, barriers and motives did not significantly differ as a result of intervention allocation. Likewise, in relation to Study 3, general mental health functioning and depressive symptomatology did not differ significantly as a result of intervention allocation. These results suggest that the addition of a pedometer did not provide any additional motivational effect in relation to increased motives for physical activity in these older adults. The findings from this thesis combined with earlier Green Prescription research (Elley et al., 2003a; Lawton et al., 2008) can help inform public health policy and primary care practice in New Zealand, as these studies provide strong research-based evidence for the efficacy of Green Prescription use with older adults. At present in New Zealand, primary health care policies and practice is governed by the

Primary Health Care Strategy (Ministry of Health, 2001).

In brief, the Primary Health Care Strategy is a major public health reform that has changed the way that primary care services are delivered and funded in New Zealand (Cumming & Gribben, 2007). This strategy is designed to restore, maintain, and improve health at a population-based level (Ministry of Health, 2001). It is also designed to reduce health-related inequalities between different groups (e.g., ethnic groups, age-based groups). This strategy is underpinned by a focus on health promotion and preventive health approaches (Stewart & Haswell, 2007). There is a focus on a need for patient education and early detection for preventing the onset or progression of diseases. There is a focus on a need to implement and support programmes designed to change at risk behaviours (e.g., physical inactivity, poor nutrition, smoking and alcohol consumption) (Ministry of Health, 2007).

In line with the health promotion and preventive stance of the Primary Health Care Strategy, the Ministry of Health has stressed that physical activity is a key component in reducing the incidence and prevalence of lifestyle related, noncommunicable diseases and conditions that are more prevalent in later life (Ministry of Health, 2003b). In turn, this can positively impact on reductions in healthcare expenditure (Ministry of Health, 2003a). The Green Prescription programme has been identified by the Ministry of Health as being an initiative that should target low-active and sedentary older adults to ensure both reductions in the prevalence of noncommunicable diseases, and in reducing healthcare expenditure that results from such diseases and conditions (Ministry of Health, 2002; Ministry of Health, 2003b).

There is strong evidence for the efficacy of the Green Prescription programme across a variety of health domains. However, work still needs to be done in integrating the Green Prescription into the New Zealand healthcare system more fully as a form of primary prevention, rather than as secondary care treatment for chronic disease. To encourage and support physical activity prescription through the Green Prescription programme for older adults, larger scale structures need to be put into place. For example, modified physical activity guidelines are required in New Zealand for older

adults. This can help ensure that those aged 65 years and older obtain specific health-related benefits from physical activity for their age group. Also, policies need to be put into place that will encourage and aid primary care physicians to counsel older adults (and adults in general) for physical activity via the Green Prescription programme. Research shows that New Zealand primary care physicians counsel for physical activity at half the prevalence of their counterparts in countries such as Australia and the United States (Croteau et al., 2006). Population survey data has indicated that 3% of New Zealanders reported receiving a Green Prescription from their primary care physician in the past 12 months (Croteau et al., 2006). As the Green Prescription is a cost effective primary care physical activity intervention (Dalziel et al., 2006; Elley et al., 2004), the Ministry of Health should focus on how to expand the Green Prescription programme. This in turn, can help aid physical and psychological health in future generations of older adults, as well as help reduce healthcare expenditure.

Strengths and Limitations

A main strength of Study 1 is that a qualitative methodology was employed. This type of data analysis allowed for physicians to voice their views and experiences of physical activity counseling and Green Prescription use (Pitney & Parker, 2001; Sofaer, 1999). An open ended questionnaire was used to ensure that all participants were asked the same questions. However, the open-ended nature of the questionnaire allowed for a range of issues to be derived from the data. A possible limitation of Study 1 is that only a small number of physicians were interviewed, thus, generalising findings to the larger physician population may be problematic. However, the frequency of Green Prescription counseling differed between the 15 physicians (i.e., one physician had never administered a Green Prescription and had no plans to do so in the foreseeable future. Two other physicians had stopped administering Green Prescriptions, and another physician administered Green Prescriptions on an infrequent basis).

In relation to Studies 2, 3, and 4, data from the Healthy Steps randomised controlled trial was used. The participants who took part in the Healthy Steps study

were predominantly from the same ethnic group (e.g., Pakeha/European New Zealanders) and same geographical location. This raises issues around whether within-country generalisations can be inferred from the findings of this thesis. Research strongly indicates that some ethnic minority older adults have different views, attitudes and experiences of physical activity participation when compared to the dominant ethnic group of the particular country they reside in (Belza et al., 2004; Kalavar et al., 2004; King et al., 2000; Kolt et al., 2006a). While a single-ethnic, single-culture sample can have control advantages in terms of generalising findings, older adults are not a homogeneous group and there is variation in the experiences, attitudes and knowledge of those aged 65 and older in relation to physical activity engagement.

While participation in the larger Healthy Steps trial was voluntary, there is some indication that individuals who volunteer for health promotion research may be more concerned about their health-status compared to the general population (van Sluijs et al., 2004). Hence, these individuals may be more motivated to become and remain physically active compared to individuals in the general population.

