1-1-2009

Self-determination theory in motivation to adopt physical activity in older adults: A community based approach

Alastair Stewart
Edith Cowan University

SELF-DETERMINATION THEORY IN MOTIVATION TO ADOPT PHYSICAL ACTIVITY IN OLDER ADULTS: A COMMUNITY BASED APPROACH

Alastair Stewart
Bachelor of Science (Sports Science) Honours

This thesis is presented in fulfilment of the requirements for the degree of Doctor of Philosophy (Sports Science)

Faculty of Computing, Health, and Science
Edith Cowan University

March 2009

USE OF THESIS

ABSTRACT

Australia has an increasingly aging population with increasing levels of physical inactivity. The potential detrimental effects of these two factors on the health of the community highlight the need to investigate methods to increase physical activity in older Australian adults. The study reported in this thesis formed part of the PATH (Physical Activity Time for Health) Project, a community-based research trial that compared two strategies to increase physical activity in underactive, 60-80 year old men (n = 66) and women (n = 188). Twelve recreation centres were randomised to either a supervised group based walking intervention with behavioural change components, or a self-managed/usual care intervention. Participants in behavioural intervention centres were asked to complete 150mins/week of moderate intensity physical activity as a supervised walking program, organised as 3 sessions/week for the first 3-months and then 1 supervised and 2 unsupervised walk sessions/week for the second 3-months. Participants in self-managed centres were asked to complete 3 sessions of moderate intensity physical activity (150mins/week) for 6 months.

In this thesis I have investigated the efficacy of Self-Determination Theory (SDT; Deci, 1980) to explain motivation of older adults to adopt physical activity. There were three sub-purposes. First, to determine the effect of the behavioural intervention compared with the self-managed approach on psychosocial, physiological, and physical activity outcomes. Second, to investigate the contributions of psychosocial predictors to adherence and physical activity level across the self-managed and behavioural intervention strategies. Third, to estimate the directional relationships between self-determination constructs and adherence using path analysis. The physical activity outcomes measured in this study were retention, adherence and total physical activity level. Retention was defined as the number of participants in the study after 6 months. Adherence was defined as the number of exercise sessions completed over the 6 months. Total physical activity level was measured using the Physical Activity Scale for the Elderly (PASE; Washburn, Smith Jette, & Janney, 1993).

At baseline the behavioural intervention program had 138 participants, compared to 116 participants in the self-managed condition. After 6 months the behavioural intervention program had retained 84% of these participants, compared to 67% in the self-managed condition. With respect to adherence there was no significant

difference between participants in the behavioural intervention compared to those in the self-managed condition (67.7% and 59% of sessions, respectively). The total physical activity level (related closely to the adherence score) also did not differ between conditions (114.69 and 115.87 for the behavioural intervention and self-managed groups, respectively).

The major and novel finding of this study was that social connectedness was a significant factor in the engagement of older adults in physical activity. This was evidenced by the increases in social connectedness in the behavioural intervention group, compared to decreases in social connectedness reported in the self-managed group. Furthermore, structural equation modelling demonstrated that social connectedness, compared to physical self-perceptions and autonomy, was the only significant predictor of adherence.

This study also found that self-perceptions outside the physical domain can have as important a role in exercise behaviour as physical self-perceptions. Structural equation modelling provided further support for this proposition showing adherence was more strongly related to social self-perceptions than physical or cognitive self-perceptions after the intervention. Also, lower perceptions of physical appearance and higher perceptions of nurturance were associated with higher total physical activity levels at 6-months

This study confirms previous research and contributes novel findings demonstrating the importance of social connectedness in physical activity behaviour in older adults. Further it provides strong evidence for the ability of physical activity to influence multiple aspects of the lives of older adults. These findings have implications for health practitioners and development of policy and programs to increase physical activity. Employing Self-Determination Theory has further elucidated motivation for exercise in older adults and provided novel findings to support inclusion of socially based components into physical activity promotion campaigns for older adults.

DECLARATION

I certify that this thesis does not, to the best of my knowledge and belief:

(i) incorporate without acknowledgment any material previously submitted for a degree or diploma in any institution of higher education.

(ii) contain any material previously published or written by another person except where due reference is made in the text; or

(iii) contain any defamatory material.

I also grant permission for the Library at Edith Cowan University to make duplicate copies of my thesis as required.

Signature: …………………………………….

Date: ……………………………..

ACKNOWLEDGEMENTS

Undertakings of this nature are not done alone. I would first like to thank my supervisors Dr. Elizabeth Rose and Dr. Kay Cox for their dedication and effort (no more quick questions, I promise). I would also like to thank Dr. Val Burke and Associate Professor Sybe Jongeling for their statistical assistance. It was greatly appreciated. Special thanks to Professor Ian Puddey and Professor Laurie Beilin for providing advice in the early stages and their ongoing encouragement. My thanks to the other Chief Investigators of the PATH Project, Dr. Robert Donovan and Professor Bob Grove. Also thank you to Dr. Kuki Singh for her assistance in the final write up. My gratitude extends to my scholarship providers Healthway and the Grand Lodge of West Australian Freemasons, also to the sponsors of the PATH Project (Healthway, Police and Nurses Credit Society, and The Water Corporation).

To the many participants, mentors, recreation centres and local governments involved in this study, thank you for giving freely of your time. Without these people this study would not have been possible. To the PATH Project research assistants and volunteers Tammy, Jacqui, Joanne, Eddie, Ruth, Joan, and Chipper, your effort was much appreciated. Special thanks to all the staff on level 3 at the MRF, and ECU School of Exercise, Biomedical, and Health Sciences. To my fellow students Messi, Mike, Wai, Sandy, Kerry, Noel, Jason, Doris, Gerard and Denise, thank you all for the encouragement and advice. Special thanks to Bharat Nepal and Peter Rampellini for making me feel welcome in my new workplaces.

For their past, present and future support I would like to thank my parents Ruth and Alan Stewart and my brothers, Geoff, Al and Mikey. Extra special thanks goes to Nan Jean and Nan Cath and all of my extended family for their encouragement. Finally, I would like to thank my fiancé Kym for her uplifting love and encouragement.

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE: INTRODUCTION

Background

The ancient Greek physician, Hippocrates (c 460-351B.C.), recognised that "If we could give every individual the right amount of nourishment and exercise, not too little and not too much, we would have found the safest way to health" (Hippocrates, trans. 1952). As western society is experiencing a demographic shift toward an ageing population, maintaining a physically active lifestyle into older adulthood is more relevant now than ever before. The Australian Medical Association, with respect to older adults and physical activity, has stated that the "…ageing population warrants a specific focus on increasing the functional capacity (and independence) of people as they age. Participation in physical activity by older people can improve bone health, reduce falls, and improve psychosocial well-being" (Australian Medical Association Position Statement on Physical Activity, 2006).

Currently the number of persons aged 60 years or over is expected to increase globally, from 672 million in 2005 to nearly 1.9 billion by 2050 (*United Nations World Population Prospects: The 2004 Revision, Volume III: Analytic Report.* 2006 United Nations Publication). Declining physical activity levels plus an aging population is likely to increase the burden of chronic disease related to sedentary behaviour in many countries. Overall, it is estimated that chronic diseases will account for 35 million deaths from a projected total of 58 million deaths in 2005, far outweighing other types of disease (Preventing Chronic Diseases: A Vital Investment: WHO Global Report, 2005 World Health Organisation Publication).. Premature death places a significant economic and social burden on many developed and developing countries (Stephenson, Bauman, Armstrong, Smith, & Bellew, 2000). In order to address the problems

associated with chronic disease caused by sedentary living, numerous pharmacological interventions, dietary changes, and physical activity lifestyle modifications have been proposed. It is well established that high levels of physical activity in older adults are associated with reduced risk of preventable lifestyle diseases (Iestra, 2005; Taylor et al., 2004). Therefore, higher physical activity levels could potentially lessen the economic and social impact of preventable lifestyle disease.

Recent statistics show that 89.8% of Australians 60 years and over are aware that 30 minutes of walking on most days is sufficient to realise health benefits (Bull, Milligan, Rosenberg, & MacGowan, 2000). However, only 48.9% are sufficiently active to reduce the risk of developing chronic lifestyle diseases (Bull et al., 2000). A follow-up survey in 2003 reported that 51.4% of this population were still not sufficiently active enough to confer health benefits (McCormack, Milligan, Giles-Corti, & Clarkson, 2003), indicating a trend toward sedentary lifestyles in older Australian adults. Within Australia the estimated health care costs of chronic diseases attributable to physical inactivity is approximately $377 million per year (Stephenson, Bauman, Armstrong, Smith, & Bellew, 2000). Therefore, if these sedentary lifestyle patterns in Australia's ageing population continue, there is the distinct possibility they may place a significant economic and social burden on Australian society.

With respect to Australian older adults this study: (a) tested two strategies designed to improve their physical activity behaviour; (b) investigated motivation for change in their physical activity behaviour; and (c) employed Self-Determination Theory (SDT) to explain the process of their behavioural change.

It has been recognised that in order to effectively change physical activity behaviours, interventions should be designed with a sound theoretical basis. Furthermore, for researchers to understand behavioural changes, the theories in question must also propose a process of change. Social Cognitive Theory (Bandura, 1986), the

Health Belief Model (Becker & Maiman, 1975), Theory of Reasoned Action (Fishbein & Ajzen, 1975), Theory of Planned Behaviour (Ajzen & Madden, 1986) and the Transtheoretical Model (Prochaska & DiClemente, 1983) have all been used, with varied success, to explain motivation in physical activity. One theory that has had limited application to older adults' physical activity behaviour is Self-Determination Theory (SDT) (Deci & Ryan, 1985) (Figure 1). The major advantage SDT affords researchers is the premise that motivation is a process of internalising behaviours that are affected by the environment. Through acknowledging the interaction between the person and the environment (as well as internal psychosocial constructs), SDT represents an inclusive framework for explaining motivation to change physical activity behaviour.

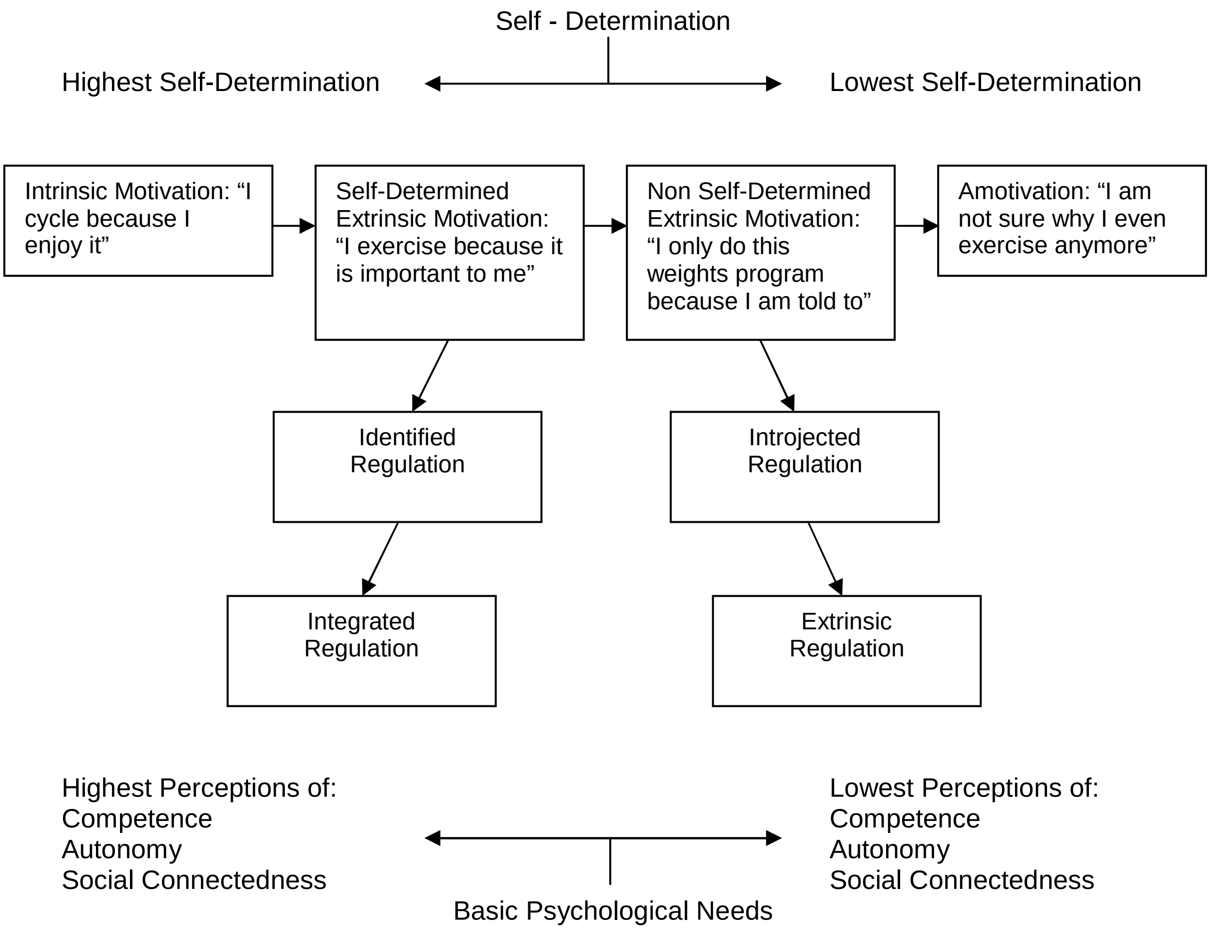


Figure 1. Schematic diagram of Self-Determination Theory (Deci & Ryan, 1985) adapted to apply to physical activity.

Central to SDT is the concept of a continuum from low to highly self-determined motivation. The lower self-determined motivations are amotivation and extrinsic motivations. As the regulation of the behaviour becomes more internalised by the individual, the type of extrinsic motivation can be classified as more self-determined but remains extrinsic in origin. According to Deci and Ryan (1985) motivation can only be defined as intrinsic if (a) the need for competence and self-determination are being fulfilled, and (b) a sense of inherent pleasure is present. It is the non-fulfilment of both these needs, and the absence of inherent pleasure that define behaviours in the extrinsic domain.

Self-Determination Theory includes two sub-theories: Cognitive Evaluation Theory (CET) and Organismic Integration Theory (OIT). Cognitive Evaluation Theory affords researchers an explanation of the variability in intrinsic motivation by emphasising the social and environmental factors that can enhance or undermine intrinsic motivation (Ryan & Deci, 2000). Proponents of CET argue that if conditions are right, then intrinsic motivation will flourish. Specifically, autonomy supportive environments conducive to the development of competence are more likely to create intrinsic motivation for an action (Ryan & Deci, 2000). There is research to show that feelings of competence are more likely to augment intrinsic motivation, if they are accompanied by autonomy (Fisher, 1978; Ryan, 1982). While CET highlights the importance of autonomy and connectedness, SDT also stresses the importance of relatedness in the development of intrinsic motivation for action. Self-Determination Theory hypothesises that intrinsic motivation for action can be developed through interpersonal relationships over the lifespan, when occurring in the presence of a sense of relatedness (Deci & Ryan, 2000). Organismic Integration Theory details the forms of extrinsic motivation and contextual factors that promote or hinder internalisation and

integration of the regulation of behaviours (Deci & Ryan, 2000). Proponents of OIT argue that motivation lies along a continuum from low to high self-determination. The lowest, in terms of autonomy, competence and relatedness, is amotivation (the far right box in Figure 1). Amotivation is exemplified by either no action in response to a situation, or when action occurs it is without intent (Deci & Ryan, 2000). This results from a combination of not valuing the activity and not expecting the action to yield any desired outcome. Within OIT four types of extrinsic motivation are placed after amotivation along a continuum of increasing self-determination. Extrinsically motivated behaviours that are least self-determining are termed extrinsically regulated. The next type of extrinsically motivated behaviour involves taking in an extrinsic regulation but not fully owning or agreeing with it. These are termed introjected regulations, and are typified by behaving out of guilt, anxiety, or to gain pride or recognition (Deci & Ryan, 2000). Following on from this a more self-determining extrinsic motivation is regulation through identification. In this case behaviour occurs as a result of conscious acknowledgement of the importance of that behaviour (Deci & Ryan, 2000). The most self-determining form of extrinsic motivation is integrated regulation. This occurs when previously identified regulations have become fully internalised and congruent with a person's values and needs (Deci & Ryan, 2000). Actions typified by integrated regulation share many characteristics in common with intrinsic motivation. The difference is behavioural regulations that are integrated with the self are still done to attain discrete outcomes rather than for inherent pleasure or joy (Deci & Ryan, 2000).

Perception of competence is the first construct important to SDT. There is evidence to suggest that older age is associated with lower perceptions of physical abilities (Franzoi & Koehler, 1998), indicating a potential age-related decline in perceived competence. While it has been demonstrated in that regular physical activity

can increase self-esteem, self-efficacy, and perceptions of physical health across adulthood (Fillipas, Oldmeadow, Bailey, & Cherry, 2006; Fox, 1999; Martin-Ginis, Latimer, Brawley, Jung, & Hicks, 2006), there is little research investigating the relationship between the adoption of physical activity and perceptions of competence social and cognitive domains.

The second construct that is central to SDT is autonomy. High autonomy in older adults has been associated with improved mental health (Hwang, Lin, Tung, & Wu, 2006) and lower autonomy with poorer mental health (Couture, Lariviere, & Lefrancois, 2005) in cross-sectional studies. In addition, regular physical activity can increase physical function and independence in the elderly, thus leading to potential increases in autonomy (Brach, Simonsick, Kritchevsky, Yaffe, & Newman, 2004; Capodaglio et al., 2005; Marsh et al., 2006). While the relationship between autonomy and exercise adoption in younger populations has been gaining popularity in the research literature (Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005; Hassandra, Goudas, & Chroni, 2003; Standage, Duda, & Ntoumanis, 2003), few studies have investigated its importance in exercise with older adults.

The third construct thought to be relevant to SDT is social connectedness. While related social constructs (social support) have been identified as mediators of adherence in exercise interventions, it has been difficult to demonstrate the significant role they might play (McAuley, Jerome, Elavsky, Marquez, & Ramsey, 2003; Oka, King, & Young, 1995). Lee and Robbins (2000) postulate that social connectedness, while similar to other social constructs, may offer a better explanation for social relationships. The authors propose that social connectedness is an internally driven construct, and unlike social support it is not as reliant on external sources. Therefore it may be more advantageous to investigate social constructs from an internal perspective rather than being dependant on the presence of social support. Additionally, the need

for connectedness is developed from an early age and is present, to some extent, in all people. Social connectedness or relatedness has received little application to physical activity adoption in older populations and it is thought that it may be more relevant to physical activity adoption than social support alone (Lee & Robbins, 2000).

It has been consistently demonstrated that regular physical activity can have many physiological and psychological benefits in older adults (Blumenthal & Gullete, 2002; King, Taylor, & Haskell, 1993; Taylor et al., 2004). One aspect of physical health in older adults that may have some application is functional fitness. Studies show that the ability to perform Physical Activities of Daily Living (PADL) are essential to good physical and mental health as people age, and are strongly related to physical activity levels (Bravo et al., 1996; King, Pruitt, Oka, Rodenburg, & Haskell, 2000; Lazowski et al., 1999; Newman et al., 2006). As the ultimate purpose of a physical activity intervention is to affect changes in health, it is essential that valid measures of fitness or physical health are incorporated.

A meta-analysis of physical activity studies revealed that there were significant gender, socio-economic status, and environmental effects on physical activity participation (Trost, Owen, Bauman, Sallis, & Brown, 2002). Trost et al (2002) were able to show that these three factors were potential covariates that could impact on the effectiveness of physical activity interventions. It is therefore important that any study investigating physical activity behaviour take these variables into account.

Reviews of physical activity interventions in older populations have identified some of the key limitations in physical activity research. These include poor study design, untested outcome measures, a lack of integrated theoretical frameworks, small sample sizes, not employing an intention to treat analysis, and few control group comparisons (Conn, Minor, Burks, Rantz, & Pomeroy, 2003; King, Rejeski, & Buchner, 1998; Van Der Bij, Laurant, & Wensing, 2002). In addition, other reviews

(Brassington, Atienza, Perczek, DiLorenzo, & King, 2002: Martin & Sinden, 2001) have highlighted the lack of research into behavioural mediators of adherence and physical activity level. The authors of these reviews go on to argue that just because a behavioural intervention is more effective compared to a control does not mean that model adequately explains the behavioural outcome.

In order to address some of these limitations the present study employed: (a) a behavioural change package developed by Cox, Gorely, Puddey, Burke, and Beilin (2003) based on the Transtheoretical Model (Prochaska & DiClemente, 1983); (b) an intention to treat principle for adherence; (c) a cluster randomised controlled design; and (d) validated outcome measures. In the past there have been few attempts to test the directional pathways for changes in physical activity behaviour. Hence this thesis sought to contribute to the literature by employing a path analytic technique to establish the relevance of psychosocial constructs in SDT, and their relationship to the outcome behaviour.

The research in this thesis was carried out as part of a larger research trial called the PATH (Physical Activity Time for Health) project. The aim of the PATH Project was to compare the effectiveness of two strategies to increase regular physical activity in older Australian adults in a community setting. While there has been justifiable concern over the psychosocial health and development in childhood, adolescence and early adulthood, little is known of the motivation for physical activity adherence in older Australian adults. Therefore, the aim of this thesis was to investigate the efficacy of Self-Determination Theory to explain the motivation of older adults to adopt physical activity in a 6-month community-based program using two different strategies to promote physical activity.

Purpose and Hypotheses

The main purpose of this thesis was to examine the role of Self-Determination Theory in explaining the motivation of older adults to adopt physical activity in an intervention utilising two different approaches. There were three sub-purposes to this study.

The First Purpose and Hypotheses

The first purpose of the study was to determine the effect of a behavioural intervention compared with a self-managed approach on psychosocial and physiological outcomes in the adoption of physical activity. The psychosocial variables included: (a) self-perceptions; (b) social connectedness; (c) autonomy; and (d) exercise motivation domains. Hypotheses 1(a), 1(b), 1(c) and 1(d) were generated from this purpose.

Hypothesis 1(a)

A 6-month behavioural intervention exercise program will be more effective at improving physical self-perceptions, self-determined and intrinsic exercise motivation, autonomy and social connectedness than a self-managed exercise program.

Hypothesis 1(b)

Retention, adherence, and physical activity level will be higher after a behavioural intervention exercise program compared to a self-managed exercise program.

Hypothesis 1(c)

A behavioural intervention exercise program will result in greater reductions in weight, BMI, waist and hip girth, and waist-to-hip ratio compared to a self-managed exercise program of similar duration.

Hypothesis 1(d)

Compared to a self-managed exercise program, participation in a behavioural intervention exercise program will lead to greater improvements in functional fitness.

The Second Purpose and Hypotheses

The second purpose of the study was to investigate the relative contribution of psychosocial predictors of adherence and physical activity score across the behavioural intervention and self-managed exercise programs. Hypotheses 2(a), 2(b), and 2(c) were developed from this purpose.

Hypothesis 2(a)

High levels of physical self-perceptions, self-determined motivation, and intrinsic motivation will be associated with higher adherence, while higher amotivation and extrinsic motivation will be associated with lower adherence.

Hypothesis 2(b)

Higher physical self-perceptions, self-determined motivation, and intrinsic motivation will be related to higher 6-month total physical activity, while higher amotivation and extrinsic motivation will be related to lower 6-month total physical activity.

Hypothesis 2(c)

Higher physical self-perceptions, self-determined motivation, and intrinsic motivation will be associated with higher 6-month leisure time physical activity, while higher amotivation and extrinsic motivation will be associated with lower 6-month leisure time physical activity.

The Third Purpose and Structural Equation Models

The third purpose of this study was to estimate the directional relationships between self-determination constructs and adherence. To achieve this, structural equation modelling and path analysis were employed. From this purpose three separate structural equation models were hypothesised.

Structural Equation Model 1

Structural equation model 1 is presented as a pathway model in Figure 3. In this model it is proposed that physical self-perceptions and distance from the recreation centre will directly and indirectly affect adherence through amotivation, non self-determined, self-determined and intrinsic motivation at baseline.

Structural Equation Model 2

Structural equation model 2 is presented as a pathway model in Figure 4. In this model it is proposed that baseline physical self-perceptions, autonomy and social connectedness will directly affect adherence. While the strength of these pathways is unknown, it is hypothesised that physical self-perceptions will be more closely associated to adherence when compared to autonomy and social connectedness.

Structural Equation Model 3

Structural equation model 3 is presented as a pathway model in Figure 5. In this model it is proposed that adherence will be most strongly related to self-perceptions in the physical domain at 6-months, and to a lesser extent may be related to scores in the social and cognitive domains at 6-months.

Definition of Terms

Self-Determination

Deci defines self-determination as "…people's flexibility and capacity to both choose from among behavioural options (regardless of the number of options) and to accommodate to the situations in which only one option is available" (1980, p. 6). Conversely a person can be said to be non self-determining "…if one behaves automatically by not considering the various behavioural options when they do exist or by not accommodating and responding flexibly when only one behavioural option exists" (Deci, 1980, p.6).

Intrinsic Motivation

Intrinsic motivation was defined as the inherent predisposition to explore one's boundaries and seek out new experiences and challenges (Deci& Ryan, 2000). These inherent tendencies are ever-present and motivate ongoing thoughts and behaviours unless interrupted by basic drives or emotions. These needs lead people to seek out and conquer challenges and to engage in activities for the inherent pleasure of doing so with no thought for reward and no form of external pressure. Fundamental to intrinsic motivation is a sense of autonomy coupled with high perceptions of competence or self-

esteem. Motivational theorists (Harter, 1999; Ryan & Deci, 2000) view intrinsic motivation as crucial to long-term performance or engagement in a task.

Extrinsic Motivation

For this study, extrinsic motivation referred to the need to engage in activities for the purposes of obtaining some external reward or in response to external pressures. Extrinsic motivation involves greater responses to external cues and involves behaviours that are separated or divorced from the rewards and accompanying feelings (Deci, 1980). Moreover, in extrinsically motivated people there is an external locus of control, rewards are contingent, and self-esteem and competence are often low.

Amotivation

Amotivation was introduced by Deci (1980) who characterised it as non-activity. Deci (1980) maintained that amotivated people could not perceive a relationship between outcomes and behaviour. Therefore amotivated behaviour would be characterised as action without any form of governing regulation. People operating in this motivational subsystem may feel helpless, incompetent and out of control. They may have very low levels of self-esteem, competence and self-determination.

Self-Perception

In the present study self-perceptions are defined as "attributes or characteristics of the self that are consciously acknowledged by the individual through language – that is, how one describes oneself" (Harter, 1999, p. 3). In employing the Adult Self-Perceptions Profile (Messer & Harter, 1989) it was possible to investigate the domain specific self-perceptions of older adults. These domains were (a) sociability, (b) job competence, (c) nurturance, (d) athletic abilities, (e) physical appearance, (f) adequacy

as a provider, (g) morality, (h) intimate relationships, (i) intelligence, and (j) sense of humour (Messer & Harter, 1989). Furthermore, the current study also investigated global self-worth in older adults which is described as the overall value one places on oneself. For the purposes of this study the term perceived competence was used interchangeably with self-perception as both require the individual to place a level of importance on the domain and judge their own abilities in that domain. Perceived competence is viewed as an underlying psychological need in Deci and Ryan's Self-Determination Theory (Ryan & Deci, 2000) in much the same way as Harter (1978) and previously White (1959) viewed self-perceptions in Competence Motivation Theory. Deci and Ryan maintain that perceived competence is absolutely essential for any type of motivation to occur (Deci & Ryan, 2000).

Autonomy

A person is said to be autonomous when "his or her behaviour is experienced as willingly enacted and when he or she fully endorses the actions in which he or she is engaged and/or the values expressed by them" (Chirkov, Ryan, Kim, & Kaplan, 2003, p. 99). Within SDT, autonomous behaviours are defined as those consistent with the values and beliefs of the individual (Deci, 1980) and should not be confused with terms such as independence or locus of control.

Social Connectedness

In the present study social connectedness is defined as "an attribute of the self that reflects cognitions of enduring interpersonal closeness with the social world *in toto.*" (Lee, Draper, & Lee, 2001, p. 310). Social connectedness (also termed relatedness or belongingness) is distinguishable from concepts such as social support and loneliness that are examinations of relationships at a contextual level.

Adoption Phase

The consensus among researchers of physical activity behaviour change is that the adoption describes the period of taking up physical activity and that this phase takes 6 months to complete (Marcus et al., 1992). This is consistent with the Stages of Change model. There are 5 stages in the adoption phase: pre-contemplation, contemplation, preparation, action and maintenance (Prochaska & DiClemente, 1983). Prochaska, DiClemente, & Norcross (1992) later proposed a sixth stage called termination. It has been shown that people in earlier stages of change will move into later stages throughout the period of the exercise intervention, provided the intervention lasts at least three months (Marcus et al., 1992; Marcus et al., 2006). Although related the term adherence should not be confused with adoption. In the context of this study adherence is measure of how well participants met the target amount of physical activity, i.e. the number of sessions a participant completed over the course of the intervention.

Level of Physical Activity

Level of physical activity was measured using the Physical Activity Scale for the Elderly (PASE) (Washburn, Smith, Jette, & Janney, 1993). This is a one-week physical activity recall questionnaire designed specifically for older adults. The PASE defines physical activities as the physical act of all occupational, exercise and leisure pursuits. Multiplying the time spent on each particular activity by validated item weights, and summing them, will result in the PASE score (Washburn et al., 1993).

Recreation Centre

State and local government recreation centres were included in this study. Suitable recreation centres were defined as having: (a) administration support; (b) services provided all year round; (c) recreational facilities and programs; (e) a program of activities that includes, or could be adapted to include older adult; (f) accessible information on their activities; and (g) not recently conducted walking programs for seniors.

Intention to Treat

The measure of adherence in this study was based on the principle of an intention to treat, where by the adherence data from participants who withdrew from the study, as well as those who stayed, is included in the data analysis. In cases where a participant has withdrawn from the study, the total number of sessions recorded for that participant is taken as their adherence score. It is argued that this method gives a true measure of the effect of an intervention as to remove the adherence data of participants who withdrew from the study can result in an artificial inflation of adherence results (King et al., 1998). Lewis and Machin (1993) maintained that intention to treat should be regarded as a strategy for the design and conduct of a trial, rather than as an approach to statistical analysis. It was this approach that was taken in the design of present study and treatment of the adherence data.

Limitations

1. There were some local governments that, as a result of financial constraints, had only the capacity to conduct the intervention with one cohort.

2. Due to financial constraints, one recreation centre allocated to the behavioural intervention group had to charge a higher fee per session in two of their cohorts, compared to other recreation centres.
3. It is possible that, as recruitment was from a general appeal to the public, only those interested in participating in a physical activity program responded to the call for participants.
4. Excluding the exercise diaries, it was not possible to collect post-intervention data on participants who withdrew during the intervention.
5. The psychosocial and physical activity data was collected using self-report questionnaires and interviews. It is acknowledged that there are limitations due to the potential inaccuracy, unreliability and bias of self-report data and interviews.
6. It is recognised that not all variables impacting physical activity adherence are investigated in this study. Where possible, confounding variables were accounted for.
7. This study was designed to test the effectiveness of two interventions, (i.e., compare two groups). As it was deemed that a null intervention control group would be unethical, such a group was not included in this study. Therefore, it was also inappropriate to employ statistical procedures that rely on the presence of a null intervention control group to test the hypotheses in this study. The general linear modelling employed in this study compares the differences between groups, post intervention, while adjusting for the baseline values. In adjusting for baseline values the increase (or decrease) from baseline is compared between groups.
8. Structural equation modelling is limited to determining the strength of a relationship between two variables. The direction of the relationship is based

on previous research and an *a priori* hypothesis. Causality cannot be inferred from this statistical procedure.

9. The structural equation models presented in this study are only three possible models that may fit the data; many more could exist. Only models with a theoretical background were tested.

10. The investigation was limited to the adoption phase (the first 6 months) as it was behavioural changes in this period that were of interest.

11. Due to the complex nature of the data collection (multi-site collection points) this study relies on quantitative data for analyses. Qualitative data could have provided additional information about participants' motivations for physical activity adoption. Incorporating additional qualitative measures had the potential to over-burden the participants.

12. This study was a cluster randomised controlled trial; that is, recreation centres were used for treatment randomisation, not participants. This form of randomisation depends on the size of the cluster, not the number of participants. For this reason there may have been insufficient power to detect potentially significant differences between groups on some measures.

13. It is acknowledged that gender is an influential covariate in physical activity trials. Where possible the effect of gender on the dependent variables has been taken into account.

14. Due to resource constraints it was not feasible to establish the relative impact of individual components of the behavioural intervention. Therefore the findings of this study only apply to this behavioural intervention when implemented in its entirety.

15. It is recognised that there is a risk of committing a type I error when conducting more than one type of statistical procedure with one sample.

However, given the magnitude of this study it is not possible to conduct a separate study for each of the three stated purposes. Therefore, as each purpose is conceptually different so are the statistical procedures used to analyse them. This thesis uses one approach to test for intervention effects, a different approach to test for basic linear relationships between psychosocial variables, and a different approach again to establish the predictors of adherence. This reduces the likelihood of committing a type I error to an acceptable level.

16. The decision to include overactive participants (N = 30) was born of the necessity to ensure continuation of the project in certain centres. Therefore the decision was made to relax some measure of experimental control. While the effect of this cannot be quantified, it was thought that the influence would be minimal as the overactive participants were still below the target amount (150mins/wk), and spread across several cohorts in the six behavioural intervention centres.

Delimitations

1. The geographical source of local governments was delimited to those within the Perth metropolitan area, as was the source of participants.
2. The study delimited local governments to those able to run at least one cohort.
3. The study was delimited to include only recreation centres that were staffed during normal business hours, had physical activity programs on offer to the public, and were under the control of local governments.

4. The inclusion criteria of the study delimited the participants to underactive, healthy older adults and may limit the ability to generalise findings to the overall population.
5. Due the nature of the data collection, all psychological questionnaires were administered to participants in take-home packs, not under the supervision of the investigators.

Significance

From a research perspective this study adds important findings to the literature on older adult's motivation to adopt regular physical activity. Prior to the current study, there was no research known to the author that investigated the efficacy of Self-Determination Theory in explaining the motivation to adopt regular physical activity in Australian older adults. By testing the efficacy of a newly applied motivational theory in physical activity adoption, this thesis can add significant original findings to the literature and direct future research toward a new theory of motivation in physical activity adoption. Additionally, utilising Self-Determination Theory can add significantly to our understanding of behaviour change as related to physical activity in older adults. The present study represents one of the few physical activity intervention studies to conduct a cluster randomised controlled comparison of two intervention strategies. Furthermore, in this study there was rigorous evaluation of objective outcome measures, such as functional fitness, in the respective intervention strategies. The practical design of the present study means that findings will be relevant to organisations engaged in changing the physical activity behaviour of older adults for the better.