A strength of Study 2 is that perceived barriers and motives for physical activity were examined within the context of a physical activity intervention that was designed for older adults. A possible limitation of Study 2 is the adequacy of the study questionnaire. The questionnaire was constructed for the purpose of this study and had therefore not been validated previously. However, the Cronbach alpha coefficients were sufficiently high, indicating good internal consistency of this instrument to quantify the perceived barriers and motives for physical activity in older adults.

A main strength of Study 3 is that it examined the effect that an existing, empirically validated nationwide physical activity intervention had on depressive symptomatology and general mental health functioning in a sample of low-active, community-dwelling older adults over a 12-month period. Physical activity, depressive symptomatology, and general mental health functioning were assessed and measured by validated measures. Also, this study was designed to control for a possible cluster effect, as data from only one individual from a spousal pair was analysed. A possible

limitation of this study is that participants were not from a depressed population. However, this study provided empirical evidence for the beneficial effect that a Green Prescription can have on psychological health-status in low-active, community-dwelling older adults.

A main strength of Study 4 is that it was designed to obtain participants' evaluative feedback concerning their experiences and views of the Green Prescription programme. This study was also designed to identify if participant evaluations differed as a result of allocation to two different versions of the Green Prescription programme (i.e., to obtain participants' views concerning the effect that a pedometer-based Green Prescription had in aiding their physical activity). In terms of possible limitations, a social desirability bias may have been evident. For example, participants may have felt that they needed to provide positive feedback. To try and counteract this, it was stated at the beginning of the questionnaire that we appreciated both positive and negative feedback, so that the intervention could be improved for future use. While this study had a high response rate, not all participants completed the process evaluation. It is not known how these non-responders may have rated the various intervention components.

Recommendations for Future Research

There is need for further research into the area of physical activity counseling, including Green Prescription use, and pedometer use in the primary care setting for low-active older adults. In view of the findings of this doctoral research and the existing literature, the following recommendations have been made:

1. A population-based study carried out with primary care physicians designed to identify and examine the circumstances under which physicians counsel for physical activity (i.e., patient characteristics) and prevalence of physical activity counseling, including Green Prescription use is required, as only one study has currently examined these factors (Croteau et al., 2006). Such a study should employ both a quantitative and qualitative research methodology.

2. Study 2 demonstrated that demographic factors, such as the existence of chronic health conditions, weight status, age, and also factors relating to social contact and support can effect physical activity participation in older adults. Future research should examine the role that these factors can have in relation to adherence to physical activity interventions, such as the Green Prescription programme.
3. Study 3 provided empirical evidence regarding the effectiveness of Green Prescription use in maintaining (and in some cases improving) mental health in low-active, (predominantly) nondepressed older adults ($n = 299$). To date, no research has been carried that has specifically examined the effect that a Green Prescription can have on specific mental health conditions such as depression with a clinically depressed population. Hence, it is recommended that a randomised controlled trial that involves both older adults who had a clinical diagnosis of depression versus non-depressed older adults be carried out. Such a study would provide research-based knowledge regarding the efficacy of Green Prescription counseling for clinically depressed older adults.
4. Study 4 demonstrated that both versions of the Green Prescription were perceived by participants to be equally effective in aiding their physical activity. Future studies can examine the potential benefits of pedometers to determine if different sub-groups of low-active older adults benefit from their use. For example, research in the form of controlled trials can be undertaken to examine the effect that pedometer use can have in aiding physical activity for older adults who have chronic health conditions, and weight problems (e.g., overweight and obese) and the effect that pedometer use can have on the physical activity levels of overweight, and obese older adults. The effect that pedometer use may have on physical activity engagement for different age categories of older adults (e.g., 65 to 75, 76 to 85 and 86 years and older), and also in relation to possible gender differences can also be explored.

Conclusions

This thesis was comprised of four interrelated studies that were designed to identify and examine the factors that can effect physical activity initiation and adherence in older adults. This thesis was also designed to examine the effect that physical activity had on mental health functioning. In line with findings from the Healthy Steps randomised controlled trial (N = 330), a prescription for physical activity administered by a primary care physician, combined with ongoing telephone-based support and supplemented with print materials for physical activity, with or without the aid of a pedometer was an effective way of significantly increasing and maintaining physical activity in previously low-active, community-dwelling older adults over a 12-month period. A pedometer step-based Green Prescription was both perceived and found to be as effective as the conventional time-based Green Prescription in aiding and maintaining physical activity. In relation to physical activity and mental health, both versions of the Green Prescription were efficacious in significantly increasing mental health functioning and in significantly decreasing depressive symptomatology over a 12-month period. Demographic factors relating to the existence of chronic health conditions, weight status, and age were found to significantly influence some barriers and motives for physical activity. This thesis provided further evidence that health and medical factors can act as both motives and barriers for physical activity participation in older adults. It appears that individuals with multiple chronic health conditions and those in the oldest age category perceive that they have more to gain from being physically active and completing the Green Prescription programme. In conjunction with the Healthy Steps study, the research carried out for this thesis has demonstrated that the Green Prescription is an efficacious intervention to use with older adults. The Green Prescription is designed to accommodate for demographic differences, such as the existence of chronic health conditions, weight status, and old age.

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APPENDICES

Appendix A Letter of Invitation with Fax Back Sheet for Study 1

March 2007



Dear Dr

My name is Asmita Patel, I am a PhD student at Auckland University of Technology working under the supervision of Associate Professor Grant Schofield and Professor Gregory Kolt and in collaboration with Associate Professor Ngaire Kerse, University of Auckland. My thesis is about the benefits of physical activity for older adults, especially when prescribed in primary care settings, with a focus on the Green Prescription (GRx). In particular I am interested in your views on the Green Prescription.

I wish to invite you to be a part of this research:

General Practitioners and Prescribing Physical Activity: A qualitative study

The Study is:

1. A simple face-to-face interview for approximately 20 minutes.
2. An opportunity to talk about issues, about dealing with physical activity prescription and exercise advice within the primary care setting.
3. An opportunity to express your views on the Green Prescription Programme .

I will contact your office by phone in the next few days. Please fax back the next page to Asmita Patel. Also attached is an Information Sheet.

Thank you for your time and consideration

A handwritten signature in black ink, appearing to read 'Ngaire Kerse', written in a cursive style.

Asmita Patel
MA (Hons), BA, PGDipHSc

Ngaire Kerse
FRNZCGP, PhD

Phone: 021 0604929 921-9999 extn 7250
Email: asmita.patel@aut.ac.nz

Please fax the note below, or call: 0210604929, 921-9999 extn 7250, or email asmita.patel@aut.ac.nz to let me know if you are interested in participating.

Fax To: Asmita Patel FAX # 921 9960 Pages (incl):
FROM: Dr Date:
I am interested in participating (circle)? Yes No

If yes, the best time to call to set up an appointment is?

Thank you

Participant Information Sheet



February, 2007

General Practitioners and prescribing physical activity: A qualitative study

Dear Dr

You are invited to take part in research being conducted by Asmita Patel, as part of her research for the Degree of Doctor of Philosophy at Auckland University of Technology, under the supervision of Associate Professor Grant Schofield and Professor Gregory Kolt.

We are interested in how General Practitioners prescribe physical activity within the general practice setting. Participation is voluntary.

If you choose to take part in this study, you will be interviewed by Asmita Patel. Your interview will be audio taped and is expected to take no more than 20 minutes. The time and place of the interview will be at your discretion. The interview will be transcribed by Asmita and only Asmita and her supervisors (Associate Professor Grant Schofield and Professor Gregory Kolt) will have access to this material, which will be stored in a secure place and which will be destroyed after a period of ten years.

If you chose to participate, you will have complete confidentiality, audiotape and written data will be number coded and the completed research will contain pseudonymous. Data will be analysed through thematic induction, (reading and re reading the

transcripts for themes) You have the right to withdraw up until the time of data analysis. You will have an opportunity to review and verify the themes.

At the conclusion of the research, if you would like a summary of the research findings you will be provided with one.

If you are interested in finding out more about this study or would like to participate, please contact Asmita Patel.

Researcher Contact Details:

Email: asmita.patel@aut.ac.nz

Phone: 021-0604929

921-9999 Extn 7250

Project Supervisor Contact Details: Associate Professor Grant Schofield

Email: grant.schofield@aut.ac.nz

Phone: 921-9999 Extn 7307

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, **Associate Professor Grant Schofield**.

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTECH, Madeline Banda, madeline.banda@aut.ac.nz , 921 9999 ext 8044.

Thank you for your time and consideration,

Approved by the Auckland University of Technology Ethics Committee on *4 December 2006*. AUTECH Reference number *06/185*.

Appendix C Participant Consent Form for Study 1

<h1>Consent Form</h1>	 AUT UNIVERSITY <small>TE WĀNANGA ARONUI O TAMAKI MAKAU RAU</small>
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Project title: General Practitioners' and prescribing physical activity:
A qualitative study

Project Supervisor: Associate Professor Grant Schofield

Researcher: Asmita Patel

- ☐ I have read and understood the information provided about this research project in the Information Sheet dated March 2007
- ☐ I have had an opportunity to ask questions and to have them answered.
- ☐ I understand that the interviews will be audio-taped and transcribed.
- ☐ I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- ☐ If I withdraw, I understand that all relevant information including tapes and transcripts, or parts thereof, will be destroyed.
- ☐ I agree to take part in this research.
- ☐ I wish to receive a copy of the report from the research (please tick one):
Yes ☐ No ☐

Participant's signature:

.....

.....

Participant's name:

.....

.....

Participant's Contact Details (if appropriate):

.....

.....


.....

.....

Date:

Approved by the Auckland University of Technology Ethics Committee on 4 December 2006. AUTEC Reference number 06/185

Appendix D: Interview Schedule for Study 1

Study One: GP Interview Schedule	 AUT UNIVERSITY TE WĀNANGA ARONUI O TAMAKI MAKAU RAU
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Physical Activity (PA) in the General Practice

(How PA is dealt with within the practice setting and within daily consultations).

(The first area I'm interested in is on PA or exercise and the practice setting. I have some questions to guide me):

Firstly I'm interested in finding out how you give out exercise advice to your patients?
What type of advice?

Pedometers

(Primary Care Physicians/General Practitioners (GPs) views on the role that pedometers can have in health promotion).