This study evaluates current recommendation of 150 minutes of physical activity per week. Therefore, findings from this study may be very relevant to health

practitioners. From a practical perspective, the results can provide information for health promotion and physical activity practitioners of behaviourally based, scientifically validated strategies to increase physical activity in Australian older adults. The strategies employed in the PATH Project could also be implemented and tested both nationally, and internationally. Furthermore, the conclusions drawn from this study can be used to inform new strategies developed by health promotion practitioners and physical activity advocates. Lastly, this study represented one of very few community-based interventions aimed at increasing physical activity in older adults. Due to the applied nature of this study, there is now the potential for local governments to conduct their own physical activity promotion activities utilising strategies that have been rigorously evaluated.

Original Contribution

It is often now the case for many studies in exercise behaviour to involve a significant number of organisations and key investigators. As such, PhD candidates who desire to undertake studies in this field need to be able to delineate the original contribution their thesis makes. This section has been included to delineate the original contribution of the author. First, the overall objectives of the parent project are outlined followed by the objectives of this thesis. Second, an outline of the work engaged in by the author is presented. Third an outline of the collaborative nature of the study is presented.

The first objective of the PATH Project was to evaluate the effect of 2 approaches on the initiation, adherence and maintenance of physical activity in older adults. The second objective was to assess changes in a number of physical health measures. The present thesis was concerned with the underlying psychosocial processes that contributed to the adoption of physical activity during 6-months

participation in a self-managed compared to a behavioural intervention physical activity program.

The formulation of theoretical concepts, data collection and analysis, framing of the hypotheses, selection of methods and analytic procedures used in this study were the work of the author. The author of this thesis was also responsible for the design, implementation, analysis and interpretation of the pilot study. The author was also responsible for the development and testing of the hypotheses presented in the main body of this thesis. Lastly, the planning and conducting of data collection for the measures used in this thesis was the responsibility of the author.

The PATH Project represented not only a novel approach to physical activity intervention testing, but also collaboration between two major universities, non-government health agencies, and state and local government authorities. The hypotheses, method, and choice of analytical procedures used in this thesis were designed prior to contacting the external agencies involved in this study. Local governments did provide support in allowing the research to be conducted in their recreation centres, and other agencies provided funding through a scholarship program.

CHAPTER TWO: REVIEW OF LITERATURE

Introduction

Physical inactivity is one of the most important risk factors contributing to the development of lifestyle disease in Australian older adults. It is estimated that by the year 2030 the percentage of Australians over 65 will rise from 2.3 million to 4.9 million (Kinsella & Volkov 2001, p. 126-129). The low level of physical activity in this aging population is likely to have a significant financial and sociological impact on Australian society (Stephenson et al., 2000). Changing the sedentary behaviours of the older population may help reduce some of this impact. As the likelihood of maintaining a sufficient level of physical activity decreases with age (McCormack, Milligan, Giles-Corti, & Clarkson, 2003) it becomes crucial to address the important psychosocial aspects that underlie the adoption of physical activity in the older adult population.

In this thesis the review of literature will focus first on the application of motivational theories to explain physical activity behaviour in older adults under the headings (a) human behaviour and physical activity, and (b) psychosocial theories and models in physical activity. The second section deals with Self-Determination Theory and the related constructs of self-perceptions, autonomy and social connectedness under the headings (a) self-determination theory, (b) self-perceptions, (c) autonomy, and (d) social connectedness. In the third section, the covariates to adherence and importance of functional fitness in older adults are discussed under the headings (a) socio-economic status, gender and environment as covariates to adherence, and (b) functional fitness. The fourth section of the review will discuss the literature concerning behavioural based physical activity interventions in older populations under the heading behavioural physical activity interventions. Lastly, the application of structural equation modelling

to exercise behaviour research, and the underlying basis for the hypothesised models presented in this study will be presented under the heading background to the hypothesised models. Figure 2 outlines the organisation of the literature review.

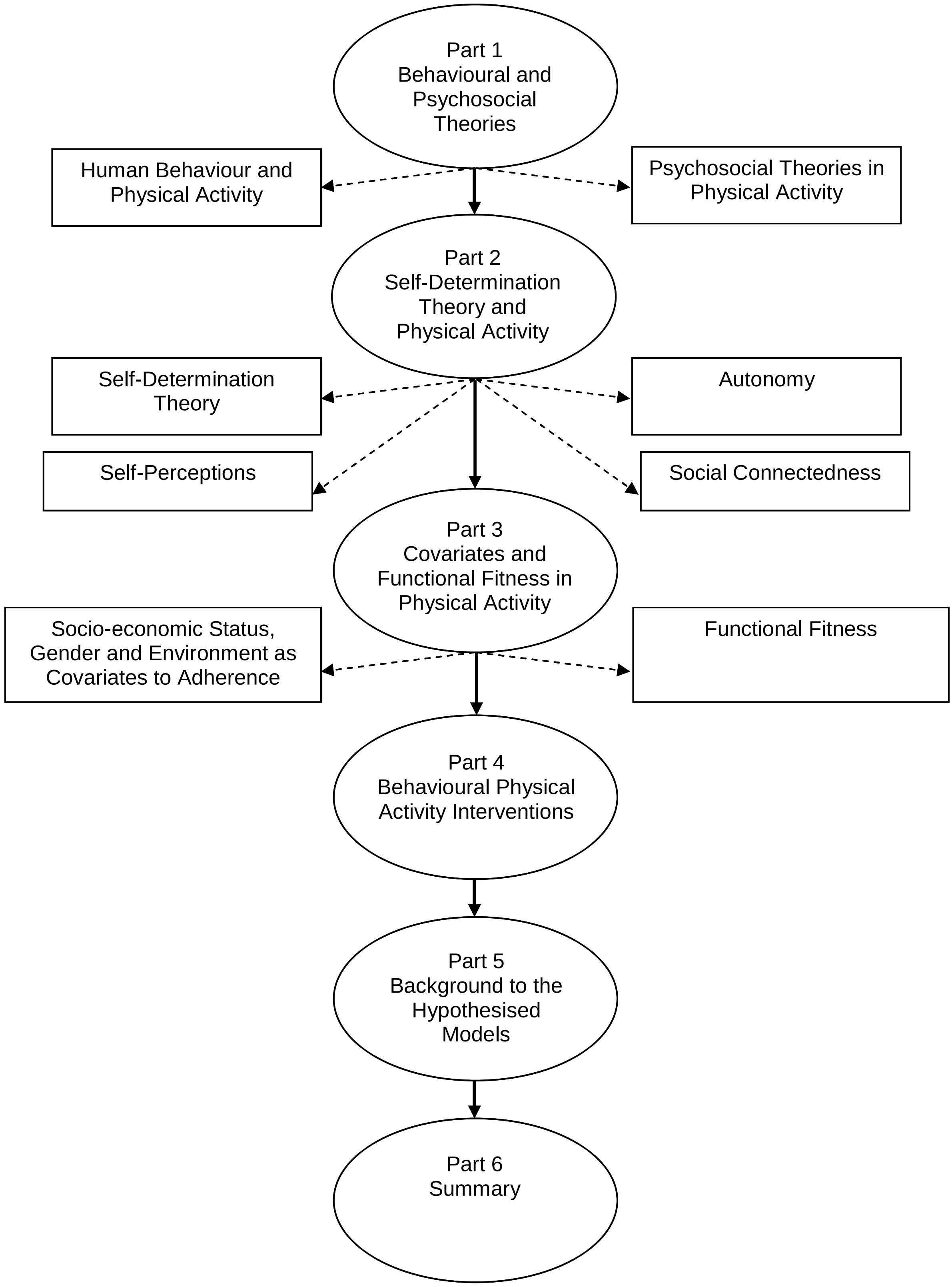


Figure 2. Graphic representation of the literature review structure.

Theories such as Social Cognitive Theory (Bandura, 1986), the Health Belief Model (Becker & Maiman, 1975), Theory of Reasoned Action (Fishbein & Ajzen, 1975), and the Transtheoretical Model (Prochaska & DiClemente, 1983) offer explanations as to why people engage or take up regular physical activity. These theories focus on internal psychological and physical processes, external sociological and environmental influences, or a combination of both. Each theory has strengths and shortcomings and the outcome being measured often depends on the point of view of the researcher. One behavioural theory that has received little attention in the literature on aging and physical activity is Self-Determination Theory (SDT) (Deci & Ryan, 1985). Self-Determination Theory can provide a sound platform upon which to examine exercise behaviour in older adults. Moreover, SDT may provide a strong theoretical basis for the development of physical activity intervention strategies for older populations.

Human Behaviour and Physical Activity

Many perspectives on the nature of human behaviour have been employed to develop a deeper understanding of why people behave the way they do. While the predictive potential of many theories have been well established, only recently have studies attempted to examine how and why behaviours change (Marcus et al., 2006). Environmental perspectives of human motivation offer significant predictive capability. According to an environmental perspective, human behaviour is dictated by external stimuli (Deci, 1980). These stimuli are observable and measurable, qualities highly valued as research variables. However, the environmental view neglects the role of cognition, or the person oriented perspective. From the person oriented perspective behaviour is determined by the internal mental process engaged in by the individual

when presented with specific environmental stimuli (Deci, 1980). Take for example, John, a retired businessman recently diagnosed with type 2 diabetes. John's local council have just developed a new state of the art multi-purpose walk/cycle trail around the local park. So John decides to use this to go for a 30 minute walk every morning. From an environmental external perspective John's diagnosis and the provision of a walk trail dictated John's behaviour; that is, going for a walk. If John were asked why he went for a walk he might say *to get healthy*. A person oriented perspective would then try to understand John's desire, or motivation, to get healthy. When asked, the response John gives can be used to determine why John is motivated to get healthy. Examples of internal cognitions related to John's exercise behaviour may be verbalised in responses such as (a) I feel guilty if I don't, because I know that I should (a non self-determined extrinsic motivation), (b) exercising will let me live long enough to see my grandchildren grow up (a self-determined extrinsic motivation), or (c) I enjoy the surroundings and the feeling regular exercise gives me (an intrinsic motivation).

Understanding how these internal constructs affect the exercise behaviour of older adults, and the relationship with environmental stimuli, can give researchers greater understanding of how to affect positive changes in behaviour. Self-Determination Theory takes the position that in order to fully comprehend, and potentially affect changes in human behaviour the interaction between the person and the environment must be understood and examined. It also is recognised that some behaviours are easier to change than others. Deci (1980) outlined three types of behaviour; automatic, automatized, and self-determined. Automatic behaviours are based on the fulfilment of non-conscious motives provided the person is disposed towards a response that fulfils said motive. Automatized behaviours, while similar, are more easily changed as they are based on the fulfilment of a conscious motive. Self-determined behaviours represent those most readily changed as they involve a conscious

decision making process and are based on information from the environment interpreted by the individual. In addition, self-determined behaviours fulfil human needs for competence, autonomy and relatedness. Shifting people from a state of automatized sedentary behaviour to a self-determined active behaviour is the aim of behavioural change physical activity interventions.

Psychosocial Theories and Models in Physical Activity

There are numerous theories and models that have been employed by researchers to explain motivation to adopt regular physical activity. These include (a) the Transtheoretical Model (Prochaska & DiClemente, 1983), (b) Social Cognitive Theory (Bandura, 1986), (c) Theory of Reasoned Action (Fishbein & Ajzen, 1975) and Theory of Planned Behaviour (Ajzen & Madden, 1986), and (d) The Health Belief Model (Becker & Maiman, 1975). These theories and models have been tested in cross-sectional studies, although it has been noted there is a distinct lack of randomised control trials that test behavioural interventions based on these theories. Whilst research using behaviourally based interventions is increasing, there still appears to be a fundamental paucity in the depth of analysis in these studies. The majority of studies are inferring relationships between the behavioural theories employed and better adherence or physical activity levels. Inferring a relationship between pre-to-post increases in physical activity and hypothetically related psychosocial constructs is insufficient. Unless the relationships between mediators in the behavioural models and the outcome behaviours are tested, then one can only make *assumptions* regarding the effectiveness of a behavioural model to explain adherence or physical activity level (Brassington et al., 2002: Martin & Sinden, 2001).

It also has been noted in the exercise psychology literature that there may exist a strong bias towards publication of studies that reject the null hypothesis. Spence and

Blanchard (2001) reviewed studies from the 1987, 1992, and 1997 issues of five sport and exercise psychology journals. The authors state that in those studies presenting tests of significance 98% had a minimum of one significant finding and 80% rejected the null hypothesis. In addition, the effect sizes of the studies included in the Spence and Blanchard (2001) review were not presented. Therefore, it is not possible to determine the practical significance of the statistically significant findings in the study.

Review of Psychosocial Theories in Randomised Controlled Physical Activity Trials

In order to develop a thorough understanding of past randomised controlled physical activity trials that have employed psychosocial theories the researcher conducted a search of the literature using the PubMed data base from January 1900 to January 2007 for randomised controlled trials in physical activity including older adults. This search found 405 published studies. This list was refined to include only studies that attempted to increase physical activity (n = 80). From this list, only studies that outlined the effect of the intervention on physical activity were kept for review (n = 71) (Table 1). From this search 56 studies employed a behavioural intervention component. Interestingly, only 21 of these 59 studies reported an increase in physical activity due to the intervention. Furthermore, of these 21 studies that reported an increase in physical activity, nine used the transtheoretical model[1, 14, 21, 38, 46, 55, 61, 64, 66], five employed social cognitive theory[19, 42, 47, 50, 70], one employed motivational interviewing[17], three on psychological skills and empowerment training[13, 37, 48], and one did not report the type of behavioural theory used[40] (superscripts indicate study ID number). One study did employ SDT[32], though the authors reported no effect of the intervention over the control condition. Of the 71 studies reviewed 53% included participants under the age of 50 years, 55% of the studies used interventions of less than 6 months in duration, and only 24% reported setting a physical activity target ≥ 150 minutes of moderate physical

activity per week. To address some of the weaknesses of past studies the PATH Project recruited older adults between the ages of 60-80 years, employed an intervention of 6 months in duration, and asked participants to maintain a target of $\geq$ 150 minutes of moderate physical activity per week throughout the intervention.

Table 1. *Randomised control trials testing interventions to change physical activity level: January 1989 to January 2007*

Study ID Number	Author	Sample Size	Age	Physical Activity Measure	Intervention Length	Study Length	Physical Activity Target	Behavioural Component in the Intervention	Name of Behavioural Component	Effect of Intervention on Physical Activity
1	Morey, Ekelund, Pearson, Crowley, Peterson, Sloane, Pieper, McConnell, and Bosworth (2006)	165	70+	Physical Activity by CHAMPS	6 months	6 months	150min/wk	Yes	Transtheoretical Model	Positive Effect
2	Costanzo, Walker, Yates, McCabe, and Berg (2006)	46	50-65	Physical Activity by 7-Day PAR	3 months	3 months	150min/wk	Yes	Health Promotion Model and Social Cognitive Theory	No effect
3	Cox, Burke, Beilin, Grove, Blanksby and Puddey (2006)	116	50-70	Physical Activity by 7-Day PAR	6 months	6 months	150min/wk	Yes	Stages of Change	No effect
4	Eriksson, Westborg and Eliasson (2006)	123	18-65	A modified self-administered physical activity questionnaire ‘‘Physical activity on recipe’’ by the Institute of Public Health, Sweden.	3 months	12 months	not stated	Yes	Stages of Change	No effect
5	Tan, Xue, Li, Carlson, and Freid (2006)	113	59-86	Minnesota Leisure Time Physical Activity Questionnaire	4-8 months	4-8 months	150min/wk	Yes	Social Capital and Self-Efficacy enhancement	No effect
6	Yancey, McCarthy, Harrison, Wong, Siegel and Leslie (2006)	366	23-77	A 4-item self-report physical activity scale	2 months	12 months	not stated	Yes	Social Ecological Model, Social Support	Increase at 2 months. No effect at 12 months

Study ID Number	Author	Sample Size	Age	Physical Activity Measure	Intervention Length	Study Length	Physical Activity Target	Behavioural Component in the Intervention	Name of Behavioural Component	Effect of Intervention on Physical Activity
7	Harting, van Assema, van Limpt, Gorgels, van Ree, Ruland, Vermeer and de Vries (2006)	1270	M = 61.1 SD = 9.69	Ronda G, Van Assema P, Brug J. Stages of change, psychological factors and awareness of physical activity levels in the Netherlands. Health Promot Int 2001; 16:305–314.	4 months	18 months	150min/wk	not stated		Small effect at 4 months. No effect at 18 months.
8	de Blok, de Greef, ten Hacken, Sprenger, Postema, and Wempe (2006)	21	40-85	Daily number of steps measured with the Yamax Digi-Walker SW-200	7 weeks	10 weeks	A personal goal between the mean number of steps per day and the maximum number of steps per day.	not stated		No effect.
9	de Jong, Lemmink, Stevens, de Greef, Rispens, King and Mulder (2006)	181	55-65	Voorrips physical activity questionnaire	15 weeks	6 months	60mins/week	Yes	Social Cognitive and Evolutionary-Biological Play Theories	No effect
10	Engel and Linder (2006)	57	M = 62	Exercise Diaries	6 months	6 months	150min/wk	Yes	Self-Efficacy enhancement strategies	No effect.
11	Gleeson-Kreig (2006)	58	40-65	Habitual Physical Activity Index	6 weeks	6 weeks	not stated	Yes	Social Cognitive Theory	No effect
12	Griffin-Blake and DeJoy (2006)	366	21-70	7-Day PAR	1 month	1 month	not stated	Yes	Processes of Change from the Transtheoretical Model and Social Cognitive Theory	No effect

Study ID Number	Author	Sample Size	Age	Physical Activity Measure	Intervention Length	Study Length	Physical Activity Target	Behavioural Component in the Intervention	Name of Behavioural Component	Effect of Intervention on Physical Activity
13	Scholz, Knoll, Sniehotta and Schwarzer (2006)	198	M = 58.5 SD = 10.6	IPAQ	6 weeks	12 months	30min/wk	Yes	Self-Regulatory skills training	Positive effect
14	Albright, Pruitt, Castro, Gonzalez, Woo and King (2005)	72	18-66	Physical Activity by 7-Day PAR	10 months	12 months	150min/wk	Yes	Stages of Change from the Transtheoretical Model	Positive effect
15	Armit, Brown, Ritchie, and Trost (2005)	28	55-70	Self report survey	3 months	6 months	not stated	not stated		No effect
16	Kerse, Ellery, Robinson and Arroll (2005)	270	65+	7-day food intake and physical activity diary.	3 months	12 months	not stated	not stated		Positive effect
17	Pinto, Goldstein, Ashba, Sciamanna and Jette (2005)	100	M = 68.5	Physical Activity by 7-Day PAR	6 months	6 months	150min/wk	Yes	Motivational Interviewing and Stages of Change	Positive effect
18	Anderson, King, Stewart, Camacho and Rejeski (2005)	874	35-75	N/A	N/A	24 months	N/A	Yes	Social Cognitive Theory	N/A
19	Ball, Salmon, Leslie, Owen and King (2005)	66	45-78	CHAMPS	3 months	4 months	30mins/day	Yes	Social Cognitive Theory and Transtheoretical Model	Positive effect in MET.min for walking only
20	Resnicow, Jackson, Blissett, Wang, McCarty, Rahotep and Periasamy (2005)	906	N/A	N/A	12 months	12 months	N/A	Yes	Motivational Interviewing	N/A

Study ID Number	Author	Sample Size	Age	Physical Activity Measure	Intervention Length	Study Length	Physical Activity Target	Behavioural Component in the Intervention	Name of Behavioural Component	Effect of Intervention on Physical Activity
21	Pinto, Frierson, Rabin, Trunzo and Marcus (2005)	86	M = 53.14 SD = 9.7	Physical Activity by 7-Day PAR	3 months	9 months	150min/wk	Yes	Transtheoretical Model	Positive effect
22	Marshall, Booth and Bauman (2005)	780	40-70	self-report Physical Activity	6 months	6 months	not stated	not stated		No effect
23	Ackermann, Deyo and LoGerfo (2005)	336	50+	The Physician-based Assessment and Counselling for Exercise (PACE)	8 weeks	4 months	not stated	Yes	Stages of Change from the Transtheoretical Model	No effect
24	Peterson, Yates, Atwood and Hertzog (2005)	42	M = 51.0 SD = 8.7	Physical Activity by 7-Day PAR	12 weeks	12 weeks	not stated	Yes	Social Support	No effect
25	Harrison, Roberts and Elton (2005)	545	18+	Physical Activity by 7-Day PAR	3 months	12 months	> 90 min/week of moderate or vigorous physical activity.	not stated		No effect
26	Ransdell, Robertson, Ornes and Moyer-Mileur (2004)	28	N/A	Physical Best Questionnaire	6 months	6 months	N/A	N/A	N/A	N/A
27	Newton and Perri (2004)	52	N/A	N/A	N/A	6 months	N/A	N/A	N/A	N/A
28	Fisher and Li (2004)	582	65+	N/A	6 months	6 months	N/A	N/A	N/A	N/A
29	Humpel, Marshall, Iverson, Leslie and Owen (2004)	399	40+	Self-reported walking	3 weeks	8-10 weeks	not stated	Yes	Motivational Interviewing	No effect

Study ID Number	Author	Sample Size	Age	Physical Activity Measure	Intervention Length	Study Length	Physical Activity Target	Behavioural Component in the Intervention	Name of Behavioural Component	Effect of Intervention on Physical Activity
30	Focht, Brawley, Rejeski and Ambrosius (2004)	147	N/A	N/A	N/A	12 months	N/A	Yes	Group Mediated, Cognitive Behavioural Intervention	N/A
31	Kelley and Abraham (2004)	252	82	Self-report of physical activity level on 10 point Likert scale	2 weeks	2 weeks	not stated	Yes	Theory of Planned Behaviour	N/A
32	Levy and Cardinal (2004)	185	M = 46.8 SD = 12.8	Leisure Time Exercise Questionnaire	2 months	2 months	not stated	Yes	Self-Determination Theory	No effect
33	Purath, Miller, McCabe and Wilbur (2004)	287	N/A	N/A	6 weeks	6 weeks	N/A	Yes	Transtheoretical Model	N/A
34	Allison and Keller (2004)	83	65-80	PASE	12 weeks	12 weeks	not stated	Yes	Self-Efficacy enhancement strategies	N/A
35	Heesch, Masse, Dunn, Frankowski, Mullen (2003)	224	18-75	Physical Activity by 7-Day PAR	6 months	24 months	150min/wk	Yes	Self-efficacy, Social Support	No effect
36	Conn, Burks, Minor and Mehr (2003)	190	N/A	N/A	N/A	N/A	N/A	Yes	Motivational Intervention	N/A
37	Duncan and Pozhel (2003)	14	M = 66.4	Exercise Sessions Completed	6 months	6 months	not stated	Yes	Goal Setting	Positive effect
38	Cox, Burke, Gorely, Beilin and Puddey (2003)	126	40-65	Exercise Diaries and 7-Day PAR	6 months	18 months	150min/wk	Yes	Stages of Change	Positive effect
39	Resnicow, Jackson, Braithwaite, DiIorio, Blisset, Rahotep and Periasamy (2002)	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Motivational Interviewing	N/A

Study ID Number	Author	Sample Size	Age	Physical Activity Measure	Intervention Length	Study Length	Physical Activity Target	Behavioural Component in the Intervention	Name of Behavioural Component	Effect of Intervention on Physical Activity
40	Keyserling, Samuel-Hodge, Ammerman, Ainsworth, Henriques-Roldan, Elasy, Skelly, Johnston and Bangdiwala (2002)	200	≥ 40	Caltrac Accelerometer	6 and 12 months	12 months	30min/day	Yes	A behaviour change theory (not specified which one)	Positive effect
41	Brassington, Atienza, Perczek, DiLorenzo and King (2002)	103	M = 70.18 SD = 4.1	Exercise Diaries	12 months	12 months	280min/week	Yes	Social Cognitive Theory and the Transtheoretical Model	No effect
42	Pinto, Friedman, Marcus, Kelley, Tennstedt and Gillman (2002)	298	M = 45.9 SD = 12.3	7-Day PAR	6 months	6 months	not stated	Yes	Social Cognitive Theory and the Transtheoretical Model	Positive effect at 3 months only
43	Hillsdon, Thorogood, White and Foster (2002)	1658	M = 54.8 SD = 5.7	Minnesota Leisure Time Activity Questionnaire	34 weeks	11 months	150min/wk	Yes	Motivational Interviewing	No effect
44	Blissmer and McAuley (2002)	196	M = 43.4	N/A	16 weeks	N/A	N/A	Yes	Transtheoretical Model	N/A
45	Lowther, Mutrie and Scott (2002)	225	N/A	N/A	3 months	12 months	N/A	not stated	N/A	No effect
46	Mutrie, Carney, Blamey, Crawford, Aitchison and Whitelaw (2002)	295	19-69	7-Day PAR	12 months	12 months	not stated	Yes	Transtheoretical Model	Positive effect
47	Resnick (2002)	17	M = 88.0 SD = 3.7	Exercise Logs and YPAS	6 months	6 months	60mins/wk	Yes	Sources of Self-Efficacy enhancing information	Positive effect

Study ID Number	Author	Sample Size	Age	Physical Activity Measure	Intervention Length	Study Length	Physical Activity Target	Behavioural Component in the Intervention	Name of Behavioural Component	Effect of Intervention on Physical Activity
48	Green McAfee, Hindmarsh, Madsen, Caplow and Buist (2002)	316	18-65	Physician-Based Assessment and Counselling for Exercise (PACE)	3 sessions	6 months	not stated	Yes	Motivational Counselling	Positive effect
49	Hopman-Rock and Westhoff (2002)	448	65+	N/A	6 sessions	6 months	N/A	N/A	N/A	N/A
50	Campbell, Tessaro, DeVellis, Benedict, Kelsey, Belton and Sanhueza (2002)	538	18+	Employed a self-report measure (not validated)	18 months	18 months	not stated	Yes	Social Cognitive Theory. Transtheoretical, and Social Support Models	Positive effect in flexibility exercises only
51	Speck and Looney (2001)	49	M = 41.45 SD = 8.75	Mean number of steps per day using the Yamax 701 pedometer	12 weeks	12 weeks	not stated	not stated		Positive effect
52	Kochevar, Smith and Bernard (2001)	N/A	55-75	N/A	6 weeks	6 weeks	N/A	N/A	N/A	N/A
53	Stewart, Verboncoeur, McLellan, Gillis, Rush, Mills, King, Ritter, Brown and Bortz (2001)	173	M = 74 SD = 6	CHAMPS	6 months	12 months	30mins on 5-7 days/wk	Yes	Social Cognitive Theory and Self-Efficacy Enhancement	N/A
54	Poston, Haddock, Olvera, Suminski, Reeves, Dunn, Hanis and Foreyt (2001)	379	M = 39.6 SD = 8.5	7-Day PAR	6 months	12 months	150min/wk	Yes	Social Cognitive Theory	No effect
55	Oldroyd, Unwin, White, Imrie, Mathers and Alberti (2001)	67	M = 58.2	self-report questionnaire on physical activity (not validated)	18 weeks	6 months	40-90mins/wk	Yes	Stages of Change from Transtheoretical Model	Positive effect

Study ID Number	Author	Sample Size	Age	Physical Activity Measure	Intervention Length	Study Length	Physical Activity Target	Behavioural Component in the Intervention	Name of Behavioural Component	Effect of Intervention on Physical Activity
56	Pinto, Lynn, Marcus, DePue and Goldstein (2001)	355	M = 65.5	N/A	6 weeks	8 months	N/A	Yes	Transtheoretical Model and Social Cognitive Theory	N/A
57	Yanek, Becker, Moy, Grittelsohn and Koffman (2001)	529	40+	N/A	12 months	12 months	N/A	N/A	N/A	N/A
58	Smith, Bauman, Bull, Booth and Harris (2000)	1142	25-65	14-Day PAR	1 session plus booklet	8 months	not stated	Yes	Transtheoretical Model	No effect
59	Norris, Grothaus, Buchner and Pratt (2000)	812	30+	PASE and Paffenbarger's physical activity index	6 months	6 months	not stated	Yes	Stages of Change from the Transtheoretical Model	No effect
60	Kreuter, Chheda and Bull (2000)	882	18+	Self-report measure (not validated)	3 months	3 months	not stated	not stated		Positive effect
61	Steptoe, Doherty, Rink, Kerry, Kendrick and Hilton (1999)	883	M = 46.7 SD = 0.4	As measured in the UK National Fitness Survey	3 sessions	12 months	not stated	Yes	Stages of Change from the Transtheoretical Model	Positive effect
62	Harland, White, Drinkwater, Chinn, Farr and Howel (1999)	523	40-64	4 week self-report physical activity recall	12 weeks	12 months	not stated	Yes	Stages of Change from the Transtheoretical Model	Positive effect over short-term only
63	Kerse, Flicker, Jolley, Arroll and Young (1999)	267	65+	Self-report measure of physical activity	3 months	12 months	not stated	not stated		Positive effect
64	Peterson and Aldana (1999)	527	79.3% under 45yrs old	7-Day PAR	6 weeks	6 weeks	not stated	Yes	Transtheoretical Model	Positive effect

Study ID Number	Author	Sample Size	Age	Physical Activity Measure	Intervention Length	Study Length	Physical Activity Target	Behavioural Component in the Intervention	Name of Behavioural Component	Effect of Intervention on Physical Activity
65	Dunn, Garcia, Marcus, Kampert, Kohl, and Blair (1998)	235	M = 46.05 SD = 6.65	7-Day PAR	24 months	24 months	30 mins of moderate activity on most if not all days of the week	Yes	Stages of Change and Social Cognitive Theory	No effect
66	Stevens, Hillsdon, Thorogood and McArdle (1998)	714	45-74	Self-report measure of physical activity	10 weeks	8 months	none	Yes	Stages of Change and Health Education Model	Positive effect
67	Chen, Sallis, Castro, Lee, Hickmann, William and Martin (1998)	125	23-54	N/A	8 weeks	5 months	N/A	N/A	N/A	N/A
68	Skender, Goodrick, Del Junco, Reeves, Darnell, Gotto and Foreyt (1996)	127	25-45	an exercise questionnaire	12 months	24 months	250mins/wk	not stated		No effect
69	van Eldern-van Kemenade, Maes and van den Broek (1994)	60	N/A	N/A	10 sessions	2 months	N/A	N/A	N/A	N/A
70	McAuley, Courneya, Rudolph and Lox (1994)	125	45-64	Exercise Diaries	20 weeks	20 weeks	120mins/wk	Yes	Self-Efficacy	Positive effect
71	King, Frey-Hewitt, Dreon and Wood (1989)	90	N/A	7-Day PAR	12 months	12 months	N/A	N/A	N/A	N/A

N/A = Information not available

Within the studies reviewed there were several key theories that have been repeatedly used to explain behaviour change in physical activity. These were (a) the Transtheoretical Model, (b) Social Cognitive Theory, (c) Theory of Reasoned Action and Theory of Planned Behaviour, and (d) Health Belief Model.

The Transtheoretical Model (Prochaska & DiClemente, 1983) was originally developed to explain the process of changing negative health behaviours (e.g. smoking, alcohol, and substance abuse). Prochaska and DiClemente (1983) theorised five stages of behavioural change they believe that individuals pass through: these are (a) pre-contemplation, (b) contemplation, (c) preparation, (d) action, and (e) maintenance.

In the pre-contemplation stage people have not yet considered changing their behaviour in the foreseeable future. For example people in this stage will not respond to a call for participants for a physical activity study. The contemplation stage refers to those people who have considered changing their behaviour, and they are often aware of the pros and cons of changing behaviour. For example people in the contemplation stage will recognise the benefits of beginning a physical activity program. On starting the exercise program these people have moved into the action stage, also referred to as the adoption or initiation phase. This is often the least stable, as people may stop exercising and experience a relapse into earlier stages.

It is generally accepted that if the person avoids becoming sedentary again for 6 months they have reached the maintenance stage. At any of the stages up to maintenance the behaviour may revert back to the original. Prochaska, DiClemente, and Norcross (1992) have proposed a sixth stage called termination, where the old behaviour does not re-emerge despite external factors, such as depression, anxiety, excessive work stress, or extended holidays. While many cross-sectional studies have shown links between stage of change and physical activity level, only a few randomised control trials in older adults show that strategies based on the transtheoretical model can

effect positive changes in physical activity outcomes. These studies elucidate behaviour in specific situations. Firstly, they only have been able to demonstrate increases for total activity, not leisure time activity in the behavioural intervention compared to the control condition (Albright et al., 2005; Morey et al., 2006). Secondly, differences were only present when leisure related activity was compared to a non exercising control condition (Pinto et al., 2005), or when measures focussed on specific behaviours such as walking to work (Mutrie et al., 2002). Thirdly, other studies assessed physical activity by the percentage of participants engaged in vigorous physical activity (Oldroyd et al., 2001) or asking participants to recall the number of vigorous sessions of activity over the last 4 weeks (Steptoe et al., 1999; Stevens, Hillsdon, Thorogood, & McArdle, 1998). From the review conducted in the present study it is apparent that there are few studies that have addressed these methodological limitations and demonstrated the effectiveness of transtheoretical model change programs in physical activity with older adults.

Social Cognitive Theory (Bandura, 1986) posits that motivation is driven by a combination of psychological, social, and activity-specific factors. Central to Social Cognitive Theory is the construct termed self-efficacy. Self-efficacy is the belief that one can perform a given behaviour. In essence, the stronger the self-efficacy, the more likely that person will continue with the behaviour when confronted with mounting problems or barriers. Self-efficacy has received wide spread popularity in physical activity research as it acknowledges the person/environment interaction. Additionally, recent reviews have shown some associations between physical activity adoption and self-efficacy (Brassington et al., 2002), and recent supporting research also indicates a relationship to self-esteem (McAuley et al., 2005). In the present review the randomised controlled trials that demonstrated the effectiveness of Social Cognitive Theory based interventions in physical activity with older adults displayed small sample size (Resnick, 2002), and effects lasting less than 6 months (Ball, Salmon, Leslie,

Owen, & King, 2005; Pinto, Friedman, Marcus, Kelley, Tennstedt, & Gillman, 2002). Other authors address these limitations and provide strong evidence for the efficacy of Social Cognitive Theory based intervention for physical activity in older populations (Campbell et al., 2002; McAuley, Courneya, Rudolph, & Lox, 1994).