What role do you think pedometers have in health promotion?

How do you think a pedometer can help a patient who has a GRx prescription for walking?

Have you recommended or endorsed pedometer use with your patients?

Would you consider doing this? (if they answered 'no' to question 3).

Have you yourself used a pedometer?

Green Prescription (GRx)

(Explore GPs attitudes around the Green Prescription (GRx), their knowledge of it, their use of it, perceived barriers, benefits and suggestions).

Are you familiar with the GRx?

How did you hear about the GRx?

Tell me how you prescribe exercise through the GRx scheme?

How often do you write GRxs?

As a GP what barriers do you encounter when thinking about writing out a GRx for a patient?

What actual barriers do you encounter with patients when you write out a GRx for them? (patients barriers to the GRx)

How do you deal with these barriers?

Can you remember if you write them more for a particular condition or age group?

Older Adults (65 and older and the GRx)

Do you write GRxs for older adults (65 and older)?

And for what conditions?

As a GP what barriers do you encounter when thinking about writing a GRx for an older patient (65 and older)?

What actual barriers do you encounter with older patients when you write out a GRx for them?

How do you deal with these barriers or issues?

Mental Health/Depression and GRx use

What are your thoughts on GRxs been written for MH conditions, such as depression?

Do you prescribe them for such conditions (what specific conditions)?

Do you find that is effective and how so?

General GRx Questions

There are differing thoughts in relation to whether a GRx is designed more to prevent a condition or to manage a condition, what are your thoughts?

Overall what do you feel are the benefits of GRx use?

Do you receive GRx newsletters, support information and research findings?

How is this information helpful or unhelpful?

Any suggestions for improvement?

What type of professional support is there within the medical community for the use of GRxs?

Do you write out a GRx on the GRx pad or do you use a computerized GRx?

Media

What role do you think the media should have in health promotion?

GPs Own PA Levels

(To identify GPs own PA levels, past, present and future PA goals).

Do you yourself engage in a sport, or recreational activity such as walking?

What type of activity or sport?

How often?

Or have you done so in the past

Demographic Questions

What age bracket do you fall in: 25-35, 36-45, 46-55, 56-65, 66-75?

Which ethnic group do you identify with?

What country did you qualify in?

Year of registration?

Number of years as a practicing GP?

How many years have you been at this practice?

**Participation Information Sheet
for
Healthy Steps: Barriers and
Motivators to Physical Activity**



2007

Dear

You are invited to take part in a survey relating to the Healthy Steps Green Prescription Programme in which you participated. We are conducting a survey that is designed to identify possible motivating factors, as well as possible barriers that may have effected how you felt about doing exercise while you were enrolled in the Healthy Steps Programme. This information will be used to help in the planning and design of future physical activity studies. Participation is voluntary. All responses will be treated confidentially. No one will be individually identified in any reporting of this survey (your name will not be associated with your comments in any way).

This survey will be conducted over the telephone, and will involve a series of short questions, in which you are asked to agree or disagree with some statements that are read out. It should take no longer than 15 minutes.

This research is being conducted by Asmita Patel, as part of her research for the Degree of Doctor of Philosophy at Auckland University of Technology, under the supervision of Associate

Professor Grant Schofield and Professor Gregory Kolt. Only Asmita and her supervisors (Associate Professor Grant Schofield and Professor Gregory Kolt) will have access to this material, which will be stored in a secure place and which will be destroyed after a period of ten years

At the conclusion of the research, if you would like a summary of the research findings you will be provided with one.

If you are interested in finding out more about this study, please contact Asmita Patel.

Researcher Contact Details:

Email: asmita.patel@aut.ac.nz
921-9999 Extn 7250

Project Supervisor Contact Details:

Associate Professor Grant Schofield
Email: grant.schofield@aut.ac.nz
Phone: 921-9999 Extn 7307

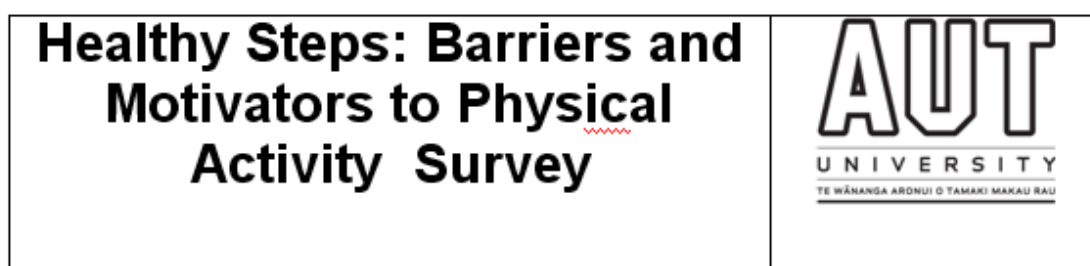
What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, **Associate Professor Grant Schofield**.

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTECH, Madeline Banda, madeline.banda@aut.ac.nz, 921 9999 ext 8044.

Thank you for your time and consideration,

Appendix F: Interview Schedule and Verbal Consent for Study 2



Participant ID:

Participant Allocation:

Information about the Study

Hello, my name is Asmita Patel, I am calling from AUT in regard to the Healthy Steps Green Prescription study you took part in. In relation to the Healthy Steps study, we are conducting a survey that is designed to identify possible motivating factors, as well as possible barriers that may have effected how you felt about doing exercise while you were in this study.