The Theory of Reasoned Action (Fishbein & Ajzen, 1975) holds that intention is the main determinant of exercise behaviour. This intention to exercise is developed through the interaction between (a) the individual's attitude toward the behaviour, and (b) a subjective norm. The attitude of the person stems from the strength of their belief that exercising will produce certain outcomes and the value placed on those outcomes. The subjective norm refers to the person's beliefs that significant others (individuals or groups) think they should or should not perform the behaviour and the person's motivation to comply with these social pressures.

While this held true for behaviours under total volitional control, the authors found that external and internal pressures could not be taken into account, leading to the development of the Theory of Planned Behaviour (Ajzen & Madden, 1986). This new theory included a construct termed *perceived behavioural control* defined as a person's perceptions regarding their ability to perform a particular behaviour. That is, the stronger a person's perceived behavioural control, the stronger their intention to exercise. This relates closely to self-efficacy (Bandura, 1986). However, a study by Martin and Kulinna (2004) demonstrated in 342 school teachers that perceived behavioural control and subjective norm had greater predictive ability for intention to conduct physically active classes, compared to self efficacy based constructs. Kelly and Abraham (2004) reported using the Theory of Planned Behaviour as a basis for a diet and physical activity intervention in a randomised control trial of 252 older adults, over 65 years of age. The authors state that the intervention was successful at positively

changing perceived behavioural control, intention, and diet and physical activity behaviours compared to the control condition.

Cross-sectional studies using the Theory of Planned Behaviour have shown that aspects of this model can partially predict physical activity participation in younger (Martin et al., 2005) and older populations (Benjamin, Edwards, & Bharti, 2005; Conn, Tripp-Reimer, & Mass, 2003; Dean, Farrell, Kelley, Taylor, & Rhodes, 2007; Michels & Kugler, 1998). While there is some evidence that the theory of planned could be an effective basis for interventions, further testing must be conducted using randomised controlled designs.

The Health Belief Model (Becker & Maiman, 1975) was developed to explain adherence to preventative health advice. This is based on the belief that people will act to reduce or remove the impact of behaviours with negative health consequences. For this behaviour change to effectively take place five factors must be taken into account: (a) concern about health and health issues, (b) perceived threat of a disease or health problem, (c) belief that the disease is preventable or controllable, (d) belief that exercise will reduce the threat of disease, (e) presence of triggers to elicit action (health promotion campaigns, advice from significant others) (Becker & Maiman, 1975). While to the author's knowledge there are no reported randomised controlled trials that have tested the Health Belief Model in physical activity, cross-sectional studies highlight relationships between key elements and physical activity levels (Al-Ali & Haddad, 2005; Kiviniemi, Voss-Humke, & Seifert, 2007; O'Brien Cousins, 2000; Von Ah, Ebert, Ngamvitroj, Park, & Kang, 2004).

Self Determination Theory

Each of the aforementioned behavioural theories has been applied to physical activity adoption, with varying degrees of success. While some have been employed in

randomised controlled designs, the majority are still being tested using cross-sectional methods. A theory that has, until now, had limited application to physical activity adoption in older adults is Self-Determination Theory (Deci & Ryan, 1985). Deci and Ryan's (1985) Self Determination Theory (SDT) can best be characterised as a method for explaining human motivation via investigation of inherent growth tendencies and psychological needs. These needs are competence, autonomy, and relatedness. Deci and Ryan's SDT (1985) proposes that if all these needs are met the consequence is a positive sense of self-worth. However, if unfulfilled, a negative sense of self-worth will result. The suggestion is that different types of factors will shift people into a state of action. That is, some will act as they value the activity and others may do so due to external coercion. These two forms are termed intrinsic and extrinsic motivation, and occur on a continuum. A benefit that SDT offers research in exercise motivation is its multidimensional perspective. That is, it allows us to identify a variety of motivational antecedents to adoption of regular physical activity in older adults. Behavioural relapses are explained in SDT by proposing that motivation can be undermined given certain conditions.

It has been shown that motivation influences behaviour at a global, contextual, and situational level (Vallerand, 1997). At a global motivational level the individual demonstrates a general orientation to interact with the environment in an intrinsic or extrinsic manner. This level of generality has not yet been investigated with relation to exercise or sport as they are domain specific behaviours (Vallerand & Fortier, 1998). It is at the contextual level, referring to separate domains of the individual's life, that exercise is often investigated. Other domains may include academic, emotional, and occupational (Vallerand, 1997). This is very similar to the domains proposed by other investigators in the area of self-perceptions (Harter, 1978; Shavelson, Hubner, & Stanton, 1976).

Previous cross-sectional research has established a strong relationship between physical activity adoption and intrinsic motivation for exercise (Kavussanu & Roberts, 1996; Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997). There also has been extensive research into development of motivation in children's education (Brophy, 1972; Grolnick, Ryan, & Deci, 1991; Guthrie, Wigfield, & Von Secker, 2000). With respect to older populations there has been some studies to investigate older adults' motivations to adhere to exercise (O'Brien Cousins, 2003; Pinto, Lynn, Marcus, DePue, & Goldstein, 2001). However, little has been done to investigate the relationship between the psychosocial constructs related to motivation within SDT, self-perceptions, autonomy, and social connectedness. Hence, in order to understand the exercise behaviours of older adults, it is important that motivation be measured at a contextual level with due attention given to the multidimensional perspective offered by SDT. Deci (1980) offers three motivational sub-systems; intrinsic motivation, extrinsic motivation, and amotivation.

Intrinsic motivation is the inherent predisposition to explore one's boundaries and seek out new experiences and challenges (Deci & Ryan, 2000). This inherent tendency leads people to seek out and conquer challenges and to engage in activities for the pleasure of doing so with no thought for reward and no form of external pressure. Fundamental to intrinsic motivation is a sense of autonomy coupled with high perceptions of competence or self-esteem. Motivational theorists (Harter, 1999; Ryan & Deci, 2000) view intrinsic motivation as crucial to long-term performance or engagement in a task. Conversely, extrinsic motivation is the need to engage in activities for the purposes of obtaining some external reward or in response to external pressures. Extrinsically motivated behaviours are characterised by response to an external cue and detachment from the rewards and accompanying feelings. According to Deci (1980) extrinsically motivated people are more likely to experience an external

locus of control, contingency based rewards, and low self-esteem and competence. Amotivation is characterised by disillusioned activity. That is, there exists no relationship between outcomes and behaviour therefore actions occur without any form of governing regulation (Deci, 1980). Additionally, competence and self-determination are often very low and people operating in this motivational subsystem feel helpless, incompetent and out of control. As long-term behaviour may be affected by type of motivation (intrinsic, extrinsic, or amotivation), studies that examine motivation for physical activity must take these into account. To further explain motivation within SDT Deci (1980) proposed two sub-theories: Cognitive Evaluation Theory and Organismic Integration Theory.

Cognitive Evaluation Theory (CET)

Cognitive Evaluation Theory (CET) was first presented as a sub-theory of Self-Determination by Deci in 1980 and further developed by Ryan and Deci (2000). Ryan and Deci (2000) argue that an autonomy supportive environment in which rewards are informative is more likely to enhance the development of intrinsic motivation to engage in an activity. Conversely, a non-autonomy supportive environment in which rewards are controlling is likely to foster extrinsic motivation to engage in an activity (Ryan & Deci, 2000). Furthermore, Ryan and Deci (2000) also state that tangible rewards, threats, deadlines, directives, evaluation, and imposed goals diminish intrinsic motivation. With respect to physical activity, to afford the greatest developments in intrinsic motivation to exercise, people must be given positive informational feedback on the behaviour with an absence of external rewards or coercion (provide an internal locus of control). In support of this Deci, Koestner, and Ryan (1999) demonstrated in a younger population that feelings of competence will not enhance intrinsic motivation unless accompanied by an environment conducive to developing a sense of autonomy.

There is research that has investigated CET and exercise. In a study that used CET as a framework, task goal orientation, perceived competence, and learning climate were the strongest predictors of intrinsic motivation for physical activity in male (n = 206) and female (n = 201) physical education students (Ferrer-Caja & Weiss, 2000). This indicates partial support for CET. Although, a cross-sectional study in competitive cyclists (n = 58) and non-competitive exercisers (n = 65) indicated that high intrinsic motivation could be present in competitive situations (Frederick-Recascino & Schuster-Smith, 2003). However, the authors of this study do point out that these findings should be interpreted with some caution as the age ranges were quite large and the MANCOVA effect size was small. While there is a scarcity of studies investigating CET, studies that have employed SDT as a theoretical framework for motivation in physical activity do provide support for CET (Mullan & Markland, 1997; Standage, Duda, & Ntoumanis, 2006; Thogersen-Ntoumani & Ntoumanis, 2006; Wilson & Rogers, 2004). While the underlying principles of CET have been established in younger, active populations, there is a paucity of research with respect to older adults.

In accordance with the operational constructs outlined by Vallerand (1997) and Biddle (1999), there were three types of intrinsic motivation measured in the present study: intrinsic motivations to (a) know, (b) achieve, and (c) experience. Intrinsic motivation to know is defined as the drive to engage in an activity for the pleasure experienced while learning or exploring that which is novel (Vallerand & Fortier, 1998). Intrinsic motivation to achieve is defined as the impetus to engage in a task for the feelings of pleasure experienced while endeavouring to (a) surpass one's previous performance, (b) to create something, or (c) to complete the task (Vallerand, 1997). Intrinsic motivation to experience refers to participation in an activity for the pleasant sensations the activity elicits. This type of intrinsic motivation can be likened to the concept of flow (Csikszentmihalyi, 1990). It is thought that a high sense of

competence, autonomy, and connectedness is important in developing intrinsic motivation in children with respect to physical activity.

Organismic Integration Theory (OIT)

The second sub-theory of SDT is Organismic Integration Theory (OIT) (Deci & Ryan, 2000). According to OIT extrinsic motivation is not necessarily a negative motivational state only that it differs from intrinsic motivation due to the lack of inherent pleasure. According to SDT, extrinsic motivation associated with high levels of autonomy may actually lead to internalisation and integration of physical activity behaviours.

Within OIT Ryan and Deci (2000) proposed four types of extrinsic motivation, differing in their level of autonomy. These were external regulation, introjected regulation, identified regulation, and integrated regulation. External regulation refers to behaviours that are externally determined and exhibiting the least amount of autonomy. The main focus is to obtain external rewards or meet external demands (Ryan & Deci, 2000). A statement such as *I exercise because my doctor said I have to or else I may suffer another stroke* is likely to be typical of a person whose behaviour is regulated by external motivators. Although introjected regulation occurs when the externally regulated behaviour becomes internalised, it is still not truly accepted as one’s own (Ryan & Deci, 2000). A person operating from this domain associates the behaviour with feelings of guilt or anxiety. Therefore, it is not intrinsic as it is based on external pressures (Vallerand and Fortier, 1998). A statement such as *I exercise because if I don’t I feel very guilty* is likely to be typical of a person with behaviours regulated by introjected motivators. Deci and Ryan (1985; 2000) found that among the four types of extrinsic motivation there were two in which high levels of autonomy were exhibited, identified regulation and integrated regulation. Identified regulation is characterised by

the choice to perform a task, even if it is undesirable, as it is judged important by the individual. A person whose behaviour is regulated by identified motivations may make the statement *I exercise because it is important to me that I look good.* Integrated regulation is the most autonomous of the four extrinsic motivations. This is when the previous identified motivators are fully integrated into the self and match the existing values and needs (Ryan & Deci, 2000). While this is very similar to intrinsic motivation, the lack of inherent pleasure in the reason for engaging in the task deems it extrinsic. A person with behaviour is regulated by integrated motivations may make the statement *I exercise because good health is an important part of my life.*

According to OIT an exercise environment that supports autonomy, competence, and connectedness, will lead to long-term engagement in exercise, despite the motivation being extrinsic in origin. While OIT has been tested in younger populations, application of this principle to physical activity adoption in older adults has yet to be investigated.

Exercise Motivation, Self-Determination Theory, and Older Adults

A qualitative study (O'Brien Cousins, 2003) explored motivation to engage in physical activity in 41 older adults (55-92 years). This study tested the viability of Social Cognitive Theory (Bandura, 1986) and the Behavioural Change Model (Marcus et al., 1992) in an older population. The findings indicated that the number of negative thoughts and barriers to physical activity were reportedly similar for the physically active and inactive groups. However, the number of positive thoughts and solutions to physical activity barriers were reportedly more numerous for the active older adults compared to the inactive (O'Brien Cousins, 2003). Both theories applied by O'Brien Cousins have highlighted the importance of positive affect and motivation in exercise for older adults. Positive affect (high self-perceptions, autonomy, and connectedness)

plays a significant role in the SDT perspective on motivation through Organismic Integration Theory. According to SDT negative affect experiences serve to undermine self-determination and enhance extrinsic and introjected regulation through the Cognitive Evaluation Theory pathway (Deci, 1985; Ryan & Deci, 2000).

While there is some research that has employed SDT to explain exercise motivation in younger populations (Levy & Cardinal, 2004; Mullan & Markland, 1997; Thogersen-Ntoumanis & Ntoumanis, 2006), these studies have employed minimal interventions or were cross-sectional in design. There are clear gaps in research applying SDT to explain motivation to adopt physical activity in older adults. Self-Determination Theory has the potential to more comprehensively explain the degree of adherence to a physical activity program in an older population. If the underlying motivational processes of physical activity adherence are understood, more effective design and implementation of physical activity programs in older adults becomes possible.

Self-Perceptions

Contrary to earlier theories on global constructs of self, it is now generally accepted that self-perceptions are made up of specific domains in addition to global self-worth. Harter (1999) defined self-perceptions as deliberate acknowledgement of the characteristics and attributes of the individual through language and global self-worth as the overall worth placed by the individual on his or her self. It is acknowledged that good mental health, and a sense of well being throughout all stages of human development, is highly dependent on positive self-perceptions (Kohut, 1984). More importantly, the positive or negative perception of the self is dependent upon the context or domain (cognitive, social or physical). Whilst there is much published research regarding self-perceptions in children (Bracken, 1996) and adolescents (Harter,

1999; Marsh, 1990; 1992), little is known about the role of self-perceptions in exercise adherence in older populations. This section on self-perceptions will review (a) the effect of physical activity on self-perceptions, (b) self-perception of the older adult, and (c) global self-worth.

Physical Activity and Self-Perceptions

It has been demonstrated in children that high self-perceptions are associated with high physical activity levels (Kavussanu & Roberts, 1996). The premise that regular physical activity is likely to be positively related to physical self-perceptions is perhaps intuitive. That is, increases in physical activity are likely to be associated with increases in physical self-perceptions, or vice versa. A meta-analysis of research into the ability of physical activity to change self-perceptions reported that from 36 randomised controlled studies 78% of the participants demonstrated improvements in self-perceptions or physical self-esteem following physical activity (Fox, 2000b). Fox (2000a) outlined five psychosocial mechanisms thought to play a role in the exercise and psychology relationship. These are improvements in perceptions of competence and appearance, improvements in the sense of autonomy and belongingness, and an improved sense of self. Fox goes on to state that while self-perceptions have been investigated in a variety of different populations up until 2000 none had been published concerning older adults (Fox, 2000a). The majority of studies that have looked at self-perceptions and physical activity have been cross-sectional. To investigate previous randomised controlled research in this area the primary researcher conducted a search of the literature using PubMed and identified 44 randomised controlled trials that (a) measured any aspect of physical self perceptions, esteem, or efficacy, and (b) included older adults. Of these articles only 13 measured the effect of a physical activity intervention on physical self perceptions, esteem, or efficacy (Table 2). The remaining

31 studies contained dietary components and as this present study was concerned with physical activity effects, dietary studies were not included. Eleven of the 13 studies reported that the physical activity intervention effected significant increases in various measures of physical self perception or efficacy[1-5, 7-10, 12, 13] (superscripts indicate study ID number). Some these studies did have methodological limitations including small sample size[6, 8, 10] and short duration intervention and follow up[5, 6, 13]. Additionally, none of 13 the studies measured, or factored in the effect of self-perceptions outside the physical domain. There is clearly a considerable need to further investigate the potential effects of physical activity on all domains of self-perceptions in older populations, and whether these other domains can impact exercise adherence. Global self-worth is a construct worth mentioning here as there have been studies conducted to test interventions to increase global self-worth. Harter (1999) and Fox (1999, 2000a) refer to global self-worth as the overall worth placed by the individual on his or her self. According to Harter (1999) and Fox (2000a) global self-worth is largely influenced by the importance placed on specific domains by an individual and the comparative perceptions of competence in that domain. Due to this it is a largely stable concept that is resistant to change. In fact, changes in global self-worth require fundamental shifts in domains an individual considers important to their sense of self accompanied with increases in the perception of competence in those domains.

Table 2. *Randomised controlled trials with physical self perceptions, physical self esteem, or physical self efficacy as a primary outcome*

ID Number	Author	Sample Size	Age	Type of Physical Self Perception / Efficacy / Esteem Measure	Effect on Self Perception / Efficacy / Esteem
1	Gitlin, Winter, Dennis, Corcoran, Schinfeld, & Hauck, (2006)	319	70+	Physical or Exercise Self-Efficacy Scale	Increased
2	Gary, (2006)	N/A	N/A	N/A	Increased
3	Taylor & Fox, (2005)	142	M = 54.25 SD = 1.05	Physical Self Perceptions Profile	Increased
4	Hughes, Seymour, Campbell, Huber, & Sharma, (2004)	150	M = 73.6 SD ± 6.53	Physical or Exercise Self-Efficacy Scale	Increased
5	Allison & Keller (2004)	83	65-80	Physical or Exercise Self-Efficacy Scale	Increased
6	Grant, Todd, Aitchison, Kelley, & Stoddart, (2004)	26	55-70	Physical Self Perceptions Profile	No Effect
7	Rejeski, Brawley, Ambrosius, Brubaker, Focht, Foy, & Fox (2003)	147	M = 64.8 SD = 6.97	Physical or Exercise Self-Efficacy Scale	Increased
8	Resnick, (2002)	17	M = 68 SD ± 3.7	N/A	Increased
9	Li, Harmer, McAuley, Fisher, Duncan, & Duncan, (2001)	94	M = 72 SD ± 5.1	Physical or Exercise Self-Efficacy Scale	Increased
10	Baker, Nelson, Felson, Layne, Sarno, & Roubenoff, (2001)	46	55+	N/A	Increased
11	Pinto, Lynn, Marcus, DePue, & Goldstein, (2001)	355	65.5	N/A	No Effect
12	McAuley, Katula, Mihalko, Blissmer, Duncan, Pena, & Dunn (1999)	174	M = 65.5 SD = 5.33	Physical or Exercise Self-Efficacy Scale	Increased
13	Tustusmi, Don, Zaichkowsky, & Delizonna, (1997)	72	M = 68	Physical or Exercise Self-Efficacy Scale	Increased

N/A = Not Available

Self-Perceptions of the Older Adult

From the literature presented in Table 2 it is clear that any physical activity intervention is more likely to affect changes in self-perceptions that relate to physical domains. However, there is an argument that can be made for the flow on effect to other self-perception domains that are non-physical in origin. A study by Sorensen, Anderssen, Hjerman, Holme, and Ursin (1997) found increases in social self-perceptions of in participants engaged in (*N* = 208) men and women engaged in a 12 month physical activity and diet intervention. Messer and Harter (1989) in the Adult Self-Perceptions Profile (ASPP) identified 12 domains that are important to adults in the development of positive overall self-concept. While Harter and Kreinik (1998) suggest that there may be up to 14 domains important in later adulthood, further differentiation has yet to be examined by empirical research, and despite an extensive search to locate this measure, it was not available at the time the PATH Project was conducted. As a consequence the domains that have been established in adults up to 55 years as identified by Messer and Harter (1989) with the ASPP were examined in the present study. These included: (a) athletic abilities, (b) physical appearance, (c) sociability, (d) job competence, (e) nurturance, (f) adequacy as a provider, (g) morality, (h) intimate relationships, (i) intelligence, and (j) sense of humour. In addition the ASPP also asks about global self-worth, i.e. the overall value one places on oneself. With respect to physical activity behaviours one may expect associations with domains such as athletic ability and physical appearance. However, there is the potential for perceptions in other domains to also be related to engagement in physical activity as hypothesised in this thesis.

Perceptions of Athletic Abilities

Perceptions of athletic ability relate to competence in physical abilities and willingness to try new physical activities (Messer & Harter, 1989). The randomised controlled trials outlined in Table 2 demonstrated strong associations between physical activity and changes in physical self perceptions[1-5, 7-10, 12, 13]. The importance of physical self-perceptions to mental health in older adults has been investigated. In 174 older sedentary adults, changes in physical self-esteem predicted change in depressive symptoms 12 and 60 months, post intervention (Motl et al., 2005). In addition, the relationship between physical self-perception and physical activity was investigated by Taylor and Fox (2005), who showed that participation in a 10-week exercise referral intervention improved physical self-worth at 16 and 37 weeks compared to a control condition. Also in this group, adherence to the 10-week exercise program was associated with changes in physical self-perceptions at baseline and 37 weeks. These studies indicate that high perceptions in this domain could relate strongly to high adherence to the physical activity program in the present study.

Perceptions of Physical Appearance

This domain pertains to the way one looks and perceptions of attractiveness and being happy and satisfied with one's appearance (Messer & Harter, 1989). In a study examining social physique anxiety of men and women between the ages of 45 and 64, it was found they place as much importance on physical appearance as do their younger counterparts (McAuley, Bane, Rudolph, & Lox, 1995). Due to this continuing importance placed on physical appearance, age associated changes in physical appearance can have quite a dramatic effect on the physical activity behaviour and psyche of older adults (Martin, Leary, & Rejeski, 2000). Negative changes may include withdrawal from social situations, depression and lowered self-esteem (Leary, 1995).

With such barriers to high perceptions of physical appearance it becomes necessary to find ways to counteract the negative portrayals and stereotypes of older adults in society. It is possible that participation in regular physical activity may increase perceptions of physical appearance due to associated weight reductions and increases in lean body mass, or vice versa.

Perceptions of Sociability

This domain refers to the behaviour of oneself in the presence of others. Perceptions that one is fun, likes to meet new people, and is at ease with others make up this domain (Messer & Harter, 1989). It is likely that people high in self-perceptions of sociability will adhere more readily to group based physical activity programs. While to the author's knowledge there are no studies on perceptions of sociability, a study employing a path analytic technique in a 6-month physical activity intervention by McAuley, Jerome, Elavsky, Marquez, and Ramsey (2003) demonstrated that high program adherence was associated with high perceived social support indicating that perceived sociability may be important in physical activity adherence.

Perceptions of Job Competence

The job competence domain relates to one's perceptions of competence in their major occupation, job or work. Perceptions that one is productive, valued, and proud of one's work form this domain (Messer & Harter, 1989). To the author's knowledge there are no published studies that have investigated the relationship between physical activity adherence and job competence. However, as the population in this study had been working in some capacity for most of their adult lives, job competence could act as a potential source of self-perceptions for physical activity adherence.

As there may be a high percentage of retirees in an older population it is a distinct possibility that perceptions of job competence may have a significantly reduced impact on the lives of older adults.

Perceptions of Nurturance

The domain of nurturance involves caring for others in fostering their growth and contributing to the future (Messer & Harter, 1989). It is possible that people with high self-perceptions of nurturance may be more motivated to adhere to a physical activity program by finding it easier to offer support to less motivated individuals in their group. In addition they may recognise the importance of maintaining their physical health in order to more successfully nurture their grandchildren and significant others. It is also possible that having high perceptions of nurturance and placing more importance on this domain, could impact detrimentally on physical activity participation if older adults are forced to choose between looking after grandchildren and engaging in a physical activity program.

Perceptions of Adequacy as a Provider

This domain refers to providing the means of support for oneself and significant others. More specifically the essential and material needs of one's own life and those of significant others (Messer & Harter, 1989). In a recent study of 2,749 older adults (average age 68 years) from the Peoples Republic of China, it was found that the more financial support was needed, the greater the depressive symptoms (Krause, Liang, & Gu, 1998). Also, financial strain was highly related to depressive symptoms in older adults who believed there would be little financial support forthcoming for other sources. Due to cultural differences, the findings of this study are limited regarding relevance to an Australian population. However in a study of 1083 older adults living

in Florida and participating in a subsidised meal program, Kirk and Rittner (1993) found that 77.4% were women whose income was significantly lower than that of men in the same program. They also found that participants reported poorer quality of life, high levels of isolation, unhappiness and despair. Furthermore a study of participants aged between 25 and 75 years revealed that older adults perceived greater control over finances than did young and middle aged adults (Lachmann & Weaver, 1998), which could indicate a high perceived importance of being able to provide and an internalised locus of control (self-determining) relating to perceptions of adequacy as a provider. All the above research seems to highlight one important fact; perception of financial control, or the ability to provide for oneself and dependents, is important in the psychological well being of older adults. Moreover, a decrease in the ability of an individual to provide for oneself and dependents is related to increases in depressive symptoms and a decrease in psychological well-being and may have implications for retired older adults. Having high perceptions of being able to adequately provide for significant others in the past may drive older adults to maintain their physical health in order to successfully accomplish this in the future. It is also possible that people with low perceptions of adequacy as a provider may perceive greater financial barriers to physical activity participation. Therefore when investigating self-perceptions outside the physical activity it is important that adequacy as provider is included.

Perceptions of Morality

Investigation of morality in children, adolescents and adults (Eisenberg, 1986; Kohlberg, 1980) is extensive. However there is limited research investigating the importance of morality in the development of healthy late adulthood. Altruistic moral judgements are made when an individual expresses an opinion as what actions they deem right or wrong in relation to a situation. Kohlberg (1980) defined six stages of

moral maturity. Several studies have indicated that there is an age related progression from stage one to stage six in Kholberg's theory (Eisenberg, 1982; Gilligan, 1982). A recent study examining altruistic moral judgements among older adults found that internal locus of control and perceived responsibilities in the community were significantly related ($p < .01$) to (a) internalised altruistic moral reasoning, (b) more opportunities to help others, (c) giving help more readily to others, and (d) feeling socially integrated into the community (Midlarsky, Kahana, Corley, Nemeroff, & Schonbar, 1999). This research indicates that an ability to make altruistic moral judgements is important in maintaining good psychosocial health into older adulthood. There is no known research that has investigated morality in older adults and how this relates to adoption of physical activity. One could speculate that perceptions of ability to make altruistic moral judgements (i.e. morality) could be an important determinant in adherence to socially based physical activity programs. According to Self-Determination Theory and the Theory of Planned Behaviour often people will engage in physical activity to avoid guilt (Chatzisarantis & Biddle, 1998). This indicates that people could be making moralistic judgements regarding physical activity participation. If this is the case, then it is possible that perceptions of morality could relate to physical activity behaviour.

Perceptions of Household Management

The household management domain relates to the management and organisation of household activities, and one's own efficiency in running the household (Messer & Harter, 1989). Due to the age of the population in this study it is highly likely that the female participants in this study would have spent their working lives in the home. For this reason, high perceptions of household management may provide a strong source of

global self-worth and could relate to adherence to a physical activity program in this population.

Perceptions of Intimacy in Relationships

This domain refers to (a) the presence of meaningful interactions with one's partner and/or close friends, and (b) the ability to seek out and communicate openly in close relationships (Messer & Harter, 1989). Adams and Blieszner (1995) outlined a structure of relationships in older adults. One key finding was the decrease in the size of the friendship network, and an increase in the intimacy and depth of existing relationships. This finding indicates that while the development of new relationships may not occur frequently, the depth of existing relationships may increase and become important into older adulthood. Perceptions of an older adult's ability to engage in meaningful relationships and communication with close friends and family may be an important factor closely aligned with social support for physical activity.

Perceptions of Intelligence

Perceptions of intelligence refer to the ability to learn and know, feel smart, understand a variety of concepts, and level of intellectual capability (Messer & Harter, 1989). A recent study by Shaw, Helmes, and Mitchell (2006) was able to demonstrate age associated declines in verbal and spatial memory. It is apparent from the limited research available that while only small increases in cognitive ability occur as a result of physical activity (Blumenthal, et al. 1991), significant reductions in age associated cognitive decline are achievable (Taylor et al., 2004). The aforementioned links between physical activity and cognition indicate potential links between adherence to a physical activity program in an older population and perceptions of intelligence.

Perceived of Sense of Humour

This domain relates to an ability to perceive amusement in certain situations, an ability to laugh at oneself, perceive irony and joke with friends (Messer & Harter, 1989). There is no published research that has investigated the relationship between perceived sense of humour and physical activity adherence in older populations. One may argue that perceived sense of humour relates to sociability. However, with no empirical evidence to support this view it can only be considered conjecture.

Global Self-Worth

Global self-worth is the value that one places on oneself, as a whole. It is associated with satisfaction in the way one is leading one's life and the kind of person one is. Previous research suggests that engagement in physical activity for at least 6-months may affect positive changes in global self-esteem in middle aged adults (McAuley, Mihalko, & Bane, 1996) and for a 4 year period in older adults (McAuley et al., 2005). Research also demonstrates that self-efficacy can change as a result of exercise (Bonhauser, 2005; Gary, 2006; Li et al, 2001; Rejeski et al., 2003). One could argue that physical activity can only affect positive changes in global self-worth when the individual deems this domain important. Therefore, it is often difficult to significantly change global self-worth when changing behaviour in only one domain. Studies show that high motor coordination and physical activity, in younger populations, have been associated with high self-perceptions within the physical domain (Crocker, Eklund, & Kowalski, 2000) and extending into other self-perception domains (Colchico, Zybert, & Basch, 2000; Sloan, 2002; Stein, Fisher, Berkey, & Colditz, 2007). This indicates that physical activity may change or be related to self-perceptions outside the physical domain. However, to the author's knowledge, the current study was the first that examined whether physical activity can impact on self-perceptions outside the

physical domain in older adults. It has been noted that as individuals move from early to late childhood through adolescence and into adulthood not only does the number self-perception domains increase; the importance placed on those domains may change (Harter, 1999, p. 119).

Gender and Self-Perceptions

While gender is not an overriding focus of this thesis, as self-perceptions are strongly influenced by gender it is necessary to briefly review the literature on this topic. First, evidence from testing of the self-perception domains measured in this study will be reviewed. In the testing and development of the ASPP Messer and Harter (1989) compared scores from full-time working men ($N = 44$) to three groups of women; full-time homemakers ($N = 42$), part-time working women/mothers ($N = 29$), and full-time working women/mothers ($N = 29$). For several of the self-perception domains there were significant differences attributable to gender and the occupational status of the groups. Within the domain of athletic ability men had significantly higher scores than all three groups of women ($F = 13.23$, $df = 3, 140$, $p < 0.001$). Within the job competence domain the full-time homemakers scored significantly lower than the full-time working women and the full-time working men ($F = 3.20$, $df = 3, 139$, $p < 0.03$). In the domain of intimate relationships it was full-time working men that scored significantly lower than all three groups of women ($F = 9.50$, $df = 3, 139$, $p < 0.001$). Lastly, the morality scale revealed significantly lower scores for men compared to the part-time and full-time working women ($F = 3.92$, $df = 3, 140$, $p < 0.01$). There is a clear pattern that has emerged here with men reporting higher self-perceptions in physical and job related domains, while the female groups report higher self-perceptions in the social and morality domains. However, to the author's knowledge there is little research in the literature that has demonstrated this relationship in a controlled manner.

Due the differences found by Messer and Harter (1989), it was essential that the present study also compare the differences between men and women using the ASPP.

Autonomy

Autonomy is an important psychological construct that has been researched in older populations (Krause & Shaw, 2000; Searle, Mahon, Iso-Ahola, Sdrolias, & van Dyck, 1998; Reich & Zatura, 1991). However, there has been little research investigating the relationship between autonomy and physical activity adherence in older adults. More recent distinctions between autonomy, detachment and individualisation in self-actualisation (Maslow, 1970) have led to its definition within SDT as behaviours that are willingly enacted and endorsed by the individual, and are congruent with their values (Ryan & Deci, 2006). In direct contrast is heteronomy, conceptualised as behaviours that are not willingly enacted by the individual, but compelled by agents external to the self regardless of values (Chirkov, Ryan, Kim, & Kaplan, 2003). Autonomy and heteronomy are distinct from independence and dependence, which refer solely to the provision of support (Cordingley & Webb, 1997). What is more, Cordingley and Webb (1997) state that feelings of autonomy can occur in the right environments irrespective of the degree to which older people are dependent on others for care. This review of autonomy will discuss some of the controversies regarding this concept and review research that has investigated the importance and relevance of this construct in older populations and physical activity behaviour.

Contention over the Nature of Autonomy

As pointed out by Ryan and Deci (2006) there has been some contention over the importance and reality of autonomy and related phenomena such as will, choice, and freedom. With respect to physical activity adoption, it is important that the nature of

any construct proposed to influence this behaviour (in this instance autonomy) be subject to due scrutiny to ensure it does not replicate existing constructs and can be separately categorised. To this end this section will discuss some of the contention regarding the nature of autonomy.

Autonomy and Material Determinism

The first point of contention often raised refers to the inability of some researchers to reconcile the notion of autonomy with material determinism (Ryan & Deci, 2006). According to a material determinism perspective, external influences fully control behaviour not adequately accounted for in SDT. However, SDT defines autonomy as the self-endorsement of actions, some of which may be externally prompted and does not neglect the role of the environment. In fact, SDT does acknowledge the effect of external pressures. Furthermore, it has been shown that rewards and punishment (environmental factors) serve to undermine autonomy and intrinsic motivation (Deci, Koestner, & Ryan, 1999). With respect to physical activity behaviour a material determinism argument would maintain that adherence to physical activity programs is completely controlled by external factors (consciously and non-consciously) with no person oriented perspective.

Cognisance and Autonomy

The second point of contention is that autonomy is an illusion as behaviour can be initiated non-consciously (Ryan & Deci, 2006). To define autonomy by whether select behaviours are, or are not consciously controlled, is a misconception of its fundamental nature. Ryan and Deci (2006) state that non-conscious behaviours can be autonomous, just as conscious behaviours can be heteronomous. For example, a person who automatically takes the stairs instead of an elevator maybe acting autonomously if

the increased activity they are engaging in is congruent with their beliefs, values or attitudes. This behaviour is by definition autonomous, yet it is a non-conscious decision. Conversely, a man forced to attend a physical activity program by his wife has made a conscious choice to attend, even though it is in no way congruent with his beliefs, values or attitudes. This behaviour is by definition heteronomous, yet it is remains a conscious decision. As autonomous and heteronomous behaviours can be both conscious and non-conscious, employing the rhetoric of cognisance to undermine the validity of autonomy as a construct is inappropriate.