I would like to ask you the questions over the phone. This should take no more than 15 minutes. All it will involve is a series of short question, in which you are asked to agree or disagree with some statements I read out.

Participation is entirely voluntary. Are you interested in participating?

If YES

All your responses will be treated confidentially. No one will be individually identified in any reporting of this survey. Your name will not be associated with your comments in any way.

This research is been carried out by myself (Asmita Patel) as part of my research requirements for my PhD at AUT, under the supervision of Associate Professor Grant Schofield and Professor Gregory Kolt. Only

myself and my two supervisors will have access to this material, which will be stored in a secure place and which will be destroyed after a period of ten years.

-Do you have any questions about this survey research?

Verbal Consent

-Would you like to participate in this survey?

Yes ☐ No ☐

-At the conclusion of the research, if you would like a summary of the research findings you will be provided with one.

-Would you like a summary of the findings?

Yes ☐ No ☐

Remember participation is voluntary and you can stop at anytime. Also if you come to a question that you would prefer to not answer, just let me know and I'll skip over it.

Motivators Section: The following is a list of possible reasons that helped motivate some people to become physically active and follow their Green Prescription. For each question please indicate how much each of these items influenced your own activity level by agreeing or disagreeing with the follow statements.

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
1. I wanted to be physically active for medical reasons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I wanted to be physically active to alleviate pain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I wanted to be physically active to keep my joints mobile	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I wanted to be physically active to keep healthy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. The Green Prescription was Enjoyable and I had fun doing my prescribed activity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. My family/friends/colleagues wanted me to be physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I wanted to be physically fit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I liked being active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I liked getting out of the house	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I wanted the challenge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
11. I liked doing something I was good at	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. The phone support I received helped keep me motivated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. I had someone to walk/ exercise with	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. The Green Prescription provided me with an opportunity for social interaction or a way to meet new people	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The following is a list of possible outcomes or feelings that people may have experienced as a result of engaging in physical activity. Now that you have completed your Green Prescription programme, for each question or statement please indicate your level of agreement or disagreement.

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
1. I feel better about myself	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I feel more in control of my life	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I have a new or renewed confidence in myself	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I feel happier	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I have more energy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I feel more relaxed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I feel fitter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I feel that my memory has improved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I now sleep better	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I have lost weight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. I have maintained my Weight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I felt that the Green Prescription helped to improve my health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Barriers Section: The following is a list of things that kept some people from carrying out their Green Prescription as much as they would have liked to. For each question please indicate how much each influenced your activity level during the time that you were enrolled in the Healthy Steps Green Prescription Programme by either agreeing or disagreeing with each question or statement.

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
1. I always felt too tired	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I had no time due to family responsibilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I had no time due to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. My health problems kept me from being physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I experienced pain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I couldn't afford it	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I had no facilities in my area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I found it hard to stick to a routine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I did not feel motivated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. It was of no interest to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. I had no one to do physical activities with	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
12. I found my neighbourhood to be unsafe for walking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. I felt too old to be physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Others discouraged me from being physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. I could not find the time to be physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Housework kept me from being physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. I find physical activity uncomfortable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. I felt too out of shape to start being physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. I felt too out of shape to continue being physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. I felt I was too overweight to be physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. I don't like to sweat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. I don't like feeling out of breath	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
23. I don't like other people seeing me being physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Physical activity takes too much effort for me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Fear of injury kept me from being physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. The weather kept me from being physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Participation Information Sheet for Healthy Steps: Green Prescription Participant Satisfaction Survey



2007

Dear

You are invited to take part in an evaluation of the Healthy Steps Green Prescription Programme in which you participated. The attached questionnaire consists of a participant satisfaction survey in which you are asked to answer short questions relating to the different aspects of the Healthy Steps programme in which you were enrolled.

The aims of the Healthy Steps study were to look at how the Green Prescription could change people's physical activity, health and healthcare costs, and to see whether any improvements could be made to the Green Prescription to make it more effective. Research has shown that physical activity engagement such as walking can help prolong independence and well-being in individuals aged 65 and older. The Healthy Steps Study was funded by the Health Research Council of New Zealand.

Three hundred and fifty older adults participated in the Healthy Steps Study. Participants were selected by chance to either receive the usual Green Prescription or to receive an altered version of the Green Prescription.

During the course of your participation in the Healthy Steps Study you would have received three home visits from an AUT research officer. At these home visits information was gathered about your

activity levels, mobility and general health. During this time you would have also received telephone support for your Green Prescription. You would have also completed monthly falls, injuries and expense calendars. Information from the home visits and calendars showed us how your physical activity and health changed over time, and which Green Prescription Programme was better at helping people.

Participation is voluntary. All responses will be treated confidentially. No one will be individually identified in any reporting of this survey (your name will not be associated with your comments in any way).