Autonomy is Culturally Specific

Some authors have argued that autonomy is culturally specific to western societies (Iynegar & Devoe, 2003). However, the argument implies that non-western cultures have no need for autonomy (Ryan & Deci, 2006). This stems from another misconception regarding the nature of autonomy. It is possible and beneficial for people in collectivist cultures to experience autonomy, as behaving in a collectivist nature is congruent with their values and beliefs (i.e., autonomous). It is has been consistently shown that high autonomy is a key factor in high self-motivation and mental health in Russian, South Korean, and Japanese cohorts; cultures that have very strong collectivist perspectives concerning behaviour (Chirkov, Ryan, Kim, & Kaplan, 2003; Yamauchi & Tanaka. 1998).

Autonomy is an Overabundance of Choice

Finally, other scholars have defined self-determination as simply making decisions between multiple options. Proponents of this view maintain that autonomy presents such a large number of choices that it eventually becomes overwhelming and ego-depleting; ergo people will not by nature do this. Autonomy is, by definition, the

endorsement of a particular behaviour by an individual. This could be only one available behavioural option (no choice), or several behavioural options (many choices). It could be said that consistently forcing individuals to actively choose from a large number of behavioural options can be ego-depleting. However, it is not within the normal scope of human behaviour to entertain options outside our belief systems. In fact, it is more likely that a person's sense of autonomy will lead them to automatically disregard options that are not congruent with their values and beliefs, greatly reducing the number of behavioural options.

Autonomy and Health in Older Adults

Autonomy has been linked to positive health outcomes in older adults. Studies investigating the links between autonomy and mortality (Krause & Shaw, 2000; Menec, Chipperfield, & Perry, 1999) have found evidence to suggest that a strong sense of autonomy in late adulthood is associated with lower mortality. Cross-sectional studies in related constructs, such as locus of control, have shown that a sense of control over one's life is a key factor in the maintenance of good mental health (Iso-Ahola, 1984; Rodin, Timko, & Harris, 1985; Seligman, 1975). Also, studies have found that education can effect perceptions of control (Searle, Mahon, Iso-Ahola, Sdrolias, & Van Dyck, 1995); and that locus of control and autonomous learning are strong predictors of well-being in the elderly (Gardner & Helmes, 1999). While there appears to be a paucity of research specifically investigating autonomy and exercise in older adults, these findings indicate that high autonomy could be associated with high adherence to physical activity in older populations.

Autonomy and Physical Activity

To the author's knowledge, there are no randomised controlled trials to date that have investigated physical activity and autonomy in an older population. However, results from cross-sectional studies provide some promising evidence to this relationship in younger populations. First, in 295 high school students it was shown that an autonomy supportive environment was strongly related to engagement in leisure time physical activity (Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005). A second study by Bagoien and Halvari (2005) in 231 secondary school students found that autonomous motivation was related to physical activity involvement. Third, a strong relationship between high autonomous motivation and latter stages of exercise behaviour change was demonstrated in 314 adults (mean age 37.55 years ±11.26) by Mullan and Markland (1997). These studies in younger populations, while only cross-sectional, indicate that autonomy may play a significant role in the motivation to adopt physical activity. The extent to which this applies in an older population has yet to be established, but based on these findings it is proposed that high autonomy is associated with high adherence to a physical activity program in older adults.

Social Connectedness

Social connectedness is the last of three developmental stages of belongingness proposed by Kohut (1984). Emanating from the developmental nature of belongingness sets social connectedness apart from related concepts such as attachment, loneliness and social support. The developmental stages of belongingness are (a) companionship, (b) affiliation, and (c) connectedness. While research across these three stages has been limited to use in the therapy context, it does have application to the field of exercise psychology. According to Kohut (1984) people will pass through the developmental stages of belongingness, though need for validation in any one of these stages may be

experienced anywhere throughout the life span. The first stage, companionship, begins in infancy as the relationship between a child and nurturing parent. The second, affiliation, begins in later childhood and is the development of peer relationships and the ability to function comfortably alongside similar others. The third stage, connectedness, emerges in late adolescence and was hypothesised to extend throughout adult life. Once having successfully developed companionship and affiliation with others, the individual feels a sense of connection to a greater social context (social connectedness). In relation to older adults a sense of social connectedness may be one key factor that could explain adherence and retention in group based physical activity programs and withdrawal from self-managed approaches. For this reason the current study limited investigation of belongingness to the social connectedness construct. The following review will outline (a) the characteristics, (b) the relationship to mental health, (c) the gender differences, and (d) the relevance to older adults, of social connectedness.

Characteristics of Social Connectedness

There are many definitions of social connectedness along with related constructs of social support, cohesion, and group integration. Lee, Draper and Lee (2001, p. 310) state that social connectedness is “an attribute of the self that reflects cognitions of enduring interpersonal closeness with the social world *in toto*.” Social Connectedness is different from social support (Laireiter & Baumann, 1992), attachment (Ainsworth, 1989), loneliness (Weiss, 1974), and need for affiliation (Maslow, 1970) which reflect relationships at a more contextual or state level. Social connectedness is a global or trait perspective (Lee & Robbins, 2000) and is not dependent on relationships within a context. It was shown by Lee and Robbins (1998) that a sense of social connectedness could account for more variance in anxiety in social settings than self-esteem or social

support. Moreover, the authors found that despite long-term marriages and friendships (high social support), participants still reported feelings of social disconnectedness (Lee & Robbins, 1998).

Several studies examined the influence of social support on adherence to exercise in older adults (O'Brien Cousins & Vertinsky, 1995; Wankel, Mummery, Stephens, & Craig, 1994). Whilst some studies have shown that social support can increase exercise adherence, the relationship is not fully understood. In a recent review of 29 studies investigating social support and physical activity, 85 social support items were identified. Only 42 of these items had a statistically significant influence on the outcome variables (Chogahara, O'Brien Cousins, & Wankel, 1998). In contrast, in two recent studies (Brassington, Atienza, Perzcek, Dilorenzo, & King, 2002; Rhodes, Martin, & Taunton, 2001) social support was not found to influence exercise adherence. Investigation of social connectedness in exercise groups may provide more information in explaining adherence than focussing on provision or perceptions of social support alone.

Social Connectedness and Mental Health

A sense of social connectedness is related to a variety of positive psychological and social behaviours, conversely a sense of social disconnectedness is related to a variety of negative psychological and social behaviours (Callen & Wells, 2003; Laditka & Laditka, 2003; Kinsel, 2005). These will now be discussed with relevance to older adults.

Positive Social Connectedness

A positive sense of social connectedness is associated with a variety of positive psychological traits and behaviours. Firstly, the sense of stable social connectedness is

not susceptible to the loss of a friend or exclusion from a social group. Secondly, high connectedness is related to feelings of closeness with others, identification with others, perceptions of others as friendly and greater participation in social activities (Lee & Robbins, 2000). Thirdly, there is a greater respect and tolerance of differences in others, and individuals only exhibit temporary lapses in belongingness (Baker & Baker, 1987). Research has shown that social isolation is associated with poor mental health and depression in older adults while high levels of social support are associated with decreased negative psychological states (Martin & Stevens, 2006; Paul, Ayis, & Ebrahim, 2006; Vanderhorst & McLaren, 2005). There is a similarity between social connectedness and personality traits such as extraversion as both are concerned with social experiences. However, they differ conceptually as extraversion is concerned more with the motivation to create social bonds and to seek attention (Costa & McCrae, 1992; Goldberg, 1999), while social connectedness is concerned more with the degree of closeness between oneself and others (Lee & Robbins, 2000). A study conducted by Lee et al (2008) used a factor analytic method to demonstrate that social connectedness was psychometrically related, yet distinct from extraversion. Furthermore Lee et al. (2008) also were able to demonstrate that social connectedness mediated the relationship between extraversion and well-being in 2 separate samples. While these studies were conducted with younger populations, it provides some support for the contention that a sense of social connectedness in older adults could have a positive influence on their lives and may help them to overcome difficulties and barriers to physical activity adherence.

Social Disconnectedness

A sense of disconnection from society is related to a number of negative psychological traits and behaviours. Firstly, individuals feel isolated from others and

society. Secondly, they perceive themselves to be misunderstood and have difficulty relating to others. Thirdly, social situations are uncomfortable for these people even though they're able to develop relationships with others and groups. Lastly, people feeling disconnected are likely to exhibit dysfunctional interpersonal behaviours (Lee, Draper, & Lee, 2001). A sense of social disconnectedness in older adults may lead to high anxiety, depression, and early morbidity due to lack of activity in their day-to-day lives, and may also be less likely to join physical activity programs.

Gender Differences in Social Connectedness

A study by Lee and Robbins (2000) found that in men (n = 185) and women (n = 198) aged between 17 and 48 years, there is a similar need for social connectedness. However, the types of relationships they form in order to develop this are different. The women felt a sense of connectedness through relationships that focused on availability, non-authoritarianism and mutual intimacy. However, men developed a sense of connectedness through relationships that allowed them to differentiate themselves from others and allowed them to feel reassured of their worth as individuals. This may have an impact on the design of physical activity programs to cater for these differences between males and females. In physical activity programs for females, developing connectedness through relationships that focus on intimacy within the group could potentially increase retention. For males, programs that develop connectedness through camaraderie and provision to demonstrate individual worth maybe be more effective.

Social Connectedness, Physical Activity, and Older Adults

There is no known research investigating social connectedness in the adoption and maintenance of physical activity. It is, therefore, necessary to draw on research from social support to provide insight into exercise adoption in older adults. As with

many psychosocial constructs it is necessary examine the reciprocal relationship between social connectedness and physical activity adherence. In their recent review of social support and physical activity Chogahara, O'Brien Cousins and Wankel (1998) outlined four positive sources of social support that are linked to exercise adherence in older adults. These are (a) instrumental (direct assistance), (b) emotional (affective support), (c) informational (knowledge assistance) and (d) esteem support (self-esteem and skill enhancement). This is consistent with the view of Berger, Pargman and Weinberg (2002), who outline similar sources of social support. The review also outlines negative social support in exercise, including (a) perceived barriers, (b) environmental barriers, (c) leisure constraints, (d) social disapproval and (e) stereotypes (Chogahara et al., 1998). The authors go on to state that there is great individual variability in the combination and strength of positive and negative social influences. Measurement of social connectedness in the proposed study will allow examination of social support from a dispositional rather than from an external influence perspective, and will remove a significant amount of the variability associated with measuring social influence. The contextual aspects of social constructs have shown limited relation to physical activity adherence (Brassington, Atienza, Perzcek, Dilorenzo, & King, 2002; Rhodes, Martin & Taunton, 2001). Therefore, investigating social connectedness could potentially increase our understanding of the role of socialisation and social support in the physical activity adherence of older adults. This may lead to better understanding of how to design socially based physical activity interventions.

The Role of Socio-Economic Status, Gender, and Environment in Exercise Adherence

There is literature to suggest that factors such as socio-economic status, gender and environment may significantly influence adoption of, or adherence to, a physical

activity program (Giles-Corti & Donovan, 2002; Epstein, Paluch, & Raynor, 2001; Johnson, 2004; Sallis & Owen, 1999). However, within models of behavioural change, little recognition is given to the effect of these aspects. There are studies that have examined socio-economic status, gender and environment as related to physical activity levels in different populations. However, by necessity, the majority of these studies are cross-sectional. Sallis and Owen (1999), after conducting a review of studies on determinants of physical activity between 1992 and 1997, found that high socio-economic status and being male (among other variables) were strongly related to high physical activity levels. Until 1997 there had been no published studies that examined the potential effects of environment on physical activity (Sallis & Owen, 1999). A review of studies published between 1998 and 2000 on the determinants of physical activity levels (Trost, Owen, Bauman, Sallis, & Brown, 2002), came to a similar conclusion that high socio-economic status and being male were strongly related to high physical activity levels. In addition, the authors found that the built environment may also have a significant impact on physical activity levels. This section of the review will highlight the potential impact of socio-economic status, gender, and environment on physical activity levels.

Socio-Economic Status

There is research to suggest that individuals from a lower socio-economic background are at greater risk of becoming physically inactive (Brownson et al., 2000; Salmon, Owen, Bauman, Schmitz, & Booth, 2000). Irrespective of the type of measure employed (education, household income, index for disadvantage) this relationship is consistently demonstrated in physical activity studies in most developed countries (Trost et al., 2002). The International Crime Victimisation Survey conducted by the Australian Institute of Criminology (Johnson, 2004) with 7000 community members

(1000 from migrant backgrounds) demonstrated that people who felt unsafe walking alone in their neighbourhood had lower SIEFA indexes than those who felt very safe walking alone through their neighbourhood. While it was not within the scope of the present study to examine the effect of crime rates or personal safety, it is recommended that physical activity interventions and research designs take into account the potential impact of socio-economic status on physical activity level.

Gender

Many studies have shown the differences between male and female's adoption of physical activity programs. In younger populations it has been demonstrated that females have significantly lower rates of physical activity adoption compared to males (Epstein, Paluch, & Raynor, 2001). The most popular opinion as to why these differences occur is that men have been socialised towards physical activity more than women, this may be particularly significant for older populations.

The Built Environment

Recent research has attempted to examine the relationship between the built environment and physical activity levels (Giles-Corti & Donovan, 2002). Cross-sectional studies have shown that some neighbourhoods appear more conducive to physical activity than others (Sallis et al., 1990; Sallis Bauman, & Pratt, 1998). This may be due to more public open space, less traffic, more lighting, better walk ways, and a greater mix of housing and commercial properties in these neighbourhoods. One theory behind this association is that if the environment is more conducive to physical activity, people will become more physically active. Berke et al. (2006) in a cross-sectional study of men and women (N = 8,162) over 65 years old, found that shorter distances between home and site of unstructured physical activity was a significant

predictor of high engagement in unstructured physical activity. Giles-Corti et al. (2005) also found in 1,773 males and females aged 18-59 years, that participants who lived closer to a public open space were almost twice more likely to utilise that space. Further, participants that regularly used a public open space were almost three times as likely to engage in at least 150 minutes of physical activity per week. These studies indicate that distance away from places where people can engage in physical activity could be a potential factor in maintaining adherence to an exercise program.

Functional Fitness

Traditionally behavioural change physical activity studies have focussed on changing physical activity level or measuring adherence. Few of these studies have evaluated the effect of the intervention on physical health outcomes. There are a number of ways physical health can be assessed. One of the most basic and relevant measures to older populations is functional fitness. Functional fitness tests are design to estimate the ability of an individual to perform the Physical Activities of Daily Living (PADL). It has been noted that even among highly dependent groups (frail elderly, chronically ill) increases in functional ability have a spill over effect to perceptions of health, quality of life and autonomy (Bravo et al., 1996; King, Pruitt, Oka, Rodenburg, & Haskell, 2000). This review will outline the impact of physical activity on functional fitness and the implications this has for overall health.

Dimensions of Functional Fitness

Studies in the past have used peak VO_2 as the outcome measure of choice to determine fitness levels. However, this often does not relate well to the ability to perform PADL to a level sufficient to maintain functional independence (Rikli & Jones, 1999). There are many measures that can be employed to measure functional fitness

and some designed for use with older populations. The Rikli and Jones (1999) Functional Fitness Test (FFT) provides a valid, reliable measure of different aspects of functional capacity in older adults. In addition, this test is designed to reflect the ability to perform PADL, an important factor in maintaining good physical and mental health (Rikli & Jones, 1999). The performance measures in the FFT are the (a) 30s chair stand, (b) 30s arm curl, (c) 6-min walk, (d) chair sit-and-reach, (e) back scratch, and (f) the 2.5m up-and-go. Each of these tests represents a generic physical ability that is inherent in many PADL. What is more, the FFT is a safe, efficient, and cost effective method for establishing functional fitness in older populations. The FFT is often employed to assess fitness in cross-sectional and intervention studies in older adults (Newman et al., 2006; Marsh et al., 2006).

Physical Activity and Functional Fitness

There are some studies that have investigated the effects of different training methodologies on the functional fitness of older adults. As functional fitness represents a generic skill base it has been noted that training effects, in healthy populations can take up to 6 months to be realised (Chin A Paw, de Jong, Schouten, van Staveren, & Kok, 2002). However, studies in chronic disease populations can experience significant improvements in as little as 10-12 weeks. A study among breast cancer survivors showed significant improvements in functional capacity over a control after a 12 week Tai chi chuan program (Mustian, Katula, & Zhao, 2006). Combinations of cardiovascular and resistance training regimes have shown improved functional fitness compared to cardiovascular and resistance training alone (Wood et al., 2001). With respect to physical activity, King, Pruitt, Phillips, Oka, Rodenburg, and Haskell (2000) found improvements in functional fitness in a comparison of two community based, moderate intensity physical activity programs. Earlier studies, (Bravo et al., 1996;

Lazowski et al., 1999) also have shown that adopting and maintaining a moderate intensity physical activity program, can have a positive impact on functional fitness in older populations. In a cross-sectional study of 3,075 older adults, Brach et al. (2004) found that sufficient levels of physical activity were strongly related to high functional fitness scores. The findings of these studies indicate that regular physical activity can impact on functional fitness and ability to perform PADL in older populations.

Health of Older Adults and Functional Fitness

It has been demonstrated that functional fitness is a strong predictor of physical health in older populations. A study by Newman et al. (2006) has shown that inability to complete a 400m walk test is associated with high mortality, incident of cardiovascular disease, mobility limitation/disability. Furthermore, each additional minute it took to complete the test was associated with high mortality, cardiovascular disease, and mobility limitation/disability. High performance on the 6-min walk test to be employed in this study, also has been independently associated with decreased morbidity and mortality in patients with left ventricular dysfunction (Bittner et al., 1993). Functional fitness is a strong factor in the health of older adults. Therefore finding methods to increase or maintain this are of great importance considering the decline in physical health associated with sedentary lifestyles. In addition to physical associations, high functional fitness may also be related psychosocial health in older adults. Bravo et al. (1996) found that improved functional fitness was associated in significantly high perceived health status in 124 community living women 50 to 70 years of age. Given that functional fitness is an important factor in physical and potentially psychosocial health, physical activity intervention research would be strengthened by including functional fitness as a primary outcome.

Behavioural Interventions in Physical Activity

Physical activity intervention reviews have focused on the key limitations in physical activity intervention research and comparing the effectiveness of physical activity interventions. It is commonly noted in most of the peer reviewed literature there is a paucity of randomised controlled trials in physical activity research (Conn, Minor, Burks, Rantz, & Pomeroy, 2003; King, Rejeski, & Buchner, 1998; van der Bij, Laurant, & Wensing, 2002). There is evidence to suggest an increasing trend toward randomised controlled trials in more recent reviews (Conn et al, 2003). Presented earlier was a list of randomised controlled trials that tested interventions designed to change physical activity in populations that included older adults (Table 1). Seventy one percent of these studies included a behavioural change component in the intervention (15.5% not reported, and in 12.7 % this information was not available). Only one of the 71 studies included had employed self-determination theory (Levy & Cardinal, 2004) as a theoretical basis to the intervention. This section of the review will outline (a) limitations in physical activity research, and (b) the effectiveness of interventions to increase physical activity.

Limitations in Physical Activity Intervention Research

Several reviews have highlighted a number of limitations in physical activity intervention research; including poor study design, untested outcome measures, a lack of integrated theoretical frame works and small sample sizes. Further, most have not employed an intention to treat principle, which may result in an overestimation of the effectiveness of an intervention to increase physical activity adherence (Conn et al, 2003; King et al, 1998; van der Bij et al, 2002).

First, the issue of study design in physical activity research has received some coverage in the literature. There are advantages and disadvantages associated with

cross-sectional, longitudinal, randomised control, and cluster randomised control designs. Therefore, researchers must take into account what type of study design they need in order to answer a research question. Also researchers must take into account the practicality of certain study designs, for example, while it may be necessary to use a cluster randomised to answer your research question, is it possible to recruit enough participants within each cluster to make this a viable option. Many authors cite the lack of a control or comparison group as the major drawback in the testing of many physical activity interventions. However others would contend that using a *zero intervention* control is unethical and researchers should adopt a usual care control comparison. Another major design problem concerns cross intervention contamination. While employing a multi-centre approach can reduce the likelihood of this occurring, many researchers do not account for clustering within centres in subsequent analyses.

Second, there has been much attention focused on the accuracy and efficacy of outcome measures in physical activity research. Of great concern to physical activity researchers, is selection of measures that best reflect the level of physical activity, adherence, or intensity of exercise. With so much dependent on the outcome measure and, the significant debate over the efficacy of the method employed, it becomes difficult to draw solid conclusions from any study, be it cross-sectional or comparative. Researchers need to address this issue by utilising centre and participant physical activity records, and validated physical activity questionnaires to measure adherence and physical activity levels. In addition physical activity monitors such as pedometers and accelerometers can be employed and compared to other more subjective measures.

Third, to change the exercise behaviour of sedentary populations in an effective manner, the intervention program must have a strong theoretical basis. Several theoretical frameworks for behavioural change lend themselves to physical activity behaviour, each having strengths and limitations in their application. A review of the

studies in Table 1 shows five different behavioural models and up to seven other behavioural strategies employed across 51 studies that had behavioural intervention components. When selecting the type of theoretical framework researchers must take into account methodological and measurement issues. For example, it may not be possible to base an intervention on a particular theory as there may be no valid measures in the exercise domain. One theoretical framework that has been used in several studies is the Stages of Change Model proposed by Marcus, Selby, Niaura, and Rossi (1992). This was adapted from the Transtheoretical Model of behavioural change developed by Prochaska and DiClemente (1983) to explain smoking cessation. Referring back to Table 1, 28% of the 51 studies that had a behavioural component used the Transtheoretical Model as the basis for their intervention. While it is accepted that the Transtheoretical Model provides a good basis for interventions and description of behaviour change, it is limited in the capacity to identify directional pathways between related behavioural change constructs.

Fourth, it is well known that the sample size for physical activity intervention studies, or any study for that matter, should be based on how many participants are needed to demonstrate a significant change in the outcome variable. Due to the high variability in most outcome measures related to physical activity research, often the sample sizes needed are quite large. This may become an issue when recruiting participants for physical activity research, as potential participants could have to meet many selection criteria before inclusion in the study. When the pre-existing reluctance for most people to engage in physical activity is taken into account, it becomes apparent why recruitment strategies are an important factor in the success of a study. Calculation of sample size, and varying recruitment procedures are an important, and sometimes neglected, part of study design.

Last, the Intention To Treat (ITT) principle is a major issue of contention in physical activity intervention studies. Best put, the ITT principle states that data from all participants, who were included at baseline, is analysed post-intervention irrespective of their withdrawal from the study. Removing the data of participants who withdrew during the intervention period can artificially increase the effectiveness of a given intervention. A review exercise adherence rates in 21 randomised controlled trials in adults ≥55 years, found that adherence rates calculated using ITT (M = 63%) was significantly lower than those that did not (M = 88%). Including the data of withdrawn participants gives a more accurate representation of the effectiveness of the intervention tested. Not employing an ITT principle can artificially inflate adherence results and misinform practitioners on the best methods to affect behavioural changes in physical activity.

Approaches of Interventions to Increase Physical Activity

Home versus Centre Based Interventions

Research into the efficacy of home versus centre based physical activity interventions has, to a limited extent, been tested and reported in the literature. Van der Bij, Laurant and Wensing (2002) reviewed home-based, group-based and educational physical activity interventions, reporting that the attenuation of adherence to a physical activity target over time was weaker in group-based compared to home-based programs. The strength of this review was that it only included studies that measured adherence to a target, and reported changes in physical activity level over time (pre-to-post measure with a control group comparison). A recent Cochrane Report (2005) found that, while in the short-term, centre based interventions proved more effective, home based interventions achieved greater adherence to exercise over the longer-term (Ashworth, Chad, Harrison, Reeder, & Marshall, 2005). This finding should be interpreted with

some caution as the results were based on a review of only two publications (King, Haskell, Taylor, Kraemer, & De Busk, 1991; King, Haskell, Young, Oka, & Stefanick, 1995). In addition, the review focused on studies with measures of COPD (Chronic Obstructive Pulmonary Disease) thus limiting the number of studies included. The high cost of centre programs over home-based programs must be taken into consideration when evaluating interventions in the community at large. Sevick et al. (2000) compared the cost effectiveness of a supervised centre-based versus non supervised lifestyle physical activity program in 235 adults, 35 to 60 years of age. The authors concluded that the non supervised lifestyle program (US$46.5 per person) was significantly more cost effective than the supervised centre-based program (US$190.24 per person) as there was no significant difference between the two groups in any of the physical activity or health outcome measures. Centre-based programs would only represent a viable alternative to a home based/minimal support approach if the potential savings accrued from high participation rates outweighed the expenditure.

In using a community-based approach when testing the intervention strategies, the present study allowed for results and findings to be readily applied to the general population. However it is essential that the interventions are based on sound behavioural change theories, and have been tested in more controlled settings to ensure they can be applied to a physical activity setting.

Direct Contact versus Mediated Interventions

Research into direct contact versus mediated physical activity interventions are gaining popularity with the increasing complexity of electronic media. Direct contact involves face-to-face meetings or exercise sessions, mediated interventions are delivered through print, television, radio, internet or telephone (Marcus et al., 2006). The significantly lower cost per head of mediated physical activity interventions makes

them a very attractive method for governments and health promotion agencies. A review of interventions from 1965 to 1995 by Dishman and Buckworth (1996) found that, when weighted by sample size, mediated delivery methods had a larger effect size compared with face-to-face delivery methods (when unweighted, there was no significant difference). King, Haskell, Taylor, Kraemer, and DeBusk (1991) found that of the three programs administered, participants reported more minutes of activity per week in the two telephone delivered programs, compared to the face-to-face group delivered program (120-130 min/week and 60 min/week respectively). Behavioural intervention studies, such as this present study that employs initial direct contact and follow-up mediated components, provide a comprehensive approach to delivery of behavioural change packages.

Background to the Hypothetical Models

In the past randomised controlled trials have neglected to analyse, in depth, the underlying psychosocial constructs central to the behavioural change models used their interventions (Martin & Sinden, 2001). Path analysis allows researchers to identify relationships between constructs important to behavioural change models and further elucidate how these models relate to physical activity behaviour.

Geneticist, Sewell Wright (1921; 1934), introduced path analysis as method of measuring direct influence along pre-determined paths, and finding the degree to which variation of a given effect is determined by each particular cause. Essentially, path analysis is a method employed to breakdown correlations among existing variables into hypothetical pathways. These pathways must be based on the order of variables in existing theoretical or temporal models. Until the 1970’s only the inter-relationships among observed variables had been analysed by the method of path coefficients.

However, the assumption of perfect measurement of observed variables is considered too "unrealistic in the case of most sociological data" (Blalock, 1964 cited in Long, 1981, p. 209). Thus other methods needed to be developed which allowed for measurement error and the use of multiple indicators of underlying latent or hypothesised variables. Through the work of Jöreskog (1973, 1977, 1979) and Jöreskog and Sörbom (1979, 1993; 2001) structural equation models have been constructed in which hypothetical causal relationships among latent variables may be estimated. It should be noted here that structural equation models are correlational in nature and must not be interpreted as causal. Basic to these models is the identification of specific observed variables as indicants or manifestations of the latent variables. While path analytic techniques have been widely used in other scientific disciplines the early application of path analysis to social and behavioural sciences (Blalock, 1968; Duncan, 1966; and Land, 1969) laid the groundwork for physical activity behaviour researchers to apply path analytic techniques (Crocker, Eklund, & Kowalski, 2000; Heesch, Masse, Dunn, Frankowski, & Mullen, 2003; Motl et al., 2005; Standage, Duda, & Ntoumanis, 2003; Standage, Duda, & Ntoumanis, 2005).

In this study path analysis assisted in determining the degree to which each particular cause influences the total variation on a subsequent variable in a causal chain of events. Each link in this chain of events is a separate path coefficient. However before the strength of each path coefficient can be determined, it was necessary to develop a causal model. Causality is a unidirectional relationship which involves changes from a preceding variable to a subsequent variable. Blalock (1964, p. 9) defines *cause* in the following terms "If X is a cause of Y, we have in mind that a change in X produces a change in Y and not merely that a change in X is followed by or associated with a change in Y". The causal models presented in this study are systems of variables placed in a predetermined order on the basis of self-determination theory. Once the

models have been derived, and the correlations among the variables are known, a set of structural equations are written and the path coefficients calculated for each model.

Structural Equation Model 1: From Baseline Physical Self-Perceptions and Environment to Adherence, via Motivation

As this thesis is concerned with Self-Determination Theory (SDT), this theory formed the basis of the first à priori model to be tested. There are other studies that have investigated SDT using structural equation modelling in physical activity (Standage, Duda, & Ntoumanis, 2003; 2006). However, these were cross-sectional studies in school age students. The outcome variable in the present study is adherence to the program, (i.e. the number of sessions accrued over 6 months). According to SDT, the higher the self-determined motivation, the more a person will adhere to the behaviour in question, i.e. exercise sessions. If self-determined motivation and its antecedent factors are important in adherence then the hypothesised model may look like Figure 3. High physical self-perceptions have been shown to be associated with high self-determined extrinsic motivation and intrinsic motivation (Ferrer-Caja & Weiss, 2000). There are also studies that indicate that these constructs may be positively related to adherence (Kavussanu & Roberts, 1996; Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997). There are no known studies that have investigated whether physical self-perceptions could be negatively related to non self-determined extrinsic motivation. However, according to SDT (Ryan & Deci, 2006), non self-determined extrinsic motivation should be negatively related to adherence. Research suggests that distance away from the recreation centre may also impact on motivation for physical activity and the amount of physical activity an individual will participate in (Giles-Corti & Donovan, 2002).

Structural Equation Model 2: From Baseline Physical Self-Perceptions, Autonomy and Social Connectedness to Adherence

The second à priori model that was tested in the present study is outlined in Figure 4. In this model the outcome variable, adherence, remains in place. However the direct contributions of baseline physical self-perceptions, autonomy, and social connectedness are employed in this model as potential predictors of adherence to the program. According to SDT these constructs may have a strong influence on behavioural change as demonstrated in a smoking cessation trial in 1006 adult smokers (Williams, McGregor, Sharp, & Levesque, 2006). Williams et al. (2006) using a path analytic model found that increases in autonomy and competence led to greater smoking cessation. Other studies have also demonstrated associations between self-perceptions, autonomy, and connectedness and adherence to a physical activity program (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Standage, Duda, & Ntoumanis, 2003). Standage et al. (2003) found that high competence, autonomy, and connectedness were related to self-determined motivations for physical activity intention in a cross-section of 328 secondary school students. These findings were supported by Hagger et al. (2003) who found that perceptions of autonomy support influenced intrinsic and identified motivation in a population of 295 high school students. These studies in children indicate that physical self-perceptions, autonomy, and connectedness may be key factors in physical activity adherence. Hypothesised structural equation model 2 examines this relationship in an older population.

Structural Equation Model 3: From Adherence to 6-month Social, Cognitive and Physical Self-Perceptions

The third and final à priori model that was evaluated in this study is presented in Figure 5. This model is testing the hypothesis that engagement in a physical activity program will influence self-perceptions in the social, cognitive, and physical domains at

6-months. Research in younger populations has shown that high levels of physical activity may be related to social and cognitive self-perceptions (Colchico, Zybert, & Basch, 2000; Sloan, 2002). However, the extent of this relationship has not been tested in an older population. Colchico et al. (2000) found, in a small sample (N = 30) of adolescent girls, that after 12 weeks of extra-curricular activity perceptions of scholastic, social and athletic competence were elevated in comparison to baseline scores. While the authors state that this was a pilot study, and there was no comparison group, the results lend some support to the pervasive nature of physical activity in the self-perceptions of adolescents. To the author's knowledge, this model was the first to examine the relationship between adherence to a physical activity program and self-perceptions outside the physical domain in older adults.

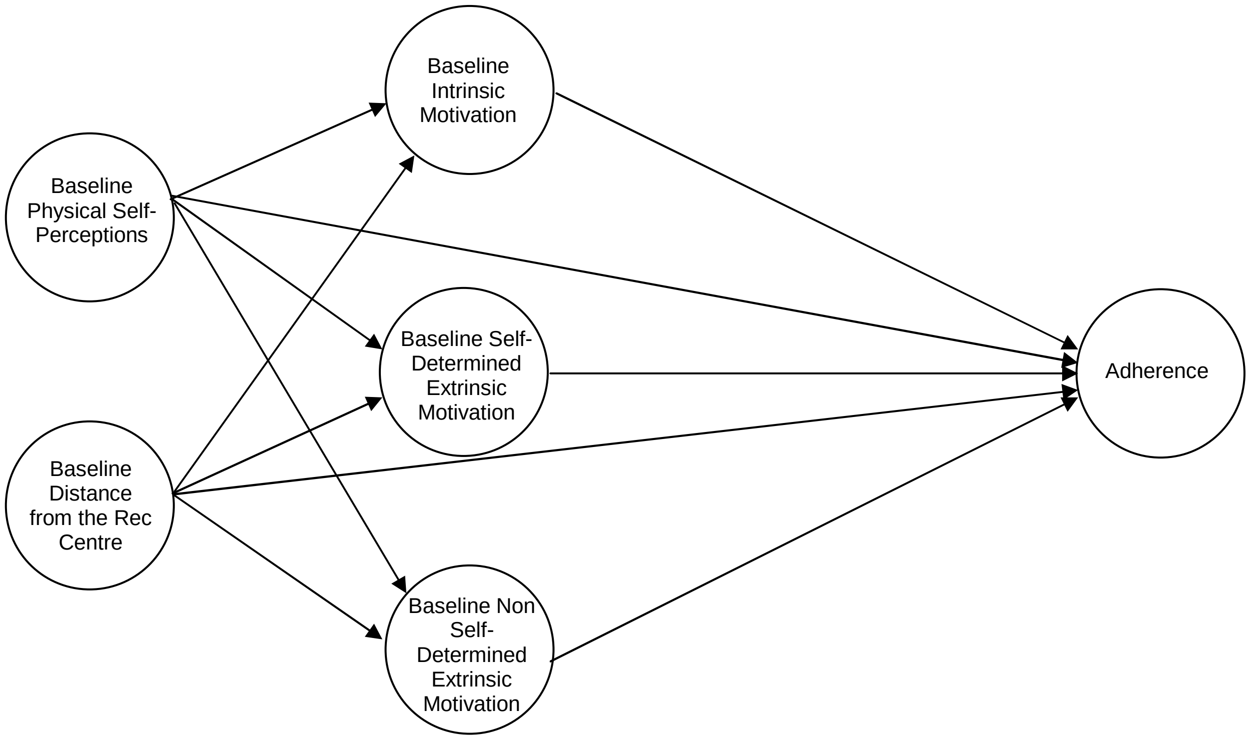


Figure 3. Hypothesised pathway model 1: From baseline physical self-perceptions, environment and motivation to adherence.

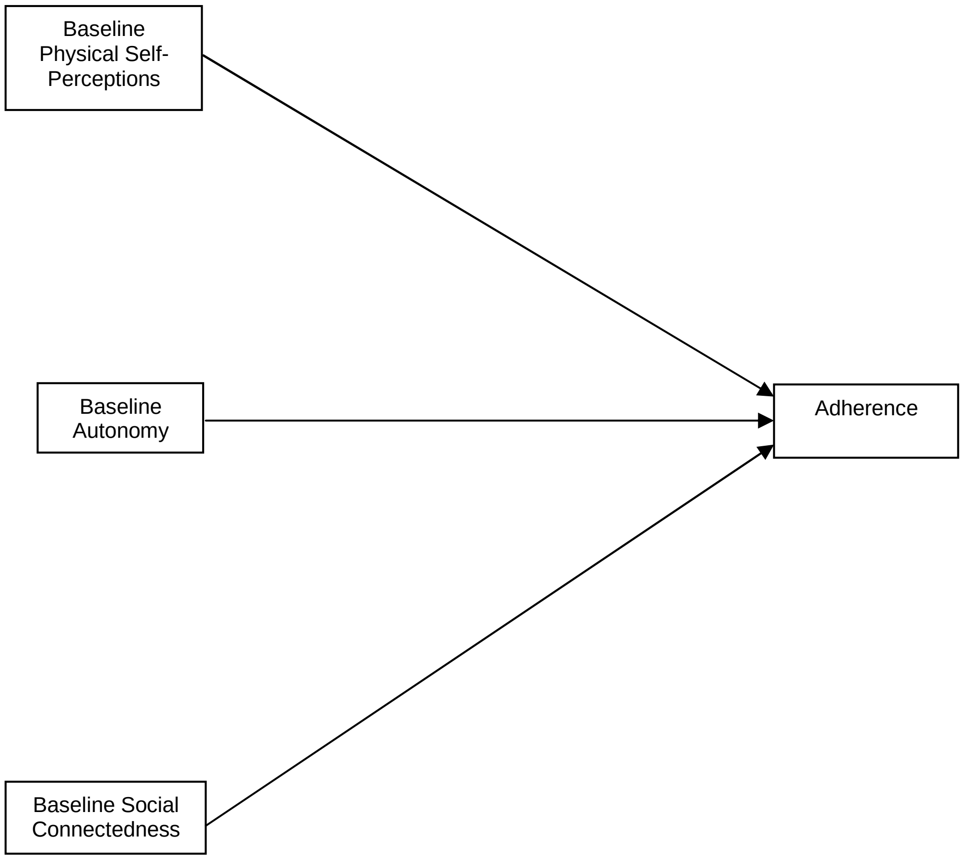


Figure 4. Hypothesised pathway model 2: From baseline physical self-perceptions, autonomy and social connectedness to adherence.

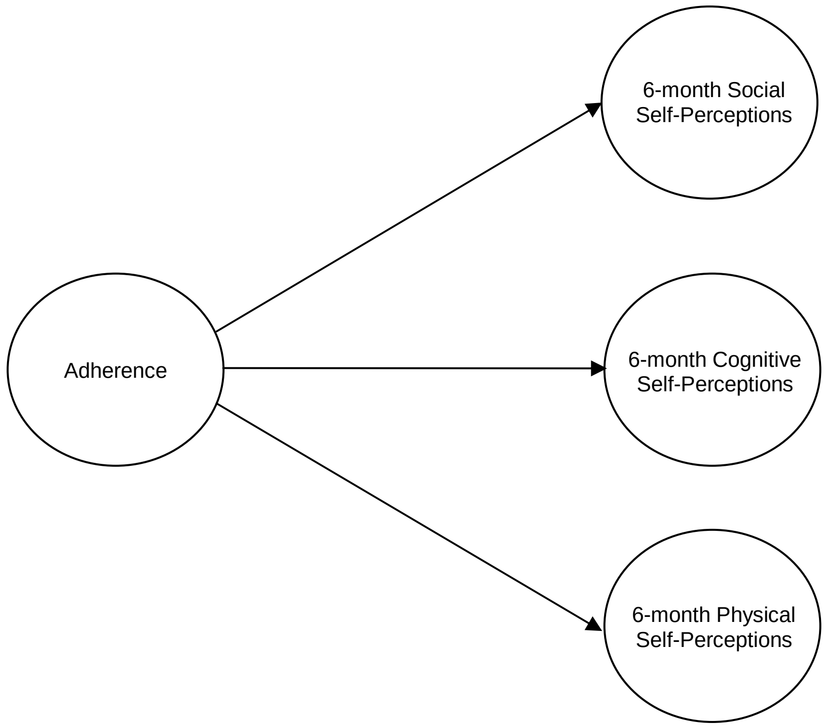


Figure 5. Hypothesised pathway model 3: From adherence to 6-month social, cognitive, and physical self-perceptions.

Summary

As our population ages, the percentage of people who experience declines in general health and wellbeing is likely to increase. With age-associated declines in aspects of health, methods for halting or reversing this trend are becoming increasingly important. This study addresses this issue by investigating the adoption phase of physical activity using two approaches, a self-managed and a centre-based behavioural intervention program. By investigating the underlying contributors to motivation to adopt and maintain regular physical activity, this study will equip health care workers and exercise professionals with tools to combat the increasing trends of sedentary lifestyles.

Previous research that has investigated behavioural interventions for physical activity in older adults has been limited in the investigation of underlying psychosocial constructs relevant to the behavioural change models employed. Based on Self-Determination Theory, (Deci & Ryan, 1985) this study proposes that the type of motivation, while influenced strongly by competence, is also affected by distance from the recreation centre, forming the basis of the first structural equation model. In addition the underlying constructs important in Self-Determination Theory, namely physical self-perceptions, autonomy, and social connectedness are examined relative to exercise adherence in the second structural equation model. In the third structural equation model the relationship between adherence and cognitive, physical and social self-perceptions after 6 months is also examined to see if there adherence is in anyway related to self-perceptions outside the physical domain.

If regular physical activity can have a positive influence on multiple perceptions of the lives of older adults, then improving the lives of those in late adulthood can be achieved in a very efficient and effective manner.

CHAPTER THREE: PILOT STUDY

Purpose

According to Duda and Hayashi (1998) it is important to test the cross-cultural efficacy and reliability of psychometric measures in exercise psychology. Whilst the psychometric measures for the major study had been validated with North American populations in a wide range of age groups, no known study had reported using these instruments, or tested their reliability and internal consistency in Australian older adults. Thus it was important to assess the questionnaires to be used in the major study and to make any necessary adjustments. Therefore, the purpose of the pilot study was to establish the test-retest and internal consistency reliabilities of the four psychometric measures employed in the major study. The questionnaires assessed were the (a) Adult Self-Perception Profile (ASPP) (Messer & Harter, 1989), (b) Exercise Motivation Scale (EMS) (Li, 1999), (c) Measure of Actualisation Potential-Autonomy (MAP-A) (Leclerc, Lefrancois, Dube, Hebert, & Gaulin, 1998) and (d) Social Connectedness Scale-Revised (SCS-R) (Lee, Draper, & Lee, 2001; Lee & Robbins, 1995).

Participants

A sample (N = 51) of older men (n = 24) and women (n = 27) (60-80 years) were recruited from the Perth metropolitan area via senior interest groups and articles in a number of community newspapers. Respondents contacted the research centre at the UWA School of Medicine and Pharmacology, Royal Perth Hospital and completed a telephone-screening questionnaire. For this study participants (a) were aged between 60-80 years; (b) considered themselves healthy; and (c) were able to attend both testing sessions. If they met the inclusion criteria an appointment was scheduled to attend two testing sessions placed one week apart at the research centre. Testing was conducted in groups of 5-20 people.

Design of the Pilot Study

The pilot study was a single group test-retest design. The independent variable was the observation group and the dependent variables were the measures administered to the participants. This design allowed for the internal consistency and test-retest reliability to be established for each measure. All questionnaires were administered at least one week apart to reduce the likelihood that participants could accurately remember the content of the questionnaires. A diagram of the pilot study is presented in Figure 6.

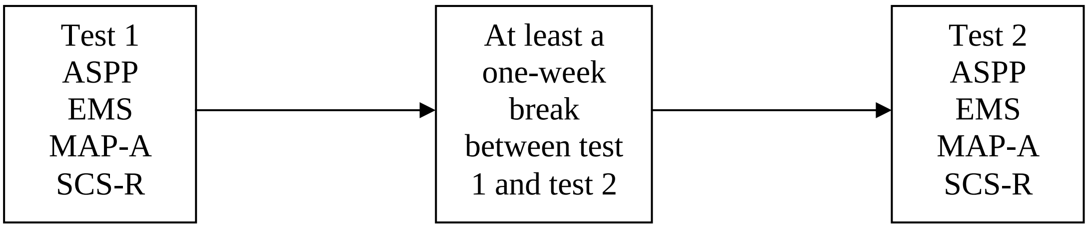


Figure 6. Diagrammatical representation of the pilot study design.

Measures for the Pilot Study

Adult Self-Perception Profile (ASPP)

The Adult Self-Perception Profile (ASPP) is a 50-item self-report questionnaire designed to assess the self-perceptions of adults (Messer & Harter, 1989). It assesses perceptions of (a) athletic abilities, (b) physical appearance, (c) sociability, (d) job competence, (e) nurturance, (f) adequate provider, (g) morality, (h) household management, (i) intimate relationships, (j) intelligence, (k) sense of humour, and (l) global self-worth. The ASPP employs a forced choice, structured alternative format on a four-point Likert scale (Appendix A). Messer and Harter (1989) report the internal consistency or alpha coefficient as ranging from 0.73 to 0.91 for all domains except adequate provider. This was in 97 females and 44 males aged 30-50 years. The authors stated that the reason for this was the population included homemakers and part-time working women who may have had difficulty interpreting this domain. For full-time

working men (n = 44) and women (n = 24) the alpha coefficient for the adequate provider domain was 0.83 and 0.90 respectively. Messer and Harter (1989) also conducted a confirmatory factor analysis that revealed acceptable loadings (ranging from 0.89 to 0.65), and cross-loadings (0.09 to 0.04), in 10 of the 11 domains. Messer and Harter (1989) did not include global self-worth in the analysis as it is not a domain specific construct and will only be related to the domains deemed important by the individual. The ASPP also asks participants to rate the importance of each sub-domain on a 1-4 Likert scale. From this discrepancy scores can be calculated for domains rated a 4 on the importance ratings scale. The discrepancy score is calculated by subtracting the ASPP score for that domain from 4 (the importance rating score for the domain). While, the discrepancy scores were not used in this study, the importance rating scale was left in as its removal may affect the internal consistency of the questionnaire. While Harter (1999) has reported preliminary development of a self-perception profile for older adults, this has not been completed. Therefore, the ASPP was selected for use in this study due to its multi-dimensional capabilities, i.e. self-perception domains can be compared to one another. Sorensen, Anderssen, Hjerman, Holme, and Ursin (1997) used the perception of physical ability and sociability sub-scales in a comparison of diet and exercise interventions to a control condition. They reported increases in perceptions of physical ability of 0.35, and of 0.20 for sociability and global self-worth in exercise condition.

Exercise Motivation Scale (EMS)

The Exercise Motivation Scale (EMS) is a self-report format questionnaire designed to measure an individual's type of motivation with respect to exercise (Li, 1999). The scale items are designed to identify the types of motivation behind an individual's decision to exercise. The types of motivation are based on those used in

the Sports Motivation Scale (SMS) developed by Pelletier and colleagues (1995) comprising of amotivation, extrinsic, and intrinsic motivation. However, as the SMS focussed on sporting experiences rather than exercise it was necessary to develop a new measure, hence the EMS. The structure of the EMS is based on Self-Determination Theory (Deci, 1980, Ryan & Deci, 2000). Extrinsic motivation was measured using questions relating to (a) external regulation, (b) introjected regulation, (c) identified regulation and (d) integrated regulation sub-domain. The sub-domains relating to intrinsic motivation asked questions relating to intrinsic motivation to (a) know, (b) achieve, and (c) experience. Each sub-domain was measured on a separate subscale, as was amotivation. The EMS lists reasons as to why an individual is engaged in exercise (relevant to a specific domain) and asks participants to rate their agreement with each reason along a scale of 1 (strongly disagree) to 6 (strongly agree) (Li, 1999). Li (1999) validated the EMS in 205 men and 393 women, aged 17-30 years (M = 21.49, SD = 2.99). Li (1999) reported the internal consistency reliability of the eight EMS subscales as alpha coefficients, ranging from 0.71 to 0.85. When the nomological validity of the EMS was tested by comparing EMS scores against measures of perceived competence, autonomy, and relatedness, there were positive relationships to intrinsic motivation and self-determined extrinsic motivation. In addition there were negative relationships to non self-determined extrinsic motivation and amotivation (Li, 1999). The EMS was used in this study as it represents a valid measure of exercise motivation domains outlined in SDT by Deci (1980) (Appendix A).

Measure of Actualisation of Potential-Autonomy (MAP-A)

Autonomy was assessed using the 6-item autonomy subscale of The Measure of Actualisation of Potential (Leclerc, Lefrancois, Dube, Herbert, & Gaulin, 1998). The Measure of Actualisation of Potential – Autonomy subscale (MAP-A) uses a 5 point

Likert scale with slightly different answers dependent on the question content, (a) very rarely to very often, or (b) very little to enormously. The entire MAP was tested and validated in 414 adults (18-60 years) and older adults (60 years and over). Leclerc et al. reported the Cronbach coefficient for the autonomy subscale as 0.72. The temporal stability was established using a test-retest correlation in 156 adults (18-85 years), this was 0.87. The MAP-A was employed in this study as it gave a valid measure of autonomy that could be used in an older population (Appendix A).

Social Connectedness Scale – Revised (SCS-R)

The Social Connectedness Scale – Revised (SCS-R) is a 20 item self-report questionnaire designed to measure an individual's sense of connectedness to society (Lee, Draper, & Lee, 2001; Lee & Robbins, 1995). Lee et al. (2001) validated the SCS-R in 218 people (n = 112 males, n = 105 women, and n = 1 unidentified), aged 17-50 years (M = 19.55, SD = 3.32), by comparing it with existing valid measures. Lee et al. (2001) found the SCS-R significantly correlated ($p < 0.006$) with loneliness (r = 0.49), 3 of the 4 types of collective self-esteem (membership r = 0.49, private r = 0.42, public r = 0.39), independent self-construal (r = 0.37), social avoidance (r = -0.57) and distress (r = -0.55). The SCS-R was selected for use in this study as it was the only validated measure of social connectedness available. Other measures based on different concepts such as social support or social capital would not have been appropriate (Appendix A).

Procedure for the Pilot Study

At the beginning of the first testing session participants were briefed fully on their role in the pilot study (Appendix B). Following this, those who wished to participate, provided informed consent on the understanding they could withdraw from the pilot study at any time. Participants were given detailed instruction on how to fill

out each questionnaire. Participants completed the questionnaires and returned one week later to complete the same questionnaires administered in the same order. During both testing sessions the researcher, or a research assistant, was present at all times to assist participants.

Data Analysis for the Pilot Study

For the Adults Self-Perception Profile (ASPP) the first step in the analysis was a paired samples *t* test between tests one and two to establish the retest reliability. This was done for (a) each sub-domain, (b) global self-worth, (c) the importance ratings, and (d) the discrepancy scores. The original validation of the ASPP used a factor analysis to assess the dimensionality of the scale. However, the number of participants in the present study was insufficient to perform a factor analysis for the 11 sub-domains. For the purposes of this study the multidimensionality of ASPP was assessed on the factor loadings provided by Messer and Harter (1989). To assess the internal consistency of the ASPP subscales the alpha coefficient was calculated for each sub-domain using the 4 items designed to evaluate that domain (6 items in the case of global self-worth). In addition the alpha coefficient was calculated for the ASPP as a whole and for the importance ratings.

Similarly the test-retest reliability of the Exercise Motivation Scale (EMS) consisted of a paired samples *t* test between tests one and two for each of the eight subscales. The internal consistency was determined by calculating the alpha coefficient for each of the eight subscales.

For the Social Connectedness Scale-Revised (SCS-R) and Measure of Actualisation Potential-Autonomy (MAP-A) where there was only one scale in each, the analyses used were identical. The test-retest reliability and internal consistency was

established using a paired samples *t* test between tests one and two, and calculating the alpha coefficient, respectively.

The data analyses for the pilot study needed to take into account the two-tailed design of the study. That is, scores could go up or down on the second test. Therefore an alpha of 0.025 was selected.

Results

Adult Self-Perceptions Profile

The paired samples *t* test for global self-worth and the ASPP sub-domains indicated no significant differences ($p < 0.025$) from test one to test two, except in intimacy in relationships. The intimacy in relationships score was significantly higher ($p < 0.001$) in test two ($M = 2.98\pm$) than in test one ($M = 2.77\pm$). However, there was a significant ($p < 0.001$) paired samples correlation 0.87 between intimacy in test one and test two. The paired samples correlations for global self-worth and the other domains and were significant ($p < 0.001$) and ranged from 0.69 on morality to 0.86 on sociability. The paired samples *t* test results for each domain and global self-worth are presented in Table 3.

The paired samples *t* test for the ASPP importance ratings and discrepancy score revealed no significant differences ($p < 0.025$) between test one and test two. The paired samples correlations for the ASPP importance ratings and discrepancy score were significant ($p < 0.001$) and ranged from 0.52 to 0.77. The results of the paired samples *t* test for the ASPP importance ratings and discrepancy score can be viewed in Table 4.

The alpha coefficients for the ASPP, the importance ratings, global self-worth and the individual sub-domains can be seen in Table 5. The alpha coefficients for the global self-worth sub-domain were 0.90 for test one and 0.87 for test two. For the

remaining sub-domains the alpha coefficients ranged from 0.68 to 0.81 for test one and 0.68 to 0.86 for test two. Alpha coefficients of 0.70 or above are considered acceptable for scales to be used as research tools to compare groups (Bland & Altman, 1997). For the domains that exhibit alpha coefficients below 0.70 (physical appearance, adequacy as a provider, and morality), caution must be exercised when interpreting results.

Table 3

Paired samples t test for ASPP sub-domains and global self-worth

Dependent Variable	Mean Test 1	Mean Test 2	Paired Samples SD	Paired Samples t	Paired Samples *p*	*r* Value	Degrees of Freedom
Athletic Competence	2.64	2.58	0.49	0.898	0.374	0.80*	49
Physical Appearance	2.84	2.89	0.36	-1.151	0.255	0.72*	49
Sociability	3.08	3.15	0.34	-1.403	0.167	0.86*	49
Job Competence	3.19	3.25	0.42	-1.064	0.293	0.73*	47
Nurturance	3.21	3.22	0.43	-0.136	0.892	0.75*	49
Adequacy as a Provider	3.30	3.33	0.41	-0.573	0.570	0.70*	49
Morality	3.44	3.46	0.40	-0.353	0.725	0.69*	49
Household Management	2.98	3.04	0.44	-0.933	0.356	0.81*	49
Intimacy in Relationships	2.77	2.98	0.36	-4.162	< 0.001	0.87*	49
Intelligence	2.98	3.03	0.39	-0.852	0.398	0.74*	49
Global Self Worth	3.23	3.24	0.36	-0.006	0.995	0.79*	49

*$p < 0.001$

Table 4

Paired samples t test for ASPP importance ratings and discrepancy score

Dependent Variable	Mean Test 1	Mean Test 2	Paired Samples SD	Paired Samples t	Paired Samples *p*	*r* Value	Degrees of Freedom
Discrepancy Score	-2.63	-2.21	1.958	-1.364	0.180	0.64*	41

Importance Ratings	Mean Test 1	Mean Test 2	Paired Samples SD	Paired Samples t	Paired Samples *p*	*r* Value	Degrees of Freedom
Athletic Competence	2.87	2.92	0.574	-0.616	0.541	0.74*	49
Physical Appearance	1.77	1.88	0.617	-1.261	0.213	0.77*	49
Sociability	3.22	3.26	0.638	-0.444	0.659	0.61*	49
Job Competence	3.31	3.37	0.575	-0.705	0.485	0.68*	45
Nurturance	3.51	3.47	0.603	0.533	0.597	0.52*	48
Adequacy as a Provider	3.17	3.34	0.636	-1.833	0.073	0.69*	46
Morality	3.55	3.52	0.484	0.511	0.612	0.70*	49
Household Management	2.85	2.90	0.567	-0.566	0.574	0.72*	48
Intimacy in Relationships	3.03	3.08	0.657	-0.538	0.593	0.77*	49
Intelligence	3.15	3.16	0.520	-0.136	0.892	0.65*	49
Humour	3.52	3.58	0.424	-1.000	0.322	0.76*	49

*$p < 0.001$

Table 5

Reliability coefficients for ASPP, ASPP importance ratings, global self-worth and ASPP sub-domains

Dependent Variable	Alpha Coefficient Test 1	Alpha Coefficient Test 2
ASPP	0.95	0.96
ASPP Importance Ratings	0.77	0.81
Global Self-Worth	0.90	0.87
ASPP Sub-Domains	**Alpha Coefficient Test 1**	**Alpha Coefficient Test 2**
Athletic Competence	0.76	0.84
Physical Appearance	0.68	0.68
Sociability	0.80	0.86
Job Competence	0.72	0.72
Nurturance	0.81	0.84
Adequacy as a Provider	0.69	0.78
Morality	0.71	0.72
Household Management	0.79	0.86
Intimacy in Relationships	0.79	0.83
Intelligence	0.68	0.73
Humour	0.72	0.82

Exercise Motivation Scale

The paired samples *t* test for the EMS revealed no significant difference ($p < 0.025$) between test one and test two for any of the sub-domains. The paired samples correlations were significant ($p < 0.001$) for all the domains, ranging from 0.61 for motivation to accomplish up to 0.86 for amotivation and identified regulation. The results of the paired samples *t* test for the EMS sub-domains are presented in Table 6.

The alpha coefficients for the EMS and the sub-domains for test one and two are presented in Table 7. The alpha coefficient for the EMS for test one was 0.90, for test two it was 0.87. The alpha coefficients for the EMS sub-domains for test one ranged from 0.77 to 0.93. For test two the alpha coefficients for the EMS sub-domains ranged from 0.71 to 0.94. All alpha coefficients for the EMS were deemed acceptable (above 0.70).

Table 6

Paired samples t test for EMS sub-domains

Dependent Variables	Mean Test 1	Mean Test 2	Paired Samples SD	Paired Samples t	Paired Samples *p*	*r* Value	Degrees of Freedom
Amotivation	1.52	1.52	0.407	-0.058	0.954	0.86*	49
External Regulation	1.80	1.70	0.531	1.442	0.156	0.80*	49
Introjected Regulation	2.96	2.91	0.972	0.352	0.727	0.64*	49
Identified Regulation	4.80	4.65	0.500	1.766	0.084	0.86*	49
Integrated Regulation	4.79	4.60	0.699	1.938	0.058	0.75*	49
Intrinsic Motivation to Learn	4.24	4.44	0.905	-1.600	0.116	0.74*	49
Intrinsic Motivation to Accomplish	4.58	4.69	0.848	-0.958	0.343	0.61*	49
Intrinsic Motivation to Experience	4.99	5.00	0.686	-1.72	0.864	0.76*	49

$*p < 0.001$

Table 7

Reliability coefficients for the EMS sub-domains

Dependent Variable	Alpha Coefficient Test 1	Alpha Coefficient Test 2
EMS	0.90	0.87
EMS Sub-Domains	Alpha Coefficient Test 1	Alpha Coefficient Test 2
Amotivation	0.88	0.84
External Regulation	0.78	0.73
Introjected Regulation	0.74	0.73
Identified Regulation	0.81	0.71
Integrated Regulation	0.81	0.81
Intrinsic Motivation to Learn	0.93	0.93
Intrinsic Motivation to Accomplish	0.77	0.76
Intrinsic Motivation to Experience	0.87	0.94

Measure of Actualisation Potential - Autonomy

The results of the paired samples *t* test for the MAP-A are presented here in text. There was no significant differences (t = -1.674, df = 50, $p < 0.025$) between the test one mean (3.77±0.347) and test two mean (3.85±0.347) on the MAP-A, while the two means were highly correlated (r = 0.80, $p < 0.001$) indicating good retest reliability. The test one and test two alpha coefficients (α = 0.77 and α = 0.80 respectively) for the MAP-A indicate acceptable levels of internal consistency.

Social Connectedness Scale - Revised

There was no significant difference (t = -0.175, df = 49, p < 0.025) between the test one mean (95.12±8.076) and the test two mean (95.32±8.076) on the SCS-R, while the two means were highly correlated (r = 0.84, p < 0.001) indicating good retest reliability. The test one and test two alpha coefficients (α = 0.90 and α = 0.94 respectively) for the SCS-R indicate acceptable levels of internal consistency.

Pilot Study Discussion

Adult Self-Perceptions Profile

With the exception of the intimacy domain, there were no significant differences between test one and test two on any of the ASPP domains. The scores for the intimacy domain increased significantly from test one to test two. However, this sub-domain exhibited the highest paired samples correlation (r = 0.87) and acceptable alpha coefficients in test one (α = 0.79) and test two (α = 0.83). The reasons for this inconsistency may be that the 4 questions constituting the intimacy domain were of a personal nature. The questions probed how easily participants developed intimate relationships, whether or not they sought out close relationships and how easy they found it to communicate openly. Therefore familiarisation and greater understanding of the questions may have prompted participants to report higher scores in perceptions of intimacy. In support of retaining the intimacy domain, its removal has the potential to compromise the content validity of the ASPP questionnaire. Therefore, the questions pertaining to that domain remained in place. However, it is recommended that when this questionnaire is used in its current form with older adults, caution should be made when interpreting the results from this domain. Marginal alpha coefficients were noted for test one in perceptions physical appearance (α = 0.68), adequacy as a provider (α = 0.69), intelligence (α = 0.68), and in test two for perceptions of physical appearance (α

= 0.68). It is possible that small sample size or a small number of items in each domain may have impacted on the alpha scores in these domains. It was decided to leave these domains of the ASPP in the questionnaire as removing them could affect its content validity and weaken the re-test reliability of the remaining items. The ASPP discrepancy scores and importance ratings exhibited no significant difference from test one to test two. The internal consistency reliability coefficients for the importance ratings for test one (α = 0.77) and test two (α = 0.81) were also acceptable. Therefore, the discrepancy scores and importance ratings subscales were not removed from the questionnaire.

Exercise Motivation Scale

Scores for the sub-domains of the EMS did not significantly differ from test one to test two. In addition the alpha coefficients for the sub-domains met the acceptability criteria suggested by Bland and Altman (1997) for test one (α = 0.74 to α = 0.93) and test two (α = 0.71 to α = 0.94). These results demonstrated the reliability of the EMS as a measure of exercise motivation in Australian older adults. Therefore, the original form of the EMS was used to assess exercise motivation in the major study.

Measure of Actualisation Potential - Autonomy

There were no significant differences in mean scores for MAP-A between test one and test two. In addition, the alpha coefficients for the MAP-A in test one (α = .77) and test two (α = .80) were acceptable. The Measure of Actualisation of Potential-Autonomy subscale maintained internal reliability and consistency, when separate from the other components of the MAP. This scale was therefore used to measure perceptions of autonomy in the major study without any modification.

Social Connectedness Scale - Revised

The analysis revealed no significant differences between the test one and test two means for the SCS-R. The SCS-R also displayed acceptable alpha coefficients in test one (α = .90) and test two (α = .94). The SCS-R was shown to be a sound tool for assessing social connectedness in Australian older adults. Therefore the Social Connectedness Scale-Revised was employed, unaltered to assess social connectedness in the major study.

Pilot Study Conclusion

This pilot study established the reliability of the ASPP, EMS, MAP-A and SCS-R in this sample of active Australian older adults. While the ASPP was found to be reliable, caution must be exercised when attempting to assess perceptions of intimate relationships in older adults. The major limitation of this pilot study is the absence of a confirmatory factors analysis of the ASPP data as there were insufficient numbers of participants to permit the inclusion of this type of statistical procedure. This pilot study provided support for the use of the ASPP, EMS, MAP-A and SCS-R in the major study. However, it is recognised that the internal consistency of these questionnaires could be lower when applied to a sedentary population of older adults.

CHAPTER FOUR: METHOD

This study was an associated research arm allied with a major research project that investigated older adults' adherence to a self-managed program, and a behavioural intervention physical activity program (PATH Project). The researcher developed the theoretical basis and hypotheses for this current study independently from the PATH Project. The data for the present study was collected concurrently with the PATH Project. There are several methods that are common to both studies and will be described along with those that relate specifically to this thesis. This thesis examined selected variables in the first 6-months of the PATH Project. Whilst these variables were investigated again at 12-months, the scope of this thesis did not permit inclusion of the 12-month data. The methodology will be presented under the following headings; (a) study design, (b) power calculations, (c) recreation centre/local government selection and recruitment, (d) the intervention programs, (e) stakeholders and training, (f) measures, (g) procedure, and (h) data analysis.

Study Design

The study was a cluster randomised controlled trial. The independent variables were the behavioural intervention and self-managed groups. The mediator variables were (a) self-perceptions, (b) social connectedness, (c) autonomy, and (d) exercise motivation. The dependent variables were (a) level of physical activity, (b) functional fitness, (c) adherence, and (d) retention. The study was set in community owned recreation centres (*N* = 12) in the Perth metropolitan area. These recreation centres (or clusters) were randomised into behavioural intervention and self-managed groups. The study design is presented in Figure 7.

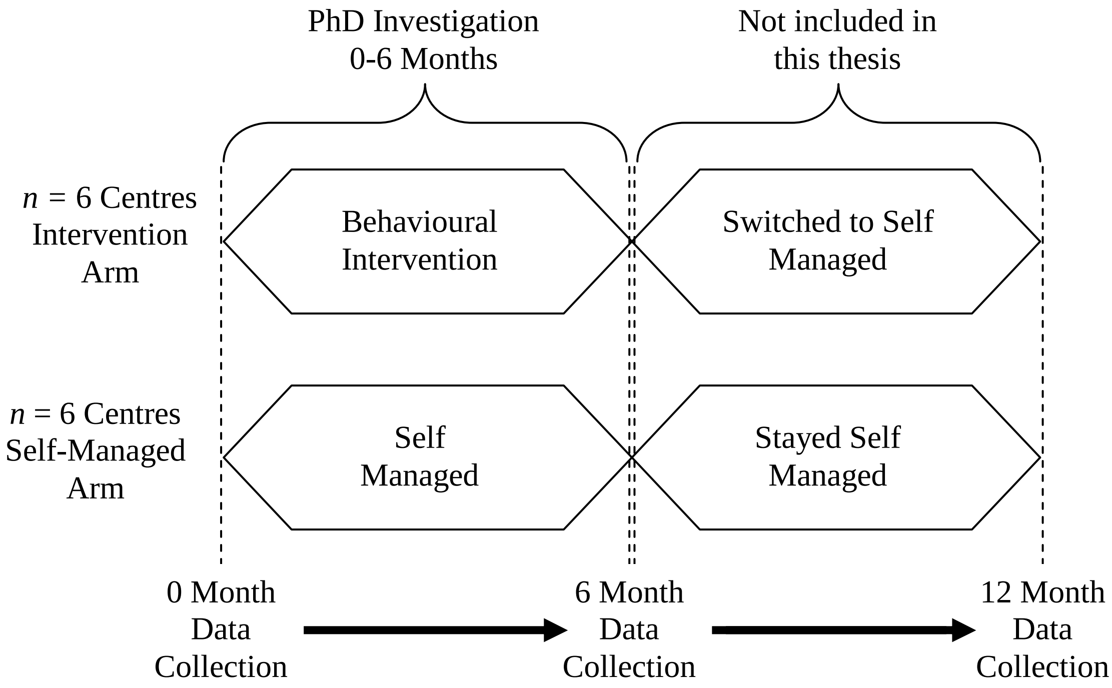


Figure 7. Study design.

The present study investigated the first 6-months of the PATH Project, as illustrated in Figure 8.

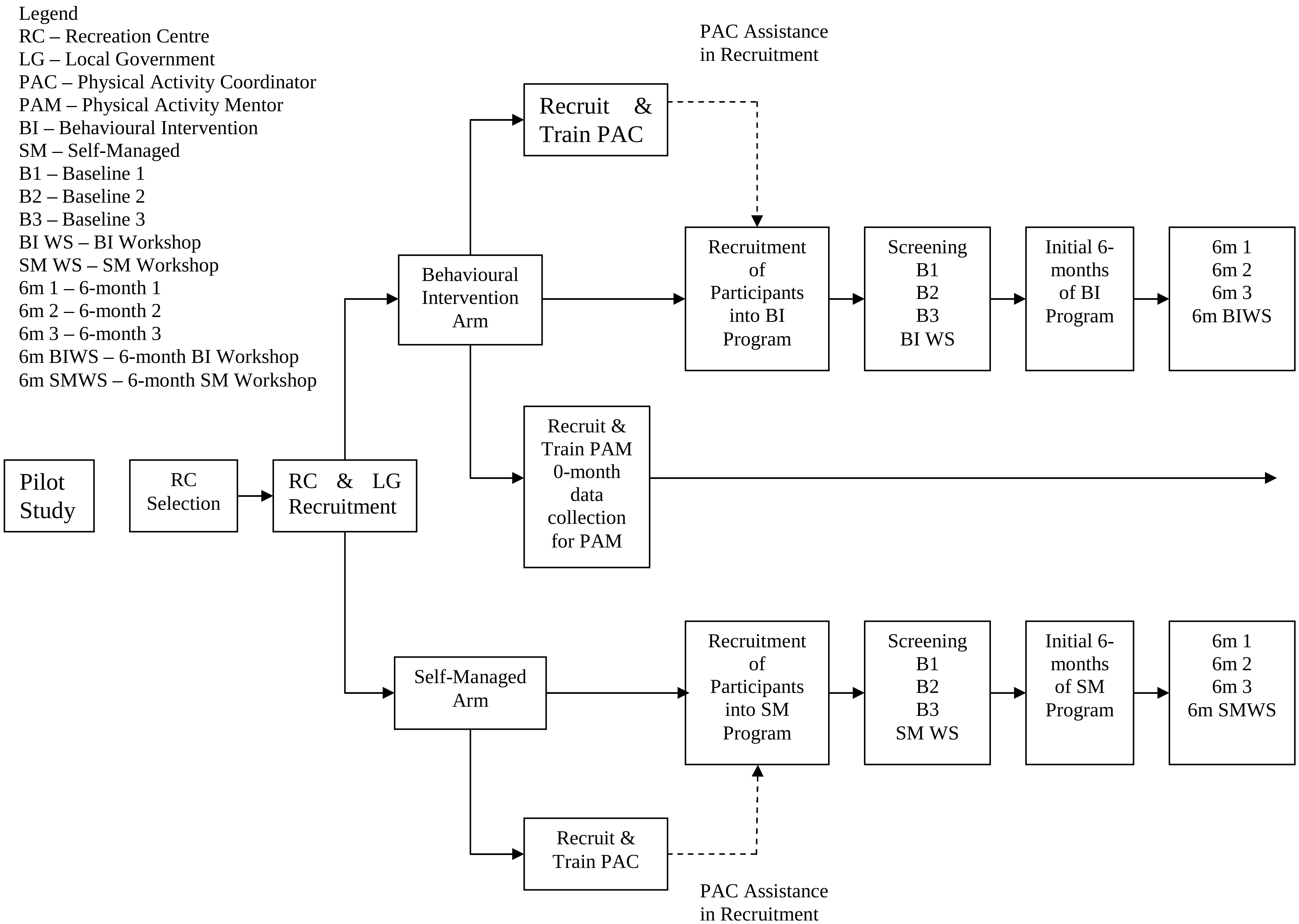


Figure 8. The study method.