This survey research is being conducted by Asmita Patel, as part of her research for the Degree of Doctor of Philosophy at Auckland University of Technology, under the supervision of Associate Professor Grant Schofield and Professor Gregory Kolt. Only Asmita and her supervisors will have access to this material, which will be stored in a secure place and which will be destroyed after a period of ten years.

Completion of the attached questionnaire will be taken as indication of your consent to participate in the survey.

At the conclusion of the research, if you would like a summary of the research findings you will be provided with one.

If you are interested in finding out more about this study, please contact Asmita Patel.

Researcher Contact Details:

Email: asmita.patel@aut.ac.nz

Phone: 921-9999 Extn 7250

Project Supervisor Contact Details:

Associate Professor Grant Schofield

Email: grant.schofield@aut.ac.nz

Phone: 921-9999 Extn 7307

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Associate Professor Grant Schofield.

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTECH, Madeline Banda, *madeline.banda@aut.ac.nz*, 921 9999 ext 8044.

Thank you for your time and consideration,

Approved by the Auckland University of Technology Ethics Committee on 17 August 2007 AUTECH Reference number
07/89

Appendix H: Interview Schedule for Study 4: Time-Based Participants

Healthy Steps: Green Prescription Participant Satisfaction Survey	 AUT UNIVERSITY TE WĀNANGA ARONUI O TAMAKI MAKAU RAU
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Participant ID:

Allocation: C

I

Thank you for taking the time to complete this survey. We are conducting this survey to help find out your thoughts on the effectiveness of the Healthy Steps Green Prescription programme, and how you feel it can be improved in the future. All of your responses will be treated confidentially. No one will be individually identified in any reporting of this survey.

It is important that you share both your positive and negative feedback in this survey, so that we can improve the service we provide to others. Your honesty is appreciated and valued. Once completed, please send this survey back in the reply paid envelope supplied.

Completion of this questionnaire will be taken as indication of your consent to participate in this survey.

Principal Researcher Contact Details

Associate Professor Grant Schofield
Faculty of Health and Environmental Sciences
Auckland University of Technology
Private Bag 92006
Auckland 1020
Phone: (09) 921-9999, Extension 7307
Email: grant.schofield@aut.ac.nz

Asmita Patel, PhD Student Contact Details

Faculty of Health and Environmental Sciences

Faculty of Health and Environmental Sciences

Auckland University of Technology

Private Bag 92006

Auckland 1020

Phone: (09) 921-9999, Extension 7250

Email: asmita.patel@aut.ac.nz

1. To let us know your thoughts on your GP appointment for your Green Prescription, could you please answer the following questions by ticking the appropriate box for each question.

Would you say that:	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Don't Recall
a. The appointment with my doctor/nurse for the Green Prescription was a positive experience	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. I felt that my doctor/nurse adequately discussed what type of physical activity was best for me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. As part of the Green Prescription programme you received telephone support calls. To let us know what you thought about the service and support you received from your telephone support person, please answer the following questions by ticking the appropriate box.

Would you say that:	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Don't Recall
a. Overall the phone support I received motivated me to be physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. The advice I was given was helpful and relevant to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. The physical activity suggested was appropriate for me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. The phone support person was supportive and understanding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. A good overall level of service and support was provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. What could your phone support person have done better to improve the service and support provided for you while you were enrolled in the Green Prescription programme? (Please write your answer in the box).

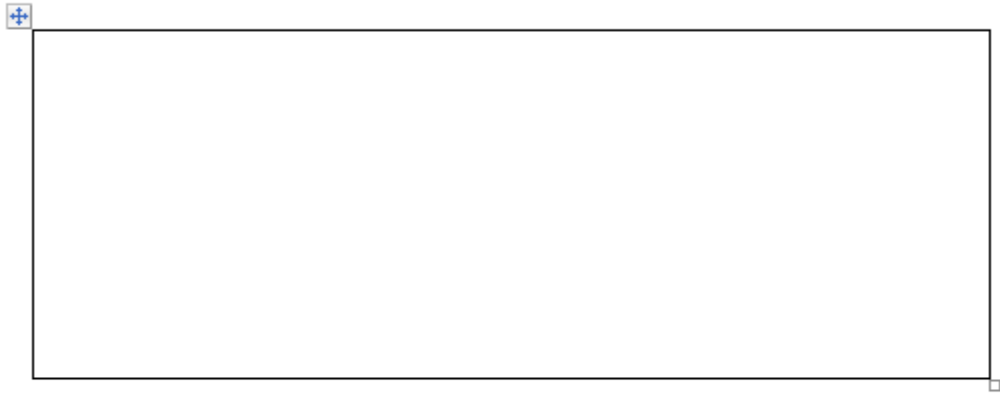
4. While enrolled in the Green Prescription programme, you were likely to have received some pamphlets from your phone support person. For the following questions, please think about what encouraged you to become active. Answer each question by ticking the appropriate box.

Would you say that these encouraged you to become active:	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Did not Receive
a. Healthy Weight- Healthy Life Pamphlet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Stretching pamphlet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Medical conditions and Physical Activity pamphlet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Water Activities pamphlet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. The following section is designed to find out what you thought about the Healthy Steps: Green Prescription programme that you have been enrolled in. For each question please tick the appropriate box and provide comments were possible.