Power Calculations

Power calculations have been based on the primary endpoint of retention, i.e. how many participants stay within the project. Withdrawal rates of 4-25% have been reported for prior studies with older adults that have employed a similar behavioural intervention (Cox, Burke, Gorely, Beilin, & Puddey, 2003; Cox, Gorely, Puddey, Burke, & Beilin, 2003). A second power analysis was conducted based on the endpoint of a detectable difference between groups on the Physical Abilities sub-scale of the Adult Self-Perception Profile (ASPP; Messer & Harter, 1989).

For the first power analysis it was anticipated that the self-managed group would increase physical activity and stay in the program but with reduced retention. Working on the 'worst case' for the behavioural intervention (a withdrawal rate of 25%) and the 'best case' scenario for the self-managed group (35%), it was calculated that the number of participants needed to detect a difference in retention rate of 10% with 80% power at a level of 0.05. As there was no information available on estimates of between cluster variation or intra-cluster correlation a design effect of 1.5 was selected to calculate the numbers of subjects needed. It was estimated that 600 participants would be needed in each study group. If each centre recruited 60-100 volunteers this would mean 6-10 centres would be needed in each study group.

The second power analysis used the difference detected by Messer and Harter (1989) between two samples of adults who were administered the ASPP. It was calculated that the number of participants needed to detect a difference in the Physical Abilities subscale of the ASPP of at least 0.20 with 80% power at a level of 0.05 with a design effect of 1.5 was 175 in each study group.

Recreation Centre/Local Government Selection and Recruitment

Recreation Centre Identification

Eligible centres were identified from a list of Local Government Venues in the Department of Sport and Recreation, 2002/2003 Sport and Recreation Directory. There were several criteria to be met by physical activity centres. These were:

1. The centre provided services all year round.
2. The aquatic centres (where listed) needed to provide non-aquatic recreational facilities and programs.
3. The centres were required to have administration support.
4. The centres had a program of activities that included or could be adapted to include older adults.
5. Information on the centres activities was accessible.
6. The centre was not conducting walking programs for seniors.

Stratification of Centres

The eligible centres were stratified according to their Socio-Economic Index For Areas (SEIFA) – Index of Relative Socio-Economic Disadvantage. Low scores on the SEIFA disadvantage index indicate areas of low income, low educational attainment, high unemployment, and employment in low skilled occupations (McLennan, 1996). Conversely, high scores on the SEIFA disadvantage index indicate areas of high income, high educational attainment, low unemployment, and employment in high skilled occupations (McLennan, 1996). The post-code of the centre was stratified using the SEIFA disadvantage index giving a measure of socio-economic status for that centre. The total number of centres (N = 35) were divided into Tertiles of high (n = 12, SEIFA range 1053.00-1121.00), medium (n = 11, SEIFA range 986.00-1024.00) and low (n = 12, SEIFA range 862.00-967.00) on the SEIFA.

Randomisation of Centres

The study required 12 centres to be recruited over 18 months. Once stratified into the 3 SEIFA categories, 6 centres were randomly selected in each category to allow for unsuitability, unwillingness to participate or withdrawal of centres. Four centres were randomly selected from each of the 3 categories (high, medium, and low) on the SEIFA. The first four selected in each category were randomly allocated to a treatment group; the other 2 in each stratum were reserves. The statistical package SPSS, was used to number each centre and randomly select 4. If a centre could not be used in the project the next reserve centre, in that SEIFA stratum, took on the treatment allocation.

Allocation to Treatment Group

A predetermined randomisation program was set out, using groups of 4, i.e. 1, 2, 3, 4, the odd numbers being self-managed (1 & 3) and the even numbers (2 & 4) being behavioural intervention. Allocation to the treatment group was from within the 3 SEIFA groups (low, medium and high). Due to some of the reserve centres being unable to participate it became necessary to re-select from the remaining eligible centres. The remaining centres were randomly allocated to either the intervention or self-managed program.

Recreation Centre/Local Government Recruitment

Once the centre had been identified the researcher then contacted the city council responsible for that centre. A series of meetings took place between the city council representatives and research staff. After the first meeting, the city council received a detailed outline of conditions of collaboration and roles and responsibilities. Subsequent meetings were then held to clarify any issues the city council might have. After these discussions took place the researchers sent an amended list of

responsibilities to the city council. Lastly, the researchers obtained an agreement from the city council to be involved in the project.

If the city council declined to participate in the study, the centres they managed were removed from the list and replacements were selected from the reserve list as previously described. The recruitment process with each city council varied in the number of meetings that took place, in order to clarify areas of responsibility. In addition, the areas of responsibility between city councils and the PATH study also differed depending on the city councils ability to meet certain requirements of the project.

The Intervention Programs

The Centre-Based Behavioural Intervention

The behavioural intervention program consisted of a behavioural change package, a centre-based supervised walk program, and physical activity mentors. There were three major differences between the behavioural intervention arm and the self-managed arm. First, participants in the behavioural intervention received a behavioural change package over the first 6-month period. Second, participants were invited to attend supervised centre-based walking sessions. Third, participants were assigned a physical activity mentor for the duration of the study. After completing the 6-month behavioural intervention period participants were asked to attend 3 data collection sessions.

The Behavioural Change Package

At the beginning of the intervention participants received a behavioural change package. This package contained a weekly schedule of work sheets, information sheets and newsletters. Already devised as part of the PATH Project, the package was

delivered via workshops, walk leaders, workbooks, mentors and newsletters. This package previously used in studies of older Western Australian women (Cox et al., 2003: 2006) was based on stages of behavioural change adapted to physical activity to describe the process of adoption and maintenance by Marcus et al, (1992). According to Marcus et al. (1992) individuals will pass through several stages before behaviour can be regarded as completely changed. These are (a) pre-contemplation, (b) contemplation, (c) preparation, (d) action, and (e) maintenance (Marcus, Simkin, Rossi, & Pinto, 1996). The pre-contemplation stage refers to people who have not yet considered changing their behaviour (Marcus et al., 1996). The contemplation stage refers to those people who have considered changing their behaviour (Marcus et al., 1996). It is these sedentary people and those in the preparation stage that became participants in the study. On joining the program they moved into the action stage (Marcus et al., 1996). Lastly, if they avoided becoming sedentary again after six months, they were in the maintenance stage (Marcus et al., 1996). There was the potential, in the behavioural intervention program, for participants to move backward into a sedentary lifestyle during the 6-month period.

It should be noted that there were elements within the Social Cognitive Theory components of the intervention (namely self-efficacy, social support, and self-management) that are similar to those in Self-Determination Theory (perceived competence, social connectedness, and autonomy). The workbook and mentoring program were designed to enhance self-efficacy, increase social support and develop self-management). For a full description of the behavioural intervention contents refer to Table C1 (Appendix C).

Supervised Walking Sessions

Participants in the behavioural intervention were required to attend 3 supervised exercise sessions per week for the first 3-months. In the second 3-months participants were required to attend only 1 supervised exercise session and make up the remaining 2 sessions by themselves. The aim of the reduction in supervised sessions was to encourage participants to become self-managed and independent. During these supervised sessions the physical activity coordinators were instructed to (a) remind participants to fill out the weekly worksheets and read the information sheets, and (b) deliver the newsletters.

Physical Activity Mentors

The behavioural intervention arm of the study required the training of physical activity coordinators and physical activity mentors for use in the behavioural intervention program. The physical activity mentors were trained in how to provide support to older adults initiating a physical activity program. The mentors were over 50 years of age, meeting or exceeding 150min of moderate physical activity per week. Training and supervision of mentors was part of the PATH Project.

The Self-Managed Program

This arm of the study was the usual care intervention. It was labelled self-managed to highlight that there was no ongoing supervision or support. Participants received advice only at the start of the program. This advice was based on what was currently available to older adults via government and senior interest groups in Western Australia. The information provided to participants in the self-managed group included (a) the amount of weekly physical activity recommended to induce health benefits, (b) the locations and situation where they might like to pursue this activity, and (c) the

contacts necessary to pursue these activities. For details on the contents of the self-managed package refer to Table C1 (Appendix C). After the completion of the 6-month self-managed program participants were asked to attend 3 data collection sessions.

Stakeholders and Training

Physical Activity Coordinators

The role of the physical activity coordinator was to conduct the behavioural intervention program in the participating recreation centre. In the first instance attempts were made to recruit coordinators from within the centre. Where this was not possible coordinators were recruited from outside the recreation centre. Applicants then met with the project director for an interview. Coordinators completed training in the behavioural intervention program. Once trained, physical activity coordinators conducted the behavioural intervention program in their centre. They were supervised by the PATH Project Director to ensure quality control and standardised delivery of the intervention.

In the case of the self-managed program, the role of the staff at the recreation centre consisted mainly of booking space for data collection.

Physical Activity Coordinator Training

The PATH Project director developed a 25-hour training package for coordinators who already had a qualification in exercise or physical activity leadership. The training package consisted of modules of physical activity programming following the American College of Sports Medicine guidelines (ACSM, 1998) and components identified in previous studies to increase physical activity adherence in older women (Cox, Burke, Gorely, Beilin, & Puddey, 2003; Cox, Gorely, Puddey, Burke, & Beilin, 2003).

Modules covered such areas as the benefits of exercise for older adults, health issues, injury prevention, physical activity programming for older adults, working with groups, and the walking session. In addition the stages of change model, components of the behavioural intervention package, counselling skills, producing newsletters, developing self efficacy, and social support were also included. Lastly recruitment of volunteers, measurement of physical activity, and administration and coordinator responsibilities were covered.

All coordinators had a current first aid with CPR qualification and received a training package and resource manual, free of charge. The opportunity to access research staff for advice and personal development was available to the coordinators. Regular communication, monitoring and updates on progress took place between coordinators and research staff.

Mentors

The first phase of the project also required training of physical activity mentors. There were n = 16 male and n = 47 female volunteers recruited and trained as mentors. The role of the mentor was to provide a source of support for participants in only the behavioural intervention group for 12 months. The mentors did not participate in the self-managed program. Mentors were physically active volunteers, all over the age of 50, recruited from community organisations and past research projects. They were required to have a Federal Police Clearance (the project provided funding for the police clearance of mentors) and take part in a 10-hour training course prior to participation. During the course of the intervention the mentors attended regular meetings to update the study staff on their progress with participants. In addition, they received regular newsletters and support from a senior mentor. Where possible mentors were matched to

participants based on gender, age, and locality. Priority was given to match participants based on gender over other factors.

Physical Activity Mentor Training

A focus group was conducted with older adults to determine the content of the mentor training package. Questions for the focus group were developed by the PATH Project director. The focus group was conducted by a facilitator from the Positive Aging Foundation. Modules for the mentor training package were developed from the focus group findings and components identified in previous programs to increase physical activity in older women. Topics covered the definition of mentoring, the roles and responsibilities of mentors, strategies for promoting motivation, safety and privacy issues. The content also aimed to develop communication skills and social support strategies, along with safe methods of physical activity. Mentors received a resource manual free of charge from the study staff.

Participants

Participants from the Perth metropolitan area were recruited for the study via media, mail outs, contact with community groups, and community notice boards. The participants were healthy, sedentary men and women aged 60-80 years. Participants were recruited into the centres allocated to the behavioural intervention (n = 6) or self-managed (n = 6) groups. In this study there were several criteria for exclusion. Participants were excluded if they had:

1. a Body Mass Index (BMI) was above 34
2. a systolic blood pressure was above 160
3. a diastolic blood pressure was above 100
4. smoked cigarettes or any tobacco products in the last 6 months

5. not sedentary (defined as doing more than 30 minutes of regular moderate physical activity per week)
6. a history of stroke, heart disease, asthma, diabetes, or any medical conditions contra-indicated for moderate physical activity
7. been regularly consuming more than 21 standard alcoholic drinks (or equivalent) per week
8. an age below 60 years or above 80 years

The blood pressure and alcohol exclusion criteria were included as change in blood pressure was a major outcome for the PATH Project. Participants also were required to provide a doctor's certificate stating they have a standard of health sufficient to allow them to participate in a moderate intensity exercise program. A detailed demographic profile of study participants is presented in the Results section. In brief there were a total of 254 participants recruited across the 12 recreation centres. Table 8 outlines the number and gender of participants per centre.

Table 8

Frequency and percentage of gender of participants across recreation centre

Centre	Group	Gender	Frequency	Percent
1	Self-Managed	Male	5	27.78
		Female	13	72.22
		Total	18	100.00
2	Self-Managed	Male	6	19.35
		Female	25	80.65
		Total	31	100.00
3	Self-Managed	Male	0	0.00
		Female	6	100.00
		Total	6	100.00
4	Self-Managed	Male	8	26.67
		Female	22	73.33
		Total	30	100.00
5	Self-Managed	Male	1	8.33
		Female	11	91.67
		Total	12	100.00
6	Self-Managed	Male	5	26.32
		Female	14	73.68
		Total	19	100.00
7	Behavioural Intervention	Male	8	18.60
		Female	35	81.40
		Total	43	100.00

Table 8 continued

Centre	Group	Gender	Frequency	Percent
8	Behavioural Intervention	Male	2	22.22
		Female	7	77.78
		Total	9	100.00
9	Behavioural Intervention	Male	17	44.74
		Female	21	55.26
		Total	38	100.00
10	Behavioural Intervention	Male	5	25.00
		Female	15	75.00
		Total	20	100.00
11	Behavioural Intervention	Male	8	42.11
		Female	11	57.89
		Total	19	100.00
12	Behavioural Intervention	Male	1	11.11
		Female	8	88.89
		Total	9	100.00

Procedures

Prospective participants, having seen the program advertised and who wished to take part, contacted the research staff and registered their interest. A member of the research staff administered, over the phone, an initial screening questionnaire which asked participants about their (a) current level of physical activity, (b) weight, (c) height, (d) health status, (e) medication, (f) diet, and (g) availability. If participants met the inclusion criteria they were then asked to make one screening visit to their participating centre to further determine their eligibility for the study. If the participants

were determined to be eligible at the screening visit, they were then invited to attend the subsequent baseline data collections and the workshop session.

Screening Visit

At screening participants were provided with information about what the program involved and asked to give written consent. Participants also were given a letter and form to take to their doctor in order to gain a medical clearance for participating in the study. The participant's height and weight were measured following the protocols outlined by Gore and Edwards (1992) using a portable stadiometer (Seca, Germany) and a set of digital scales (Seca, Germany). For a full description of the height and weight protocol, refer to Appendix C. If BMI exceeded 34 the participant was excluded from the study. The reason for these inclusion criteria was to ensure participants could safely participate in a group based walking program. The participants completed a written screening questionnaire (see Appendix A). When this had been completed the questionnaire was reviewed away from view of the participant. If there were any results in the screening questionnaire that required clarification by the researchers, they were discussed with the participant. Blood pressure was measured as outlined in Appendix A. If the mean blood pressure was over 160mmHg systolic or 100mmHg diastolic the participant was advised to see their doctor and excluded from the study. For those participants whose blood pressure was on the borderline, a letter was sent to their doctor to advise them of the result. If the participant's doctor had no objection the participant was included in the study. The reason for this was to rule out any undiagnosed cardiovascular disease.

Included participants were given information regarding the requirements and procedures for the next visit, and also the first questionnaire pack. They were then

given a letter and medical clearance form to take to their doctor. This form was returned prior to the participant commencing the fitness test and exercise intervention.

Baseline Data Collection

The baseline data collected for the present study included (a) self-perceptions, (b) level of social connectedness, (c) level of autonomy, (d) exercise motivation, (e) level of physical activity, (f) level of functional fitness and (g) body mass index.

Baseline consisted of 3 visits to the centre approximately 1 week apart. To collect questionnaire data for the major study as well as the present study three questionnaire packs were administered over a 3-4 week period and completed by participants in their own homes. Prior to receiving the questionnaire pack, participants were given instructions on how to complete each questionnaire. The researcher also reminded the participants that all results were completely confidential.

Baseline Visit One

At baseline visit one blood pressure, height and weight were measured again using the same protocol as in the screening visit. In addition to this each participant completed a self-administered 7-day retrospective alcohol diary. The primary researcher also administered the PASE (Physical Activity Scale for the Elderly) in a one-on-one interview. Following the interview the waist and hip circumference were measured. After all measures had been completed the researcher collected back questionnaire pack one. The researcher then gave the participant an appointment slip that outlined what they would be asked to do at baseline visit two, and the second questionnaire pack. In the event where questionnaires from pack one were not completed correctly the participant was asked to fill them out along with pack two or complete them at that visit.

Baseline Visit Two

The fitness test was conducted at baseline visit two. In most cases the fitness test was conducted indoors on a basketball court. In some instances, due to space restrictions, the test was conducted outdoors on an even grass surface. Following instructions on its use, participants were asked to wear a heart rate monitor (Edge series Polar Heart Rate Monitor, Polar, Finland) for the duration of the fitness test. After ensuring the monitor was fitted correctly, a resting heart rate was obtained and the participants were taken through a standardised 10 minute warm-up (Appendix E). At the completion of each test the heart rate and RPE (Rating of Perceived Exertion) (Borg, 1962) were recorded. After all tests had been completed the participants went through a cool down that consisted of a 10 min cool down walk, followed by the same 5 stretches done in the warm up. The participant's heart rates were monitored and recorded at 5, 10 and 15 minutes into the cool down.

Workshop Sessions

All participants attended workshops specific to the self-managed or behavioural intervention. The workshops took place in the participant's respective recreation centre. The 2 workshops differed in the type of information given to participants. The researchers on the PATH Project conducted all the workshops which, on average, took 2 hours to complete. Participants in both arms received a file containing all the information from the workshop and additional resources specific to the behavioural intervention or self-managed program.

The Behavioural Intervention Arm. There were four objectives of the workshop for the behavioural intervention arm. These were to (a) present information regarding the program and outline the delivery of the behavioural intervention package, (b)

explain the details of the mentoring program and cover the safety aspects of physical activity for older adults, (c) demonstrate the practical aspects of a physical activity session and complete a 15-minute trial session, and (d) outline the procedure for recording physical activity sessions.

Participants were required to maintain a target of 150 minutes of moderate physical activity per week for the 6-month intervention. This was split into three supervised walking sessions per week (each lasting 50 minutes) for the first 3-months. For the next 3-months researchers asked participants to attend one supervised walking session per week lasting 50 minutes and engage in their own activity in two more 50 minute sessions. To ensure participants exercised in the moderate range the target heart rate range was calculated for each participant. This range was 55%-65% of Heart Rate Reserve. Participants were given instruction and practice on how to calculate heart rate in beats per minute using their carotid or radial pulse. Participants in the intervention arm received a behavioural intervention package developed in and modified from two previous studies (Cox, Burke, Gorely, Beilin, & Puddey, 2003; Cox, Gorely, Puddey, Burke, & Beilin, 2003). The behavioural intervention package was outlined in the workshop, the topics covered in the package are described in Table C1 (Appendix C).

The Self-Managed Arm. There were four objectives of workshop for the self-managed arm, these were to (a) present information regarding the program and cover the safety aspects of physical activity for older adults, (b) conduct a trial session, (c) plan the practical aspects of a session, and (d) outline the procedure for recording physical activity sessions. The researcher asked participants in this group to maintain a target of 150 minutes of moderate physical activity per week for 6 months. It was suggested to participants this be done in three, 50 minute sessions per week. To ensure participants exercised in the moderate range the target heart rate range was calculated

for each participant. This range was 55%-65% of Heart Rate Reserve. Participants were given instruction and practice on how to calculate heart rate in beats per minute using their carotid or radial pulse. The contents of the self-managed package are outlined in Table C1 (Appendix C).

6-Month Data Collection

Participants were recalled in weeks 23, 24 and 25 of the study. Measurements taken at baseline were repeated at 6-months using the same protocols apart from two modifications. Firstly, questionnaire packs one and two were mailed out a fortnight before the first 6-month appointment (22 weeks) with a letter asking participants to return them at their first 6-month appointment (23 weeks). Secondly, participants received questionnaire pack three at the first appointment and asked to complete and return it at the second appointment. A workshop was conducted after the end of the testing period to give participant's feedback on the results of their various tests

Measures

The internal consistencies and test-retest reliabilities of the Adult Self-Perception Profile, Exercise Motivation Scale, Measure of Actualisation Potential-Autonomy, and Social Connectedness Scale-Revised were established in the pilot study. These same measures are used in the current study. Other measures used in the current study included the PASE (Physical Activity Scale for the Elderly), adherence, percent Heart Rate Reserve (%HRR), Rating of Perceived Exertion (RPE), FFT (Functional Fitness Test) and BMI (Body Mass Index). Demographic information was also collected from participants using a health and lifestyle questionnaire.

Physical Activity Level

Level of physical activity was measured using the Physical Activity Scale for the Elderly (PASE). The PASE is a self-report 7-day physical activity recall questionnaire that measures leisure, household and occupational activity. Washburn, Smith, Jette, and Janney (1993) provide evidence of the reliability of the PASE established in 254 males and females age 65 years and above. The test-retest correlation coefficient was $R = .85$ ($p < .05$) in a self-administered format. They also validated the PASE against measures of perceived health ($r = -0.34$), Sickness Impact Profile ($r = -0.42$), heart rate ($p = -0.13$), grip strength ($p = 0.37$), static balance ($p = 0.33$), and leg strength ($p = -0.25$) (Washburn et al., 1993). The PASE also has been validated against activity measured by a portable accelerometer in 20 volunteers aged 67-80 years ($r = 0.49$, $p < 0.05$) (Washburn & Ficker, 1999). The PASE was selected for use in this study as it has acceptable criterion validity, high test-retest reliability and is designed specifically for older adults (Appendix A).

Retention

In this study, retention was measured by the number of participants who remained in the study and completed 6-month testing.

Adherence

In both interventions, participants were asked to complete a total of 72 sessions. In this study, adherence was measured by counting number of sessions a participant completed and recorded in their exercise diaries over the course of the study (Appendix A).

Missing Sessions

For the purposes of this study a missed session was counted only if the participant recorded that they missed the session. If the record was left blank it was treated as missing *data*, not as missing a session.

Exercise Intensity (% Heart Rate Reserve)

Exercise intensity for each session was measured using % Heart Rate Reserve (%HRR). Participants were asked to measure and record their heart rate for each activity session at pre warm-up, post warm-up, midway through the session, the end of the session, and post cool down (Appendix A). The formula below was the used to calculate the %HRR.

$$\%\text{HRR} = \frac{(\text{Training HR} - \text{Resting HR})}{(\text{Maximum HR} - \text{Resting HR})} \times 100$$

The theoretical heart rate max (220 – years of age) was used to determine maximum HR, unless the HR achieved during the fitness test was higher in which case the fitness test HR was taken. The training HR for each session was calculated as the mean of the midway and end of session heart rates. Resting HR was taken as the mean heart rate of the four blood pressure measures taken during baseline.

Exercise Intensity (Rating of Perceived Exertion)

At the completion of each exercise session participants recorded RPE (Rating of Perceived Exertion) for that session (Appendix A). The Borg RPE Scale (Borg, 1962) was used and the scale's use was explained to participants in accordance with the manner described by Borg (1962).

Walk Session

For the purposes of this study a walking session was counted only if the participant recorded the type of activity as walking. If the activity type was not recorded it was treated as missing data.

Activities other than Walking

For the purposes of this study activities other than walking are defined as any type of activity other than walking that was recorded.

Functional Fitness Test (FFT)

The FFT developed by Rikli and Jones (1999) measures the functional fitness of older adults with a battery of six tests to evaluate leg strength, arm strength, hip flexibility, shoulder flexibility, walking agility, and walking endurance. Test-retest reliability was established using 82 volunteers (mean age = 71.8 years, *SD* = 6.9). The tests were administered 2-5 days apart and the intraclass correlation coefficients for the 30-s chair stand (R = 0.89), arm curl (R = 0.81), 6-min walk (R = .94), 2-min step test (R = 0.90), chair sit-and-reach (R = 0.95), back scratch (R = 0.96), and 2.5m up-and-go (R = 0.95) were obtained using a one-way ANOVA (Rikli & Jones, 1999). This procedure was used as it gives a more accurate estimate of the retest reliability of the measure beyond a simple correlation. The high intraclass correlation coefficients for the FFT measures indicate good retest reliability. The validity of each test was established by comparing the test items with criterion measures and calculating the Pearson correlation (Rikli & Jones, 1999). The 30-s chair stand was measured against a 1RM (1 Rep Max) leg press (r = 0.77). The arm curl was compared to a combined 1RM chest press, biceps and upper back (r = 0.81 for males, and r = 0.78 for females). The 6-min walk was measured against the modified Balke-graded exercise test (r = 0.78). Chair sit-and-

reach was compared to goniometer measured hamstring flexibility (r = 0.83). While there was no single criterion available to compare back scratch and the 2.5m up-and-go, the remaining items exhibited high correlations to criterion measures. A full description of each functional fitness test is included in Appendix E. For the sake of brevity only a general description is provided here.

Leg Strength

Leg strength was assessed using the 30s Chair Stand Test. The score for the 30s Chair Stand is the total number of stands executed correctly within 30 seconds. If the participant is more than halfway up at the end of 30 secs, it counts as a full stand.

Arm Strength

To assess arm strength the 30s Arm Curl Test was used. The score for the 30s Arm Curl Test is the total number of arm-curls executed correctly within 30 seconds. If the angle at the participant's elbow was greater than 90 degrees at the end of 30 secs, it counts as a full curl. Males were given an 8lb dumb bell hand weight while females were given a 5lb dumb bell hand weight.

Hamstring Flexibility

The Chair Sit-and-Reach test was used to measure the flexibility of the hamstring muscles, The score for the Chair Sit-and-Reach is the number of centimetres the participant is short of reaching the toe (minus score) or beyond the toe (plus score). The middle of the toe at the end of the shoe represents a zero score.

Shoulder Flexibility

Shoulder flexibility was measured using the Back Scratch Test. The score for the Back Scratch is the distance between the fingers (minus score) or the distance of overlap (plus score) to the nearest centimetre, with one hand reaching down the back while the opposing hand reaches up the back.

Agility

To assess agility in this population the 2.5m Up-and-Go test was employed. The score for the 2.5m Up-and-Go is the time elapsed from the signal *go* until the participant returns to the original seated position (hands on thighs, sitting up straight and feet flat on the floor). Scores are to the nearest 1/10th second.

Aerobic Endurance

The 6-min Walk Test was employed to measure aerobic endurance in this study. The score for the 6-min Walk Test is the total distance walked to the nearest meters within the 6-min time period.

Body Mass Index (BMI)

In this study BMI was employed as an estimate of obesity. BMI was calculated using the following formula:

$$\text{BMI} = \text{weight (kg)} \div \text{height (m)}^2$$

It is recognised that BMI as an estimate of obesity is open to criticism as it is a ratio of weight to height and not a direct measure of body fat. However, due to the nature of the current study it was the most practical and efficacious measure possible. Prior to measuring their height and weight the researcher asked participants to remove their shoes, any heavy items of clothing (jackets, belts, etc) and any heavy items in their

pockets. Height was measured using a fixed stadiometer and body mass was measured using a set of scales (Seca, Germany). Stretched height and weight were measured according to the Australian Fitness Norms (Gore & Edwards, 1992) (Appendix D).

Waist and Hip Circumference

Waist and hip circumference and Waist-to-Hip Ratio (WHR) were measured in the present study as estimates of central obesity. WHR was calculated using the following formula:

WHR = waist circumference (cm) ÷ hip circumference (cm)

It is recognised that waist-to-hip ratio is only an estimate of obesity. However, as the present study was based in community recreation centres, access to more accurate methods (i.e. Dexa-scan and Bio-impedance) were not available. Girth measurements were taken on the right side of the participant's body. Participants were instructed to wear shorts and a t-shirt to all baseline visits. Waist and hip circumference were measured using a steel tape (Lufkin, Germany) according to the Australian Fitness Norms (Gore & Edwards, 1992). (Appendix D).

Blood Pressure

The participant's blood pressure was measured 4 times after 5 minutes rest and each measurement was taken at 2-minute intervals. Blood pressure was measured using an AND UA-767PC Non-Invasive Blood Pressure Unit (AND, Australia). The mean systolic, diastolic blood pressure, and heart rate were calculated from the 4 measures (Appendix D).

Health and Lifestyle Data

Health and lifestyle data was collected using a self-report questionnaire that asked participants a series of questions relating to (a) demographic and cultural background, (b) medical history, (c) physical activity history, (d) smoking and alcohol history, (e) diet, and (f) family medical history (Appendix A).

Data Analysis

The data analysis was separated into 5 components. These were based on the individual purposes and related questions of the proposed study. As this study was a cluster randomised controlled trial, where possible, the variance between the 12 recreation centres on all variables was adjusted in the first step of each analysis. The adjustment for clustering is made using the Intracluster Correlation Coefficient. It is calculated in a similar manner to the Intraclass Correlation Coefficient which is used to establish the variance within and between subject measurements. The difference here is the Intracluster Correlation Coefficient is used to establish the variance within and between clusters rather than an individual. A simple equation is used to calculate the ICC where a = variance of the true cluster means, while b = variance from observations from individuals within the cluster (Kerry & Bland, 1998).

$$ICC = a \div (a+b)$$

To adjust for clustering effects the standard errors for a given test are multiplied by the square root of the ICC (Bland, 2008. Workshop on Cluster Randomised Trials at the First Conference on Randomised Controlled Trials in the Social Sciences, University of York, September 2006).

The SPSS 15.0 (SPSS Inc, Chicago, Illinois) software package was used to analyse all data for component 1 and the factor analysis in component 5. The SAS 9.1.2 (SAS Institute, Cary, North Carolina) software package was used to analyse all data for

components 2, 3 and 4. The LISREL 8.5 (Scientific Software International, Lincolnwood, Illinois) software package was used to test the structural equation models in component 5.

Component 1: Internal Consistency of Questionnaires

The internal consistency of the questionnaires, at baseline and 6-months was determined prior to any further data analysis. As this study compared two interventions there was no strict control group, therefore, it was not possible to ascertain the test-retest reliability of the questionnaires in this sample. The internal consistency was established by calculating Cronbach's alpha values for each questionnaire. The questionnaires tested were the (a) Adult Self-Perception Profile (ASPP), (b) Exercise Motivation Scale (EMS), (c) Measure of Actualisation Potential-Autonomy (MAP-A), and (d) Social Connectedness Scale-Revised (SCS-R).

Component 2: Distribution and Group Differences

The first step in the analysis was to examine the distribution of the data and see if there were any differences between the sexes, centres, type of intervention, and socio-economic status of the participants. The SAS 9.1.2 (SAS Institute, Cary, North Carolina) analysis package SURVEYFREQ procedure was used to generate a chi statistic to determine if there was an unequal distribution of gender or socioeconomic group across intervention at baseline. The SURVEYREG and SURVEYLOG procedures were used to generate ANOVAs for each dependent variable to determine any differences in the data between the groups. SURVEYREG was used for continuous variables and the SURVEYLOG was used for categorical variables. The variables examined included (a) self-perceptions, (b) social connectedness, (c) autonomy, (d) type of motivation, (e) PASE score, (f) PAR score, (g) body mass index, (h) adherence, (i)

functional fitness, and (j) demographic information. The syntax used for running the SURVEYREG procedure is:

```
PROC SURVEYREG <options> ;
BY variables ;
CLASS variables ;
CLUSTER variables ;
CONTRAST ’label’ effect values < ... effect values> </ options> ;
DOMAIN variables <variablevariable variablevariablevariable ... > ;
ESTIMATE ’label’ effect values < ... effect values> </ options> ;
MODEL dependent = <effects> </ options> ;
OUTPUT <keyword <=variable-name> ... keyword <=variable-name>> </
option> ;
REPWEIGHTS variables < / options> ;
STRATA variables </ options> ;
WEIGHT variable.
```

The syntax used for running the SURVEYLOG procedure is:

```
PROC SURVEYLOGISTIC <options> ;
BY variables ;
CLASS variable <(v-options)> <variable <(v-options)> ...> </ v-options> ;
CLUSTER variables ;
CONTRAST ’label’   effect values <,...effect values> </ options> ;
DOMAIN variables <variablevariable variablevariablevariable ...> ;
FREQ variable ;
MODEL events/trials = <effects < / options>> ;
MODEL variable <(v-options)> = <effects> < / options> ;
OUTPUT <OUT= SAS-data-set> <options> ;
REPWEIGHTS variables < / options> ;
STRATA variables </ option> ;
<label:> TEST equation1 < , ... , equationk> </ options> ;
UNITS independent1 = list1 <... independentk = listk> < / options> ;
WEIGHT variable </ option> ;
```

The same syntax is used to analyse the entire set of relevant variables.