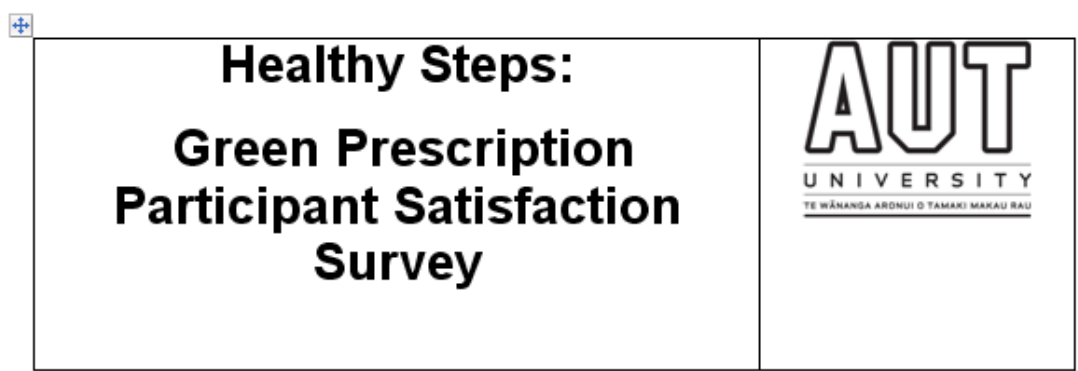
Would you say that:	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Don't Recall
a. I was comfortable in answering the questions that the AUT research officer(s) asked me at my home visits	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. I did not mind having to complete my monthly Falls and Expenses Calendar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Overall I was satisfied with the Healthy Steps Green Prescription programme	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. As a result of participating in this programme, I am now more active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. Are there any other comments you would like to add? (please write in the box).



Thank you for your time and assistance.
Please return the completed survey in the Freepost AUT envelope provided.

Appendix I: Interview Schedule for Study 4: Pedometer Participants



Participant ID:

Allocation: |

Thank you for taking the time to complete this survey. We are conducting this survey to help find out your thoughts on the effectiveness of the Healthy Steps Green Prescription programme, and how you feel it can be improved in the future. All of your responses will be treated confidentially. No one will be individually identified in any reporting of this survey.

It is important that you share both your positive and negative feedback in this survey, so that we can improve the service we provide to others. Your honesty is appreciated and valued. Once completed, please send this survey back in the reply paid envelope supplied.

Completion of this questionnaire will be taken as indication of your consent to participate in this survey.

|

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1. To let us know your thoughts on your GP appointment for your Green Prescription, could you please answer the following questions by ticking the appropriate box for each question.

Would you say that:	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Don't Recall
a. The appointment with my doctor/nurse for the Green Prescription was a positive experience	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. I felt that my doctor/nurse adequately discussed what type of physical activity was best for me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. As part of the Green Prescription programme you received telephone support calls. To let us know what you thought about the service and support you received from your telephone support person, please answer the following questions by ticking the appropriate box.

Would you say that:	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Don't Recall
a. Overall the phone support I received motivated me to be physically active	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. The advice I was given was helpful and relevant to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. The physical activity suggested was appropriate for me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. The phone support person was supportive and understanding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. A good overall level of service and support was provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. What could your phone support person have done better to improve the service and support provided for you while you were enrolled in the Green Prescription programme? (Please write your answer in the box).



4. While enrolled in the Green Prescription programme, you were likely to have received some pamphlets from your phone support person. For the following questions, please think about what encouraged you to become active. Answer each question by ticking the appropriate box.

Would you say that these encouraged you to become active:	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Did not Receive
a. Walking log for pedometer step counts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Pedometer information booklet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Healthy Weight-Healthy Life Pamphlet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Did Not Receive
d. Stretching pamphlet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Medical conditions and Physical Activity pamphlet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Water Activities pamphlet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. As part of the Green Prescription programme you would have received a Pedometer, the following are statements that people often make after wearing their pedometer. Please rate how much you agree or disagree with each statement by ticking the appropriate box.

Would you say that:	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Don't Recall
a. My pedometer made me aware of how active I was	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. My pedometer helped me to be more active, take more steps	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. My pedometer helped me to walk more	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. My pedometer was always accurate in recording my steps	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. I could easily secure my pedometer to my clothing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. My pedometer was comfortable to wear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. My pedometer measured all my activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

h. Do you still wear your pedometer?

Always Most of the time Occasionally Rarely ever Never

☐
☐
☐
☐
☐

6. The following section is designed to find out what you thought about the Healthy Steps: Green Prescription programme that you have been enrolled in. For each question please tick the appropriate box and provide comments were possible.

Would you say that: **Strongly Agree** **Agree** **Not Sure** **Disagree** **Strongly Disagree** **Don't Recall**

a. I was comfortable in answering the questions that the AUT research officer(s) asked me at my home visits

☐
☐
☐
☐
☐
☐

b. I did not mind having to complete my monthly Falls and Expenses Calendar

☐
☐
☐
☐
☐
☐

c. Overall I was satisfied with the Healthy Steps Green Prescription programme

☐
☐
☐
☐
☐
☐

d. As a result of participating in this programme, I am now more active

☐
☐
☐
☐
☐
☐

7. Are there any other comments you would like to add? (please write in the box).

A large, empty rectangular box with a thin black border, intended for the respondent to write any additional comments.