Component 3: The Effect of the Intervention

The first purpose of the study was to determine the effect of the intervention on psychosocial variables central to the adoption phase and some physiological outcomes. Power calculations were performed at the outset of the study in order to determine the power needed to detect any potential significant differences between groups. The effect size was calculated using the pooled standard deviation for both groups and was also adjusted for clustering effects. The psychosocial variables measured included (a) self-

perceptions, (b) social connectedness, (c) autonomy, (d) type of motivation, and (e) global self-worth. From this purpose four hypotheses were generated. Hypothesis 1(a) stated that a 6-month behavioural intervention exercise program would be more effective at improving self-perceptions, self-determined and intrinsic exercise motivation, autonomy and social connectedness, compared to a self-managed program. Hypothesis 1(b) stated that retention, adherence, and physical activity level would be higher after a behavioural intervention exercise program compared to a self-managed exercise program. Hypothesis 1(c) stated that a behavioural intervention program would result in greater reductions in weight, BMI, waist and hip girth, and waist to hip ratio compared to a self-managed program. Hypothesis 1(d) stated that compared to a self-managed program, participation in a behavioural intervention program would lead to greater improvements in functional fitness. To answer these questions the SAS 9.1.2 (SAS Institute, Cary, North Carolina) SURVEYREG procedure was used to test a general linear model to determine the differences between intervention group and gender on all psychosocial and physical activity data. In the analysis of each variable the socio-economic status and baseline value of that variable were controlled for by including these in the SURVEYREG general linear models.

Component 4: Correlates and Predictors of Physical Activity

The second purpose of the study was to investigate the relative contribution of psychosocial predictors of adherence and physical activity scores in the behavioural intervention and self managed groups. From this purpose three hypotheses were generated.

Hypothesis 2(a) stated high levels of physical self-perceptions, self-determination, and intrinsic motivation would be associated with higher adherence,

while higher amotivation and extrinsic motivation would be associated with lower adherence.

Hypothesis 2(b) stated that higher physical self-perceptions, self-determined motivation, and intrinsic motivation would be related to higher 6-month total physical activity, while higher amotivation and extrinsic motivation would be related to lower 6-month total physical activity.

Hypothesis 2(c) stated that higher physical self-perceptions, self-determined motivation, and intrinsic motivation would be associated with higher 6-month leisure time physical activity levels, while higher amotivation and extrinsic motivation would be associated with lower 6-month leisure time physical activity levels.

To answer these questions the psychological and sociological correlates of adherence were entered into a series of adjusted linear regressions using the SAS SURVEYREG procedure. The development of the regression model to answer questions 2(a), 2(b) and 2(c) involved several stages. First, the correlations between the covariates, self-perceptions, exercise motivation, adherence, total PASE, and leisure time PASE were calculated. Second, the strength of the covariates to predict each outcome variable was determined using the SAS SURVEYREG procedure and all variables with $p > 0.1$ were removed. The remaining significant covariates were used in subsequent analyses. The selection of the *p* value is based on the work by Hosmer and Lemeshow (2000). They argue that to include all variables in a regression often results in high error values and models which cannot be generalised. The setting of criteria for the removal of variables in a regression is done to ensure that the changes to the models are consistent. While values as high as $p > 0.25$ have been suggested, for the purposes of this study the cut-off value suggested by Hosmer and Lemeshow (2000) was deemed the most appropriate. In the self-perception models all self-perception domains were entered and any variable with $p > 0.1$ was removed. The same procedure was followed

for the exercise motivation models. The SURVEYREG procedure was used as this allows for the randomised cluster design of the study to be taken into account. The SURVEYREG procedure computes regression coefficient estimators via a generalised least squares estimation in an element-wise regression. When there are clusters, as in the present study, the SURVEYREG procedure estimates the covariance matrix from the variation among cluster totals.

Component 5: Directional Pathways

As noted by Brassington et al., (2002) and Martin and Sinden, (2001) to assume that a behavioural model provides an accurate representation of behaviour change based only on simultaneous changes in constructs and observed behaviour, is incorrect. In this instance all that is observed are equivalent changes in behaviour and a change in psychosocial variables related to behaviour over the course of an intervention. Only by testing the relationship between constructs or mechanisms central to a behavioural theory and the behavioural outcome in question can researchers establish the accuracy of a model to explain a given behaviour. Therefore, the third purpose of this study was to employ structural equation modelling and path analysis in order to estimate the directional relationships between self-determination constructs and adherence. Sophisticated statistical techniques are available to estimate the unknown parameters of a structural equation model by comparing estimated variance and covariance matrices generated from the model with those obtained from the observed data. Goodness of fit may be estimated on the basis of unweighted least squares (ULS) or maximum likelihood (ML) ratios. The method used by Jöreskog and Sörbom in their LISREL program involves maximum likelihood estimates to analyse linear structural equations. The LISREL model is an extension of the traditional path analysis model for observed

variables, but its major difference with earlier models is the ability to analyse relationships among latent or hypothesised variables.

The general LISREL model consists of a measurement component and a structural equation component. The measurement model specifies a mathematical relationship between the observed and latent, dependent or independent variables. The structural equation model specifies the relationships among the latent dependent and independent variables.

The LISREL structural equation model and the measurement models for latent and observed variables are specified on the basis of temporal sequence or pre-existing theory. The LISREL program may then be used to generate a population variance-covariance matrix, Σ, from the sample variance-covariance matrix, S, obtained from the observed scores. If the difference, $S - \Sigma$ is small, the model may be retained for further investigation. If the generated matrix does not fit the sample matrix, the model is rejected and other plausible models may be tested, beginning with a new set of structural and measurement equations (Bohrnstedt & Borgatta, 1981). When there is a sufficient fit of the population variance-covariance matrix, Σ, as estimated from the variance-covariance matrix of the observed data, the LISREL program examines a *fitting function* based on a maximum likelihood estimation. This function is based on the assumption that the observed variables have a normal distribution, and are therefore most precise in large samples, although moderate deviation from normality is permissible for parameter estimation. However, the associated standard errors for the parameters must be interpreted with caution (Jöreskog & Sörbom, 1993; 2001).

Goodness of Fit Method

The LISREL 8.5 uses a set of initial parameter values to generate a predicted covariance matrix ä based on the structural model presented. The set of initial values is

either estimated by the model on the basis of the observed data or if estimates of the parameter values are known from previous research, the values may be entered into the program.

The estimated covariance matrix Σ is compared with the obtained sample matrix S and if a close fit is not found, new estimates of the parameter values are generated to provide an even closer fit between Σ and S. This procedure continues until the fit between Σ and S cannot be improved. The parameter values of the fitting function which produce the best fit between Σ and S are said to be the maximum likelihood estimates.

A number of fit functions have been developed to establish how well an estimated model fits the sample data. Early methods employed a ratio of chi squared to degrees of freedom (Werts, Jöreskog, & Linn, 1971; Wheaton, Muthen, Alwin, & Summers, 1977). This method has since been superseded by a plethora of available indices. Generally speaking the indices can be classified into four types. First are fit functions based on predicted versus observed covariances. These include discrepancy functions, minimum fit functions, goodness of fit index, adjusted goodness of fit index, root mean square residual, standardised root mean square residual, centrality index, non-centrality parameter, and relative non-centrality parameter. For structural equation model 2 the root mean square residual (RMSR), standardised root mean square residual (SRMSR) will be used to estimate which model is the better fit. It has been suggested that the goodness of fit and adjusted goodness of fit methods of estimating model fit are sensitive to sample size (Bollen 1990) and will not be reported in this study.

The second set of fit functions are estimated by comparing the given model with an alternate model. These include the comparative fit index, incremental fit index, normed fit index, non-normed fit index, Bollen86 fit index, and relative fit index. For the purposes of this study the non-normed fit index (NNFI) will be used as it is one of

the few fit indices less affected by sample size. According to Hu and Bentler (1999) NNFI values above 0.90 are acceptable, while above 0.95 indicates good fit. The NNFI can range from 0 to 1 and what it demonstrates is the improvement in fit above the null model (i.e. NNFI = 0.95 equals 95%). The NNFI will be used to establish the fit for structural equation models 1 and 3.

The third set of fit functions are estimated by comparing the predicted versus observed covariances while accounting for lack of parsimony in the model. Essentially this class of measures is useful in complex model structures. The types of test include the parsimony ratio, parsimony index, root mean square error of approximation, parsimony goodness of fit index, parsimony normed fit index, and parsimony comparative fit index. For the purposes of this study the root mean square error of approximation (RMSEA) will be used to establish the fit for structural equation models 1 and 3. According to Hu and Bentler (1999) while RMSEA values below 0.08 are acceptable, values below 0.06 are considered a better indicator of model fit.

Structural Equation Model 1: From Baseline Physical Self-Perceptions and Environment to Adherence via Motivation

Structural equation model 1 is presented in Figure 9. In this model it is proposed that latent physical self-perceptions (ξ_1) and distance away from the recreation centre (ξ_2) at baseline will (a) affect the level of non self-determined (η_3), self-determined (η_2) and intrinsic motivation (η_1) at baseline (with these affecting adherence), and (b) directly affect latent adherence (η_4). This model is made up of latent and observed variables. The latent variables are represented by oval shapes, and the observed variables that make these up are represented by rectangles. Constrained pathways are depicted by a broken line; free pathways are a solid line. This format will be maintained for all subsequent models. The non-normative fit index (NNFI) and root

mean square error of approximation (RMSEA) will be used to establish model fit for structural equation model 1 (see Appendix F for LISREL structural equation).

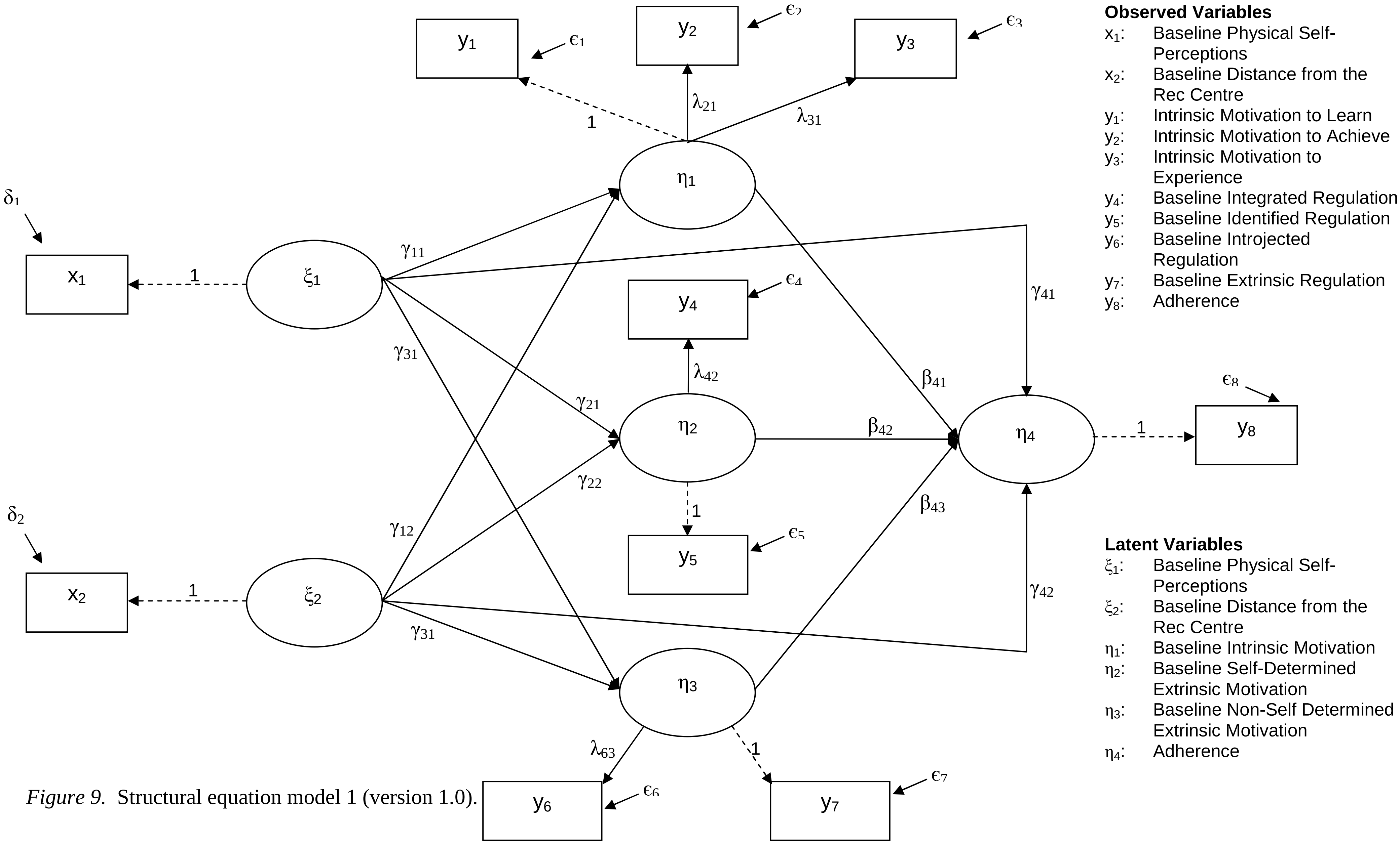
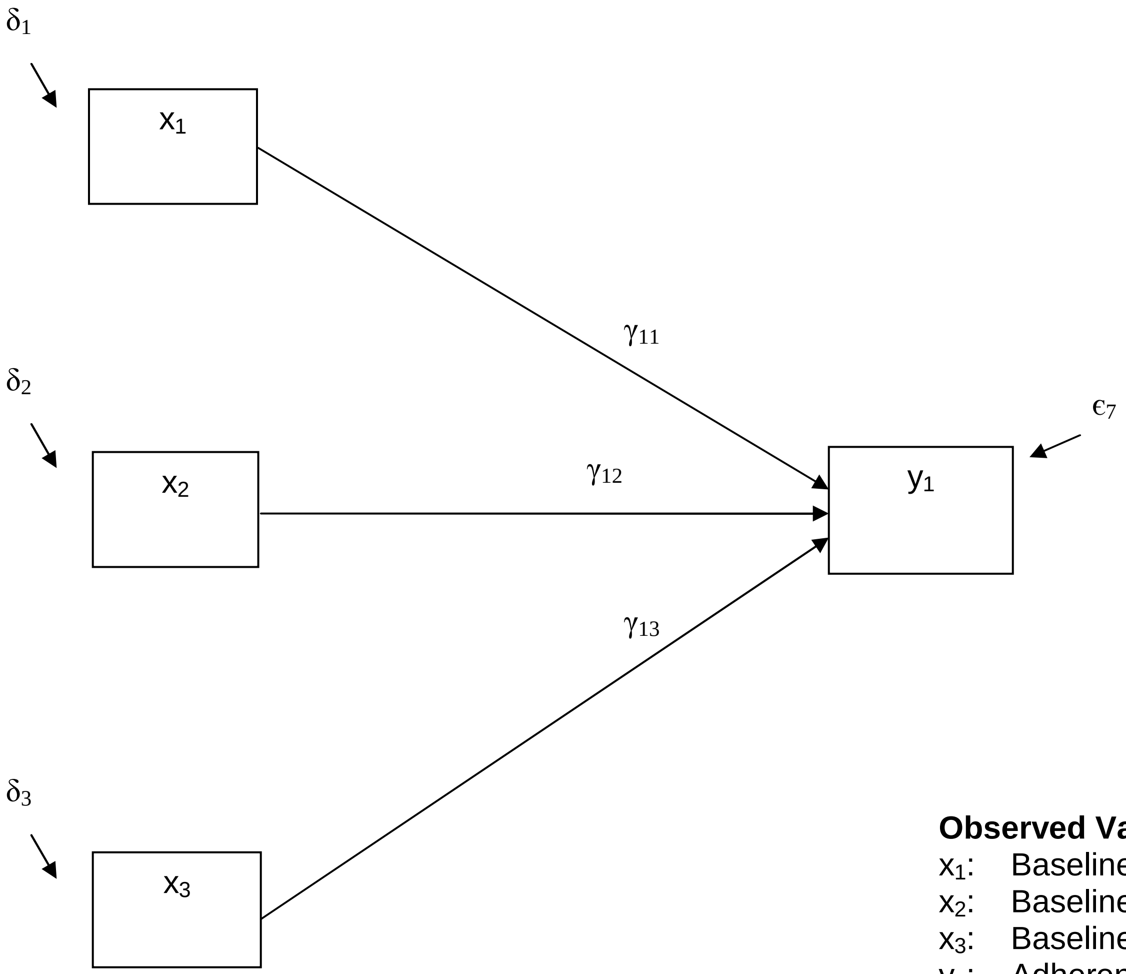


Figure 9. Structural equation model 1 (version 1.0).

Structural Equation Model 2: From Baseline Physical Self-Perceptions, Autonomy and Social Connectedness to Adherence

Structural equation model 2 is presented in Figure 10. In this model it is proposed that baseline physical self-perceptions (x_1) will more strongly predict adherence (y_1) over baseline autonomy (x_2) and social connectedness (x_3). This model contains only observed variables, therefore, no structural equations are necessary. Model 2.0 has an equal number of parameters to predictor variables; as such it is termed a 'saturated model'. Within structural equation modelling models are saturated when the number of free parameters is equal to the number of known values. As model 2.0 is saturated (the number of parameters equals the number of known values, i.e., predictor variables), to determine whether baseline perceived physical abilities, social connectedness, or autonomy was the strongest predictor of adherence, 3 models are compared each with a different parameter held constant. The root mean square residual (RMSR), and standardised root mean square residual (SRMSR) will be used to establish the best of the three specified models (see Appendix F for LISREL measurement equations).

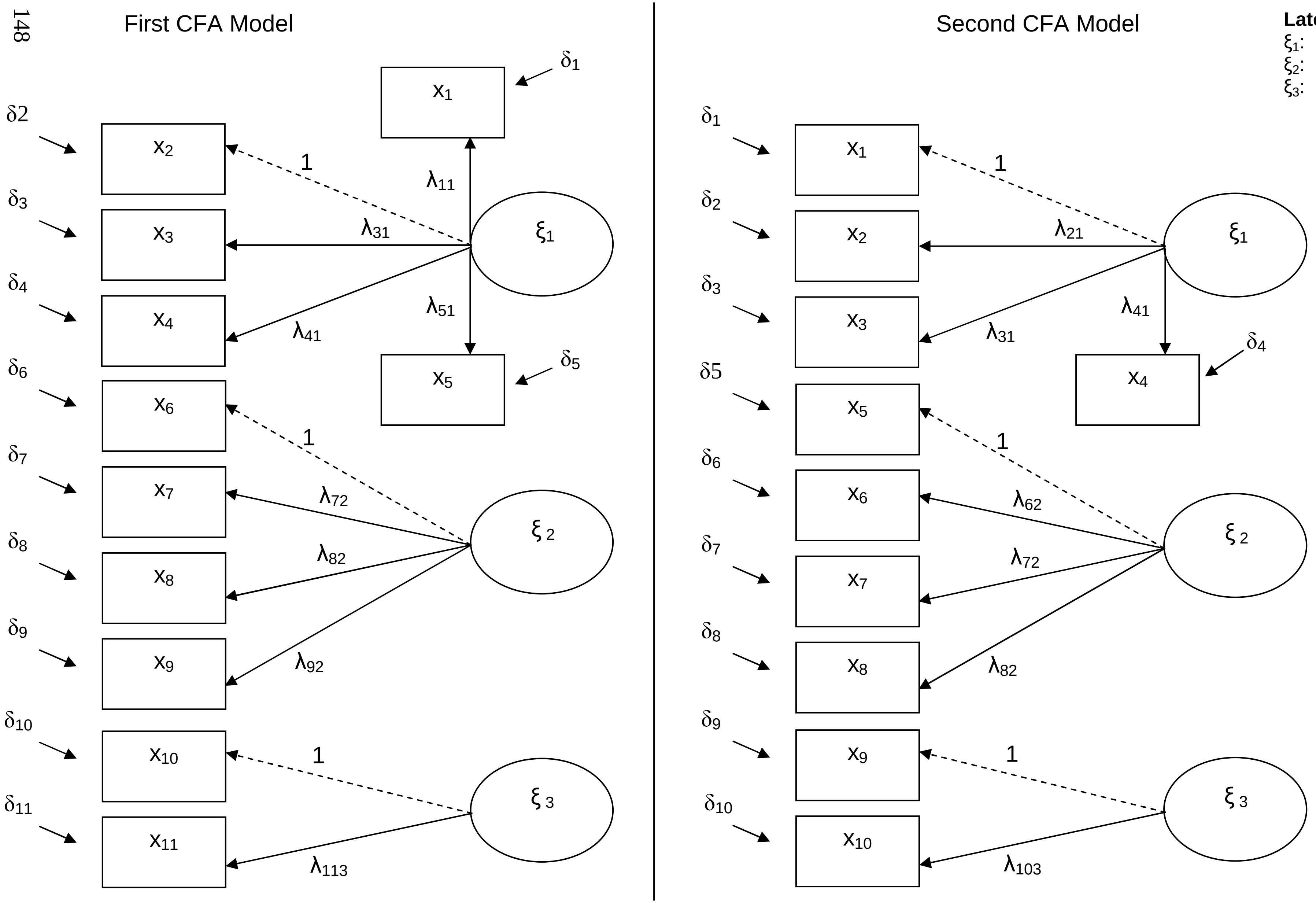


Observed Variables
x_1: Baseline Physical Self-Perceptions
x_2: Baseline Autonomy
x_3: Baseline Social Connectedness
y_4: Adherence

Figure 10. Structural equation model 2 (unconstrained version 2.0).

Structural Equation Model 3: From Adherence to 6-month Social, Cognitive and Physical Self-Perceptions

Prior to the design of structural equation model 3 it was necessary to identify which of the ASPP domains corresponded to the three latent constructs physical, social, and cognitive self-perceptions. A factor analysis on the correlation matrix using the 11 domains of the Adult Self-Perception Profile was performed using SPSS 14.1. This revealed three factors in the data. Using LISREL it is possible to conduct a confirmatory factor analysis (CFA). The questions in each domain were reviewed by the researcher and a tentative model was developed to group sub-domains of the ASPP into 3 major domains, social (ξ_1), cognitive (ξ_2), and physical (ξ_3). This model was tested against the data and changes were made based on the modification indices calculated in LISREL only if the changes were deemed acceptable. The removal of perceptions of intelligence was deemed acceptable as it did not significantly contribute to the latent variable of cognitive self-perceptions. The first and second CFA models are presented in Figure 11. There are no relationships specified between the latent variables in either of the CFA models (see Appendix F for LISREL structural equation). Structural equation model 3 is presented in Figure 12. In this model it is proposed that high levels of adherence (ξ_1) will be most strongly related to high self-perceptions in the physical (η_3) domain at 6-months, and to a lesser extent may be related to high scores in the social (η_1) and cognitive (η_2) domains at 6-months. For structural equation model 3 the non-normative fit index (NNFI) and root mean square error of approximation (RMSEA) will be used to establish model fit (see Appendix F for LISREL structural equation).



Latent Variables (6-months)

ξ_1: Social Self-Perceptions
ξ_2: Cognitive Self-Perceptions
ξ_3: Physical Self-Perceptions

Observed Variables for the First CFA Model (6-months)

x_1: Perceived Nurturance
x_2: Perceived Sociability
x_3: Perceived Intimacy
x_4: Perceived Humour
x_5: Perceived Morality
x_6: Perceived Job Competence
x_7: Perceived Adequacy as a Provider
x_8: Perceived Intelligence
x_9: Perceived Household Management
x_{10}: Perceived Physical Appearance
x_{11}: Perceived Physical Abilities

Observed Variables for the Second CFA Model (6-months)

x_1: Perceived Sociability
x_2: Perceived Intimacy
x_3: Perceived Nurturance
x_4: Perceived Humour
x_5: Perceived Job Competence
x_6: Perceived Adequacy as a Provider
x_7: Perceived Morality
x_8: Perceived Household Management
x_9: Perceived Physical Appearance
x_{10}: Perceived Physical Abilities

Figure 11. The first and second CFA (Confirmatory Factor Analysis) Models.

Observed Variables (6-months)

x_1: Adherence
y_1: Perceived Sociability
y_2: Perceived Intimacy
y_3: Perceived Nurturance
x_4: Perceived Humour
y_5: Perceived Job Competence
y_6: Perceived Adequacy as a Provider
y_7: Perceived Morality
y_8: Perceived Household Management
y_9: Perceived Physical Appearance
y_{10}: Perceived Athletic Abilities

Latent Variables (6-months)

ξ_1: Adherence
η_1: Social Self-Perceptions
η_2: Cognitive Self-Perceptions
η_3: Physical Self-Perceptions

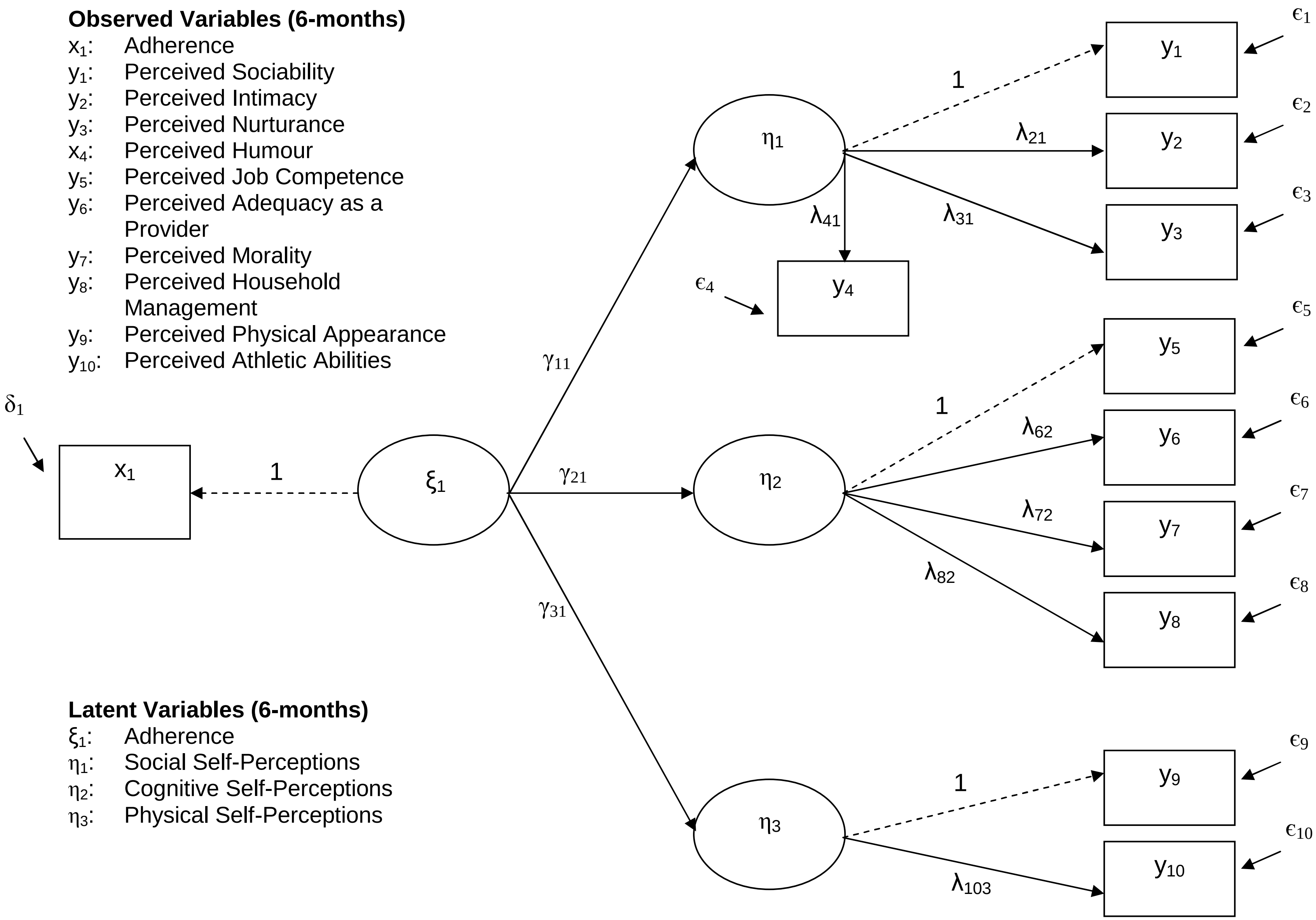


Figure 12. Structural equation model 3 (version 3.0).

CHAPTER FIVE: RESULTS

The results section is separated into, baseline results, post intervention results, and a summary of results. The baseline results are presented to demonstrate the effectiveness of the randomisation. They are presented in the following order (a) internal consistency of psychosocial questionnaires (b) baseline distribution and population demographics, (c) baseline psychological measures, (d) baseline physical activity measures, and (e) baseline functional fitness measures. The post intervention results are presented in separate sections pertaining to each hypothesis. Lastly a summary of the findings is presented. A total of 2,363 people responded to the call for participants and 1,761 were excluded during the telephone screening process. The most common reasons for exclusion were being too active (30.49%), medical contraindications (22.48%), and 21.90% did not give a reason. From the remaining 602 that attended a screening visit a further 318 were excluded, common reasons included, not enough time/changed mind (35.22%), being too active (24.84%), and 15.40% did not provide a reason. A total of 284 participants completed baseline testing and entered the study, although 30 of these participants were classified as active (≥ 60 mins moderate intensity exercise) at baseline. These 30 participants were included to increase the number of participants in the behavioural intervention groups. This was done as some centres unable to conduct the behavioural intervention program with less than 10 members due to financial constraints. Results from the remaining 254 participants, deemed sedentary at baseline, are presented. For the results section the unadjusted means, standard deviations, deltas and confidence intervals are presented.

As this study was cluster analysed the numerator and denominator degrees of freedom are reported. The numerator degrees of freedom can be calculated using the formula $dfn = (n - 1)$ where n is the number of groups being compared. The

denominator degrees of freedom $dfd = (n - 1)$ where n is the number of clusters in the analysis. In the present study the numerator degrees of freedom (dfn) is 1 where two groups are compared (e.g. male and female), or $dfn = 2$ where three groups are compared (e.g. low, medium and high socioeconomic status). The denominator degrees of freedom (dfd) is always 11 as the number of clusters remains at twelve across all analyses. Lastly, it should be noted that the p values presented in the results section have been established using values that were adjusted for clustering effects.

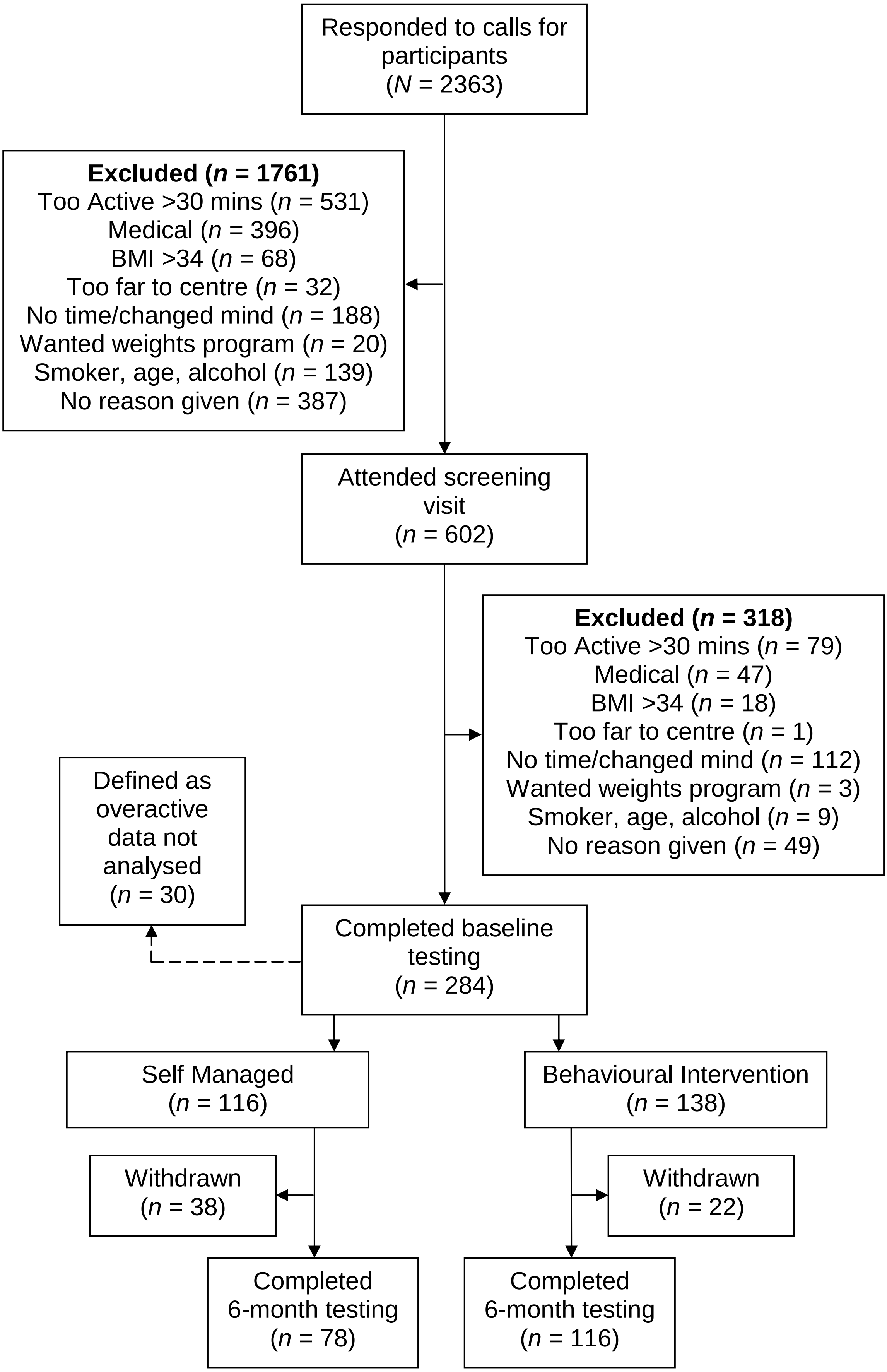


Figure 13. *Flow chart of public response calling for participants through to 6-months completion*

Baseline Results

The baseline results section is separated into (a) internal consistency of psychosocial questionnaires (b) baseline distribution and population demographics, (c) baseline psychological measures, (d) baseline physical activity measures, and (e) baseline functional fitness measures. The differences between intervention type, gender, and withdrawal status in the first 6 months are presented. The tables corresponding to Socio-Economic Status (SES) and occupational background are presented in Appendix H and I respectively. Please note that the numerator degree of freedom for all SES analyses is 2, the denominator degree of freedom is 11.

Internal Consistency of Psychosocial Questionnaires

For psychosocial scales to be considered internally consistent and used as research tools to compare groups, alpha values of 0.70 or above are desirable (Bland & Altman, 1997). According to this classification the ASPP, EMS and SCS-R scales, at baseline and 6-months, had acceptable levels of internal consistency (See Tables E1, E2, and E4 for alpha values). While the MAP-A scale was internally consistent at baseline, at the 6-month measurement the alpha level fell below 0.70 (see Table E3 for alpha values). Leclerc, Lefrancois, Dube, Herbert, & Gaulin (1998) have previously established the test-retest reliability of the MAP-A. In addition, the pilot study also demonstrated the acceptable level of internal consistency on the MAP-A. One possible reason this autonomy subscale failed to remain internally consistent may be due to the reduction in the number of participants at 6-months, and the perceived autonomy of the participants that withdrew from the study (Table 36). Therefore, interpretation of results that include the 6-month MAP-A data should be treated with some degree of caution as the findings may be misleading.