Thank you for your time and assistance.

Please return the completed survey in the Freepost AUT envelope provided.

Appendix J: Geriatric Depression Scale (Study 3)

Study ID: _____

GDS-15

Instructions: Choose the best answer to describe how you have felt over the past week.

0 = no 1 = yes

Score

- | | |
|---|--------------------------|
| 1. Are you basically satisfied with your life? | <input type="checkbox"/> |
| 2. Have you dropped many of your activities and interests? | <input type="checkbox"/> |
| 3. Do you feel that your life is empty? | <input type="checkbox"/> |
| 4. Do you often get bored? | <input type="checkbox"/> |
| 5. Are you in good spirits most of the time? | <input type="checkbox"/> |
| 6. Are you afraid that something bad is going to happen to you? | <input type="checkbox"/> |
| 7. Do you feel happy most of the time? | <input type="checkbox"/> |
| 8. Do you often feel helpless? | <input type="checkbox"/> |
| 9. Do you prefer to stay at home, rather than going out and doing new things? | <input type="checkbox"/> |
| 10. Do you feel you have more problems with memory than most? | <input type="checkbox"/> |
| 11. Do you think it is wonderful to be alive now? | <input type="checkbox"/> |
| 12. Do you feel pretty worthless the way you are now? | <input type="checkbox"/> |
| 13. Do you feel full of energy? | <input type="checkbox"/> |
| 14. Do you feel that your situation is hopeless? | <input type="checkbox"/> |
| 15. Do you think that most people are better off than you are? | <input type="checkbox"/> |

Appendix K: SF-36 Health Questionnaire (Study 3)



Healthy Steps SF36 Questionnaire

INSTRUCTIONS:

This questionnaire asks for your views about your health, how you feel and how well you are able to do your usual activities.

If you are unsure about how to answer a question, please give the best answer you can.

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

(circle one)

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

2. Compared to one year ago, how would you rate your health in general now?

(circle one)

- | | |
|--|---|
| Much better now than one year ago..... | 1 |
| Somewhat better now than one year ago..... | 2 |
| About the same as one year ago..... | 3 |
| Somewhat worse now than one year ago..... | 4 |
| Much worse now than one year ago..... | 5 |

3. The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

(circle one number on each line)

<u>ACTIVITIES</u>	Yes, Limited A Lot	Yes, Limited A Little	No, Not Limited At All
a. Vigorous activities , such as running, lifting heavy objects, participating in strenuous sports	1	2	3
b. Moderate activities , such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
c. Lifting or carrying groceries	1	2	3
d. Climbing several flights of stairs	1	2	3
e. Climbing one flight of stairs	1	2	3
f. Bending, kneeling or stooping	1	2	3
g. Walking more than one kilometre	1	2	3
h. Walking half a kilometre	1	2	3
i. Walking 100 metres	1	2	3
j. Bathing or dressing yourself	1	2	3

4. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?



(circle one number on each line)

	YES	NO
a. Cut down on the amount of time you spent on work or other activities	1	2
b. Accomplished less than you would like	1	2
c. Were limited in the kind of work or other activities	1	2
d. Had difficulty performing the work or other activities (for example, it took extra effort)	1	2



5. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

(circle one number on each line)

	YES	NO
a. Cut down on the amount of time you spent on work or other activities	1	2
b. Accomplished less than you would like	1	2
c. Didn't do work or other activities as carefully as usual	1	2

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours, or groups?

(circle one)

Not at all..... 1
 Slightly..... 2
 Moderately..... 3
 Quite a bit..... 4
 Extremely..... 5

7. How much bodily pain have you had during the past 4 weeks?

(circle one)

No bodily pain.....	1
Very mild.....	2
Mild.....	3
Moderate.....	4
Severe.....	5
Very severe.....	6

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?
(circle one)

Not at all.....	1
A little bit.....	2
Moderately.....	3
Quite a bit.....	4
Extremely.....	5

9. These questions are about how you feel and how things have been with you during the past 4 weeks. 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 past 4 weeks -

(circle one number on each line)

	All of the Time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	None of the Time
a. Did you feel full of life?	1	2	3	4	5	6
b. Have you been a very nervous person?	1	2	3	4	5	6
c. Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
d. Have you felt calm and peaceful?	1	2	3	4	5	6
e. Did you have a lot of energy?	1	2	3	4	5	6
f. Have you felt down?	1	2	3	4	5	6
g. Did you feel worn out?	1	2	3	4	5	6
h. Have you been a happy person?	1	2	3	4	5	6
i. Did you feel tired?	1	2	3	4	5	6

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

(circle one)

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

11. How TRUE or FALSE is each of the following statements for you?

(circle one number on each line)

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
a. I seem to get sick a little easier than other people	1	2	3	4	5
b. I am as healthy as anybody I know	1	2	3	4	5
c. I expect my health to get worse	1	2	3	4	5
d. My health is excellent	1	2	3	4	5

ENGLISH (AUSTRALIA/NEW ZEALAND)

SF-36

7/94

IQOLA SF-36 English (Australia/New Zealand)
Version 1.0