Baseline Distribution and Population Demographics

The population in this study had a mean age of 66.32 yrs (±4.60), 74.02% were female, and 96.7% were Caucasian. The distribution of males and females was not significantly different across intervention groups ($\chi^2 = 1.497$, *dfn* = 1, *p* = 0.246) (Table 9). Additionally the distribution of participants in low, medium and high SES was not significantly different across intervention groups ($\chi^2 = 1.237$, *dfn* = 2, *p* = 0.586) (Table 10). The differences between intervention, gender, and SES in baseline population demographics are presented in this section. The demographic information is separated by physiological demographics, sociological demographics, and physical activity background. Tables G1, G2, G3 and G4 present the distribution of occupation type by intervention group, gender, withdrawal status, and SES.

Table 9

Frequency and percentage of genders across intervention groups

Group	Gender	Frequency	Percent
Self-Managed	Male	25	9.84
	Female	91	35.83
	Total	116	45.67
Behavioural Intervention	Male	41	16.14
	Female	97	38.19
	Total	138	54.33
Total	Male	66	25.98
	Female	188	74.02
	Total	254	100.00

Table 10

Frequency and percentage of socio economic status (SES) across intervention groups

Group	SES	Frequency	Percent
Self-Managed	Low	54	21.26
	Medium	34	13.39
	High	28	11.02
	Total	116	45.67
Behavioural Intervention	Low	35	13.78
	Medium	51	20.08
	High	52	20.47
	Total	138	54.33
Total	Low	89	35.04
	Medium	85	33.47
	High	80	31.49
	Total	254	100.00

Baseline Physiological Demographics

Table 11 outlines the baseline sample sizes of the physiological demographics for intervention, gender, SES and withdrawal status groups. Sample sizes for the baseline waist girth, hip girth, and waist-to-hip ratio measures were 251, 252, and 251, respectively. Table 12 shows the baseline means and standard deviations for the physiological demographics of the total population. There were no significant differences between the intervention groups in age, height, body weight, BMI, waist girth, hip girth, or waist-to-hip ratio at baseline (Table 13).

There were some gender differences; males were significantly older (F = 11.17), taller (F = 261.16), heavier (F = 46.19), had larger waist girth (F = 69.46), had larger

waist to hip ratio (F = 419.78), and smaller hip girth (F = 11.91) compared to females. According to World Health Organisation (WHO) guidelines (WHO Technical Report Series, No. 894), men and women with a BMI between 25.00 and 29.99 are classified as pre-obese, a waist circumference of ≥ 94 in men and ≥ 80 in women indicates increased risk of metabolic complications, and a waist-to-hip ratio (WHR) of ≥ 1.00 in men and ≥ 0.85 in women indicates abdominal fat accumulation. According to these criteria the men and women in this study would be classified as pre-obese (mean BMI of 27.68 and 27.84, respectively) and at increased risk of metabolic complications (mean waist girth of 100.06 cm and 88.88 cm, respectively (Table 14). When BMI for males at baseline was analysed more closely it was revealed that 21.2% were classified as normal (BMI = 18.50-24.99), 56.1% were pre-obese (BMI = 25.00-29.99), 18.2% were obese class 1 (BMI = 30.00-34.99), and 4.5% were obese class 2 (BMI = 35.00-39.99) according to WHO guidelines for BMI classification. For females 23.9% were classified as normal, 42.0% were pre-obese, 31.4% were obese class 1, and 2.1% were obese class 2. According to these classifications those defined as pre-obese, obese class 1 and obese class 2 are at respectively increased, moderate, and severe risk of developing metabolic complications. Close examination of waist girth at baseline shows that according to WHO guidelines 25.8% (< 94cm), 33.3% (94.0cm-101.99cm), and 40.9% (≥ 102cm) of males were at low, increased and substantially increased risk of developing metabolic complications respectively. Similarly, for females 21.1% (< 80cm), 24.3% (80.00cm-87.99cm), and 54.6% (≥ 88cm) were at low, increased, and substantially increased risk of developing metabolic complications according to these same guidelines. When the WHR at baseline, was examined closely it was shown that 33.3% (WHR > 1.0) of men, and 49.4% (WHR > 0.85) of women were at high risk of increased fat accumulation. It should be noted that there remains some conjecture over the efficacy of using WHR to determine central adiposity (WHO Technical Report Series, No. 894). According to the

WHO guidelines for BMI, waist girth and WHR, large percentages of participants in this study were at increased risk of developing metabolic complications in later life.

The high SES group were significantly less obese than the low SES group at baseline as evidence by a lower BMI (M = 26.88 and M = 28.1 respectively, p = 0.043), and smaller hip girth (M = 102.65 and M = 105.41 respectively, p = 0.044) (Table G1). A post hoc analysis revealed that those who withdrew from the study had higher hip girth than those who stayed (F = 7.08, p = 0.022) (Table 15).

Table 11

Sample sizes of baseline physiological measures for each intervention, gender, socio economic status (SES), and withdrawal status group

	Intervention			Gender			SES				Withdrawal Status		
	Self Managed	Behavioural Intervention	Total	Males	Females	Total	Low	Medium	High	Total	Retained	Withdrawn	Total
Measure	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*
Age	116	138	254	66	188	254	89	85	80	254	194	60	254
Height	116	138	254	66	188	254	89	85	80	254	194	60	254
Weight	116	138	254	66	188	254	89	85	80	254	194	60	254
Body Mass Index	116	138	254	66	188	254	89	85	80	254	194	60	254
Waist Girth	114	137	251	66	185	251	88	85	78	251	192	59	251
Hip Girth	115	137	252	66	186	252	88	85	79	252	193	59	252
Waist to Hip Ratio	114	137	251	66	185	251	88	85	79	252	192	59	251

Table 12

Total unadjusted means and standard deviations for baseline physiological measures

Measure	Mean (±SD)
	Total
Age (yrs)	66.32 (4.60)
Height (cm)	163.89 (8.08)
Weight (kg)	74.79 (12.31)
Body Mass Index (kg.m^2)	27.8 (3.85)
Waist Girth (cm)	91.82 (11.53)
Hip Girth (cm)	104.39 (8.13)
Waist to Hip Ratio	0.88 (0.09)

Table 13

Unadjusted self-managed and intervention group means for baseline physiological measures. Differences between groups (p values) are adjusted for clustering effects

Measure	Mean (±SD)		*p* value
	Self Managed	Behavioural Intervention	
Age (yrs)	65.92 (3.93)	66.66 (5.09)	= 0.088
Height (cm)	163.66 (7.61)	164.09 (8.47)	= 0.745
Weight (kg)	74.77 (11.67)	74.80 (12.86)	= 0.688
Body Mass Index (kg.m^2)	27.89 (3.78)	27.72 (3.92)	= 0.974
Waist Girth (cm)	91.82 (10.75)	91.82 (12.19)	= 0.993
Hip Girth (cm)	104.61 (7.69)	104.20 (8.50)	= 0.670
Waist to Hip Ratio	0.87 (0.08)	0.88 (0.09)	= 0.876

Table 14

Unadjusted male and female group means for baseline physiological measures.

Differences between groups (p values) are adjusted for clustering effects

Measure	Mean (±SD) Males	Females	*p* value
Age (yrs)	67.36 (5.13)	65.96 (4.36)	= 0.006
Height (cm)	172.78 (7.46)	160.77 (5.59)	< 0.0001
Weight (kg)	82.73 (12.00)	72.00 (11.17)	< 0.0001
Body Mass Index ($kg.m^2$)	27.68 (3.45)	27.84 (3.99)	= 0.788
Waist Girth (cm)	100.06 (9.52)	88.88 (10.76)	< 0.0001
Hip Girth (cm)	101.72 (6.32)	105.33 (8.49)	= 0.005
Waist to Hip Ratio	0.98 (0.05)	0.84 (0.07)	< 0.0001

Table 15

Unadjusted retained and withdrawn group means on baseline physiological measures.

Differences between groups (p values) are adjusted for clustering effects

Measure	Mean (±SD) Retained	Withdrawn	*p* value
Age (yrs)	66.48 (4.70)	65.82 (4.28)	= 0.132
Height (cm)	164.46 (8.22)	162.05 (7.36)	= 0.067
Weight (kg)	74.56 (12.75)	75.53 (10.82)	= 0.697
Body Mass Index ($kg.m^2$)	27.52 (3.96)	28.70 (3.32)	= 0.067
Waist Girth (cm)	91.52 (11.97)	92.80 (10.00)	= 0.507
Hip Girth (cm)	103.89 (8.17)	105.99 (7.85)	= 0.022
Waist to Hip Ratio	0.88 (0.09)	0.87 (0.08)	= 0.799

Baseline Sociological Background

The baseline difference between intervention, gender, SES, and withdrawal status groups in marital status and educational background are presented. There was no significant difference between participants in the intervention groups in their baseline marital status, educational background, or years of education (Table 16).

There was a significant interaction effect for gender by marital status (χ^2 = 15.13, CI = 1.15, 4.02, $p < 0.001$). In this sample 78.5% of men were married compared to 57.4% of women. Additionally 15.8% and 20.2% of women were widowed or divorced, compared to 7.7% and 7.5% of men. In addition, there was also a significant gender interaction effect in educational background (χ^2 = 13.36, CI = 0.19, 0.61, $p < 0.001$). Among men the most common highest level of education was a university degree (47.7%), followed by a trade or technical qualification (29.9%). For women the most common highest level of education was having passed high school (32.2%), followed closely by a university degree (29.0%), and some high school education (21.3%). This trend is also evidenced by the fact that males had significantly more years of education than females (F = 12.18, $p < 0.05$) (Table 17).

There were no significant differences between retained and withdrawn participants in baseline marital status, educational background, or years of education (Table 18). There was no significant difference between participants in the SES groups in baseline marital status. However, there was a significant interaction between the SES groups in the participant's educational background (χ^2 = 4.85, CI = 0.98, 4.70, $p <$ 0.05). Within this sample the percentage of the High, Medium and Low SES group that reported the highest level of education as a university degree was 42.9%, 36.1%, and 23.9%, respectively. The percentage of the High, Medium and Low SES group that reported the highest level of education as some high school was 6.5%, 18.1%, and

23.9%, respectively. This trend was not reflected in the total years of education (p = 0.074) (Table G2).

Table 16

Marital status, educational background and total years of education compared by intervention group

Marital Status and Educational Background	Number (% within intervention group)		
	Self Managed	Behavioural Intervention	Total
Single	5 (4.4)	5 (3.7)	10 (4.0)
Married	75 (65.8)	81 (60.4)	156 (62.9)
Widowed	16 (14.0)	18 (13.4)	34 (13.7)
Divorced	15 (13.2)	25 (18.7)	40 (16.1)
Separated	1 (0.9)	4 (3.0)	5 (2.0)
De-facto	1 (0.9)	4 (3.0)	5 (2.0)
Total	**114 (100)**	**134 (100)**	**248 (100)**
Primary School	2 (1.8)	2 (1.5)	4 (1.6)
Some High School	24 (21.1)	17 (12.7)	41 (16.5)
Passed High School	32 (28.1)	38 (28.4)	70 (28.2)
Trade or Technical Qualification	25 (21.9)	24 (17.9)	49 (19.8)
University Graduate	31 (27.2)	53 (39.6)	84 (33.9)
Total	**114 (100)**	**134 (100)**	**248 (100)**
	Mean (±SD)		
	Self Managed	Behavioural Intervention	Total
Total Years of Education	12.20 (3.51)	12.85 (3.66)	12.57 (3.60)

Note. Values in bold are within group totals
* indicates p value <0.05 (adjusted for clustering effects)

Table 17

Marital status, educational background and total years of education compared by gender

Marital Status and Educational Background	Number (% within gender)		
	Male	Female	Total
Single	3 (4.6)	7 (3.8)	10 (4.0)
Married	51 (78.5)	105 (57.4)	156 (62.9)
Widowed	5 (7.7)	29(15.8)	34 (13.7)
Divorced	3 (7.5)	37 (20.2)	40 (16.1)
Separated	1 (1.5)	4 (2.2)	5 (2.0)
De-facto	2 (3.1)	1 (0.5)	3 (1.2)
Total	**65 (100)**	**183 (100)**	**248 (100)**
Primary School	2 (3.1)	2 (1.1)	4 (1.6)
Some High School	2 (3.1)	39 (21.3)	41 (16.5)
Passed High School	11 (16.9)	59 (32.2)	70 (28.2)
Trade or Technical Qualification	19 (29.2)	30 (16.4)	49 (19.8)
University Graduate	31 (47.7)	53 (29.0)	84 (33.9)
Total	**65 (100)**	**183 (100)**	**248 (100)**

	Mean (±SD)		
	Males	Females	Total
Total Years of Education*	14.31 (4.22)	11.92 (3.11)	12.57 (3.60)

Note. Values in bold are within group totals
* indicates *p* value <0.05 (adjusted for clustering effects)

Table 18

Marital status, educational background and total years of education compared by withdrawal status

Marital Status and Educational Background	Number (% within withdrawal status)		
	Retained	Withdrawn	Total
Single	10 (5.3)	0 (0.0)	10 (4.0)
Married	119 (62.6)	37 (63.8)	156 (62.9)
Widowed	27 (14.2)	7 (12.1)	34 (13.7)
Divorced	29 (15.3)	11 (19.0)	40 (16.1)
Separated	3 (1.6)	2 (3.4)	5 (2.0)
De-facto	2 (1.1)	1 (1.7)	3 (1.2)
Total	**190 (100)**	**58 (100)**	**248 (100)**
Primary School	3 (1.6)	1 (1.7)	4 (1.6)
Some High School	27 (14.2)	14 (24.1)	41 (16.5)
Passed High School	56 (29.5)	14 (24.1)	70 (28.2)
Trade or Technical Qualification	36 (18.9)	13 (22.4)	49 (19.8)
University Graduate	68 (35.8)	16 (27.6)	84 (33.9)
Total	**190 (100)**	**58 (100)**	**248 (100)**
	Mean (± SD)		
	Retained	Withdrawn	Total
Total Years of Education	12.72 (3.66)	12.06 (3.37)	12.57 (3.60)

Note. Values in bold are within group totals

Baseline Physical Activity Background

This section details the baseline differences between intervention, group, gender, SES group, and withdrawal status in physical activity background. There was no significant difference between the percentage of self managed and behavioural intervention participants who enjoyed physical activity when younger, or those who had started a physical activity program in the last 12 months. There was a higher percentage of behavioural intervention participants who had engaged in a competitive sport in the past, 72.4% versus 56.1% (χ^2 = 19.45, CI = 1.48, 2.81, *dfn* = 1, $p < 0.0001$). This is also evidenced by the fact the participants in the behavioural intervention had significantly more years experience in competitive sport compared to the self managed group, 14.37 versus 10.96, respectively ($F = 6.64$, $p < 0.05$). Interestingly the participants in the self managed group had a significantly lower number of years since they were last involved in a vigorous physical activity 15.19 versus 21.64, respectively ($F = 20.19$, $p < 0.001$). Lastly, there was no significant difference at baseline between the intervention groups on self rated walk ability (Table 19).

There was no significant difference between the percentage of men and women who enjoyed physical activity when they were younger, or in those who had attempted to start a physical activity program in the last 12-months. A significantly greater percentage of men had participated in competitive sport than women, 78.5% versus 60.1% (χ^2 = 4.42, CI = 0.18, 0.94, *dfn* = 1, $p < 0.05$). While, this difference was also apparent in the years of experience in competitive sport, 17.30 for men and 10.80 for women ($F = 9.85$, $p < 0.05$), there was no difference in the years since they were last involved in any vigorous physical activity. At baseline there was no difference between males and females self rated walk ability (Table 20).

Physical activity background was similar in those who remained and those who withdrew from the study. However, the participants who withdrew from the study had

lower self rated walk ability at baseline compared to those who stayed in, 2.82 versus 3.09, respectively ($F = 9.27$, $p < 0.05$) (Table 21).

The percentage of participants who enjoyed physical activity when younger, those who had attempted to start a physical activity program in the last 12 months, the years of competitive sport, or years since they were last involved in vigorous physical activity was significantly different across the SES groups. There was a significant interaction effect across the SES groups in the percentage of participants who had been involved in competitive sport, these were 58.0%, 72.3%, and 64.9% for the Low, Medium, and High SES groups, respectively ($\chi^2 = 4.54$, CI = 0.81, 2.20, $dfn = 2$, $p < 0.05$) (Table G3).

Table 19

Physical activity background compared by intervention group

	Number (% intervention group)		
Physical Activity Background	Self Managed	Behavioural Intervention	Total
Enjoyed physical activity when younger	92 (80.7)	114 (85.1)	206 (83.1)
Competed in a competitive sport*	64 (56.1)	97 (72.4)	161 (64.9)
Started a program in the last 12 months	25 (22.3)	38 (28.6)	63 (25.7)
	Mean (±SD)		
	Self Managed	Behavioural Intervention	Total
Years you participated in competitive sport*	10.63 (13.11)	14.37 (13.99)	12.75 (13.70)
Years since you were last vigorously active*	15.19 (15.78)	21.64 (16.28)	18.53 (16.32)
Walk ability	3.01 (0.73)	3.04 (0.70)	3.03 (0.71)

* indicates *p* value <0.05 (adjusted for clustering effects)

Table 20

Physical activity background compared by gender

Physical Activity Background	Number (% within gender)		
	Male	Female	Total
Enjoyed physical activity when younger	57 (87.7)	149 (81.4)	206 (83.1)
Competed in a competitive sport*	51 (78.5)	110 (60.1)	161 (64.9)
Started a program in the last 12 months	11 (16.9)	52 (28.9)	63 (25.7)
	Mean (±SD)		
	Male	Female	Total
Years you participated in competitive sport*	17.30 (16.06)	10.80 (12.11)	12.75 (13.70)
Years since you were last vigorously active	15.51 (13.33)	19.83 (17.29)	18.58 (16.32)
Walk ability	3.09 (0.80)	3.01 (0.68)	3.03 (0.71)

* indicates *p* value <0.05 (adjusted for clustering effects)

Table 21

Physical activity background compared by withdrawal status

Physical Activity Background	Number (% within withdrawal status)		
	Retained	Withdrawn	Total
Enjoyed physical activity when younger	159 (83.7)	47 (81.0)	206 (83.1)
Competed in a competitive sport	122 (64.2)	39 (67.2)	161 (64.9)
Started an exercise program in the last 12 months	46 (24.3)	17 (30.4)	63 (25.7)
	Mean (±SD)		
	Retained	Withdrawn	Total
Years you participated in competitive sport	12.72 (13.40)	12.84 (14.98)	12.75 (13.70)
Years since you were last vigorously active	19.24 (16.15)	16.43 (16.90)	18.58 (16.32)
Walk ability*	3.09 (0.71)	2.82 (0.69)	3.03 (0.71)

* indicates *p* value <0.05 (adjusted for clustering effects)

Baseline Psychological Results

The sample sizes for the baseline self-perceptions sub-domains for each intervention group, gender, SES group, and withdrawal status group are shown in Table 22. There were 236 viable ASPP questionnaires returned at baseline. Missing data was due to incorrectly filled out questionnaires, or participants not returning questionnaires. Table 23 shows the baseline means and standard deviations for the self-perception sub-domains.

The intervention groups were similar in baseline self-perception sub-domain scores (Table 24).

At baseline males were significantly higher than females in perceptions of athletic competence (F = 8.20, p = 0.015), physical appearance (F = 5.06, p = 0.049), intelligence (F = 22.89, p = 0.0006), humour (F = 14.90, p, 0.0002), and global self worth (F = 5.72, p, 0.035) (Table 25).

Participants who later withdrew from the program had lower perceptions of job competence (F = 8.19, p = 0.015), physical appearance (F = 16.68, p = 0.001), intimacy in relationships (F = 5.71, p = 0.035), and global self-worth (F = 6.26, p = 0.029), compared to those who stayed in (Table 26).

There were no significant differences between the SES groups on baseline self-perception sub-domain scores except for perception of adequacy as a provider (F = 5.71). Post hoc comparisons showed that the Medium SES group reported lesser perceptions of adequacy as a provider compared to the Low (t = -3.17, p = 0.008) and High (t = 2.77, p = 0.018) SES groups (Table G4).

Table 22

Sample sizes of baseline self-perception sub-domains for each intervention, gender, socio economic status (SES), and withdrawal status group

Self-Perception Sub-Domains	Intervention			Gender			SES				Withdrawal Status		
	Self Managed	Behavioural Intervention	Total	Males	Females	Total	Low	Medium	High	Total	Retained	Withdrawn	Total
Athletic Competence	109	127	236	60	176	236	86	81	69	236	184	52	236
Physical Appearance	109	127	236	60	176	236	86	81	69	236	184	52	236
Sociability	109	127	236	60	176	236	86	81	69	236	184	52	236
Job Competence	109	127	236	60	176	236	86	81	69	236	184	52	236
Nuturance	109	127	236	60	176	236	86	81	69	236	184	52	236
Adequacy as a Provider	109	127	236	60	176	236	86	81	69	236	184	52	236
Morality	109	127	236	60	176	236	86	81	69	236	184	52	236
Household Management	109	127	236	60	176	236	86	81	69	236	184	52	236
Intimacy in Relationships	109	127	236	60	176	236	86	81	69	236	184	52	236
Perceived Intelligence	109	127	236	60	176	236	86	81	69	236	184	52	236

Table 22 (continued)

Sample sizes of baseline self-perception sub-domains for each intervention, gender, socio economic status (SES), and withdrawal status group

Self-Perception Sub-Domains	Intervention			Gender			SES				Withdrawal Status		
	Self Managed	Behavioural Intervention	Total	Males	Females	Total	Low	Medium	High	Total	Retained	Withdrawn	Total
Sense of Humour	109	127	236	60	176	236	86	81	69	236	184	52	236
Global Self-Worth	109	127	236	60	176	236	86	81	69	236	184	52	236

Table 23

Total unadjusted means and standard deviations for baseline self-perception sub-domains

	Mean (±SD)
Self-Perception Sub-Domains	Total
Athletic Competence	2.01 (0.66)
Physical Appearance	2.63 (0.62)
Sociability	2.93 (0.63)
Job Competence	3.22 (0.55)
Nuturance	3.27 (0.52)
Adequacy as a Provider	3.35 (0.52)
Morality	3.51 (0.47)
Household Management	3.06 (0.68)
Intimacy in Relationships	2.71 (0.70)
Perceived Intelligence	3.02 (0.57)
Sense of Humour	3.14 (0.63)
Global Self-Worth	3.18 (0.59)

Table 24

Unadjusted self-managed and intervention group means for baseline self-perception sub-domains. Differences between groups (p values) are adjusted for clustering effects

Self-Perception Sub-Domains	Mean (±SD) Self Managed	Mean (±SD) Behavioural Intervention	*p* value
Athletic Competence	1.95 (0.66)	2.07 (0.66)	= 0.246
Physical Appearance	2.60 (0.63)	2.66 (0.62)	= 0.333
Sociability	2.87 (0.62)	2.98 (0.64)	= 0.180
Job Competence	3.23 (0.56)	3.22 (0.55)	= 0.877
Nuturance	3.28 (0.52)	3.26 (0.53)	= 0.778
Adequacy as a Provider	3.38 (0.53)	3.32 (0.51)	= 0.326
Morality	3.51 (0.46)	3.50 (0.47)	= 0.884
Household Activities	3.07 (0.70)	3.05 (0.66)	= 0.850
Intimacy in Relationships	2.69 (0.71)	2.73 (0.68)	= 0.542
Intelligence	2.97 (0.57)	3.07 (0.57)	= 0.198
Sense of Humour	3.14 (0.67)	3.13 (0.58)	= 0.866
Global Self-Worth	3.21 (0.60)	3.15 (0.59)	= 0.312

Table 25

Unadjusted male and female group means for baseline self-perception sub-domains.

Differences between groups (p values) are adjusted for clustering effects

Self-Perception Sub-Domains	Mean (±SD) Males	Mean (±SD) Females	*p* value
Athletic Competence	2.25 (0.73)	1.93 (0.62)	= 0.015
Physical Appearance	2.85 (0.61)	2.56 (0.61)	= 0.049
Sociability	3.00 (0.52)	2.90 (0.66)	= 0.254
Job Competence	3.35 (0.53)	3.18 (0.55)	= 0.125
Nuturance	3.26 (0.50)	3.27 (0.53)	= 0.921
Adequacy as a Provider	3.42 (0.63)	3.32 (0.48)	= 0.198
Morality	3.45 (0.46)	3.52 (0.47)	= 0.336
Household Management	3.05 (0.59)	3.06 (0.71)	= 0.870
Intimacy in Relationships	2.70 (0.67)	2.71 (0.71)	= 0.920
Perceived Intelligence	3.29 (0.48)	2.93 (0.57)	=0.0006
Sense of Humour	3.30 (0.64)	3.08 (0.61)	= 0.002
Global Self-Worth	3.40 (0.56)	3.10 (0.59)	= 0.035

Table 26

Unadjusted retained and withdrawn group means for baseline self-perception sub-domains. Differences between groups (p values) are adjusted for clustering effects

Self-Perception Sub-Domains	Mean (±SD) Retained	Withdrawn	*p* value
Athletic Competence	2.06 (0.67)	1.84 (0.61)	= 0.050
Physical Appearance	2.70 (0.62)	2.39 (0.60)	= 0.001
Sociability	2.96 (0.62)	2.81 (0.65)	= 0.115
Job Competence	3.27 (0.55)	3.07 (0.52)	= 0.015
Nuturance	3.28 (0.53)	3.24 (0.49)	= 0.523
Adequacy as a Provider	3.38 (0.54)	3.25 (0.43)	= 0.158
Morality	3.52 (0.48)	3.47 (0.44)	= 0.435
Household Activities	3.10 (0.67)	2.93 (0.70)	= 0.180
Intimacy in Relationships	2.76 (0.70)	2.52 (0.65)	= 0.035
Intelligence	3.06 (0.56)	2.89 (0.57)	= 0.123
Sense of Humour	3.14 (0.65)	3.13 (0.51)	= 0.963
Global Self-Worth	3.23 (0.61)	3.00 (0.49)	= 0.029

Table 27 shows the sample size of the baseline exercise motivation sub-domains for each intervention, gender, SES, and withdrawal status group. Of the 254 questionnaires handed out a number of each of the exercise motivation sub-domains were not filled out correctly or left blank. These included amotivation (*n* = 19), extrinsic regulation (*n* = 19), introjected regulation (*n* = 18), identified regulation (*n* = 17), integrated regulation (*n* = 19), intrinsic motivation to learn (*n* = 19), intrinsic motivation to achieve (*n* = 19), and intrinsic motivation to experience (*n* = 19). In Table

28 the baseline means and standard deviations for each exercise motivation sub-domain are presented. Participants in the self managed group were higher than the behavioural intervention group in baseline identified regulation (F = 9.60, p = 0.01) and intrinsic motivation to experience (F = 7.32, p = 0.02) (Table 29). At baseline males were significantly lower than females on intrinsic motivation to experience (F = 7.13, p = 0.021) (Table 30). The participants who withdrew from the study had higher baseline identified regulation than those who did not withdraw (F = 6.15, p = 0.03) (Table 31). There were significant differences between SES groups on identified regulation (F = 4.50) and integrated regulation (F = 5.46). Post hoc comparisons showed that the participants in the High SES group were greater than the Medium SES group on identified regulation (t = -2.27, p = 0.044). In addition, participants in the Low SES group reported lesser integrated regulation than the Medium SES group (t = -2.36, p = 0.037) and greater integrated regulation than the High SES group (t = -3.30, p = 0.007) (Table F5).

Table 27

Sample sizes of baseline exercise motivation sub-domains for each gender, intervention, socio economic status (SES), and withdrawal status group

	Intervention			Gender			SES				Withdrawal Status		
Exercise Motivation Sub-Domains	Self Managed	Behavioural Intervention	Total	Males	Females	Total	Low	Medium	High	Total	Retained	Withdrawn	Total
Amotivation	105	130	235	62	173	235	80	82	73	235	185	50	235
Extrinsic Regulation	105	130	235	62	173	235	80	82	73	235	185	50	235
Introjected Regulation	106	130	236	62	174	236	81	82	73	236	186	50	236
Identified Regulation	107	130	237	626	175	237	82	82	73	237	186	51	237
Integrated Regulation	107	130	237	62	175	237	82	82	73	237	186	51	237
Int. Mot. To Learn	105	130	235	62	173	235	80	82	73	235	185	50	235
Int. Mot. To Achieve	105	130	235	62	173	235	80	82	73	235	185	50	235
Int. Mot. To Experience	105	130	235	62	172	235	80	82	73	235	185	50	235

Table 28

Total unadjusted mean and standard deviation at baseline for exercise motivation sub-domains

Exercise Motivation Sub-Domains	Mean (±SD) Total
Amotivation	1.78 (0.82)
Extrinsic Regulation	2.19 (0.97)
Introjected Regulation	3.09 (1.16)
Identified Regulation	4.78 (0.79)
Integrated Regulation	4.34 (0.92)
Intrinsic Motivation to Learn	4.35 (1.09)
Intrinsic Motivation to Achieve	4.52 (0.88)
Intrinsic Motivation to Experience	4.80 (0.88)

Table 29

Unadjusted self managed and intervention group means at baseline for exercise motivation sub-domains. Differences between groups (p values) are adjusted for clustering effects

Exercise Motivation Sub-Domains	Mean (±SD)		
	Self Managed	Behavioural Intervention	*p* value
Amotivation	1.73 (0.84)	1.81 (0.82)	= 0.258
Extrinsic Regulation	2.05 (0.94)	2.31 (0.99)	= 0.050
Introjected Regulation	3.06 (1.13)	3.12 (1.19)	= 0.762
Identified Regulation	4.88 (0.70)	4.70 (0.85)	= 0.010
Integrated Regulation	4.41 (0.85)	4.28 (0.97)	= 0.151
Intrinsic Motivation to Learn	4.38 (1.04)	4.33 (1.14)	= 0.497
Intrinsic Motivation to Achieve	4.59 (0.84)	4.47 (0.91)	= 0.075
Intrinsic Motivation to Experience	4.90 (0.75)	4.72 (0.98)	= 0.020

Table 30

Unadjusted male and female group means at baseline for exercise motivation sub-domains. Differences between groups (p values) are adjusted for clustering effects

Exercise Motivation Sub-Domains	Mean (±SD)		
	Males	Females	*p* value
Amotivation	1.77 (0.86)	1.78 (0.81)	= 0.942
Extrinsic Regulation	2.25 (0.97)	2.17 (0.98)	= 0.492
Introjected Regulation	2.91 (1.10)	3.16 (1.18)	= 0.210
Identified Regulation	4.70 (0.87)	4.81 (0.76)	= 0.281
Integrated Regulation	4.25 (0.88)	4.37 (0.93)	= 0.406
Intrinsic Motivation to Learn	4.10 (1.10)	4.44 (1.08)	= 0.087
Intrinsic Motivation to Achieve	4.30 (0.96)	4.60 (0.84)	=0.080
Intrinsic Motivation to Experience	4.60 (0.97)	4.88 (0.84)	= 0.021

Table 31

Unadjusted retained and withdrawn group means for baseline exercise motivation sub-domains. Differences between groups (p values) are adjusted for clustering effects

Exercise Motivation Sub-Domains	Mean (±SD) Retained	Withdrawn	*p* value
Amotivation	1.74 (0.81)	1.90 (0.86)	= 0.484
Extrinsic Regulation	2.17 (0.96)	2.29 (1.03)	= 0.533
Introjected Regulation	3.09 (1.20)	3.12 (1.01)	= 0.893
Identified Regulation	4.74 (0.83)	4.95 (0.61)	= 0.030
Integrated Regulation	4.36 (0.92)	4.28 (0.90)	= 0.654
Intrinsic Motivation to Learn	4.34 (1.10)	4.38 (1.08)	= 0.846
Intrinsic Motivation to Achieve	4.53 (0.89)	4.50 (0.85)	= 0.820
Intrinsic Motivation to Experience	4.82 (0.89)	4.76 (0.86)	= 0.664

In Table 32 the baseline autonomy and social connectedness scores for each intervention, gender, SES, and withdrawal status group are displayed. There were 12 MAP-A, and 39 SCS-R questionnaires not returned at baseline. Table 33 presents the baseline means and standard deviations for the autonomy and social connectedness scores of the whole group.

For the autonomy and social connectedness scores at baseline, there were no significant differences between intervention, gender, or SES groups (Table 34, 38, and F6 respectively). While there also was no difference between the withdrawal groups in social connectedness, those participants who withdrew from the study had significantly lower autonomy than those who stayed ($F = 5.97$, $p = 0.032$) (Table 36).

Table 32

Sample sizes of baseline autonomy and social connectedness for each gender, intervention, socio economic status (SES), and withdrawal status group

	Intervention			Gender			SES				Withdrawal Status		
Measures	Self managed	Behavioural Intervention	Total	Male	Female	Total	Low	Medium	High	Total	Retained	Withdrawn	Total
Autonomy	111	131	242	64	178	242	87	82	73	242	189	53	242
Social Connectedness	197	117	214	55	159	214	76	73	65	214	166	48	214

Table 33

Total unadjusted means and standard deviations for baseline autonomy and social connectedness

Measures	Mean (±SD) Total
Autonomy	3.78 (0.52)
Social Connectedness	93.80 (14.01)

Table 34

Unadjusted self managed and intervention group means for baseline autonomy and social connectedness. Differences between groups (p values) are adjusted for clustering effects

	Mean (±SD)		
Measures	Self Managed	Behavioural Intervention	*p* value
Autonomy	3.76 (0.51)	3.80 (0.52)	= 0.425
Social Connectedness	93.77 (13.82)	93.83 (14.23)	= 0.300

Table 35

Unadjusted male and female group means for baseline autonomy and social connectedness. Differences between groups (p values) are adjusted for clustering effects

Measures	Mean (±SD) Males	Females	*p* value
Autonomy	3.91 (0.48)	3.73 (0.52)	= 0.857
Social Connectedness	94.52 (12.73)	93.55 (14.46)	= 0.420

Table 36

Unadjusted retained and withdrawn group means for baseline autonomy and social connectedness. Differences between groups (p values) are adjusted for clustering effects

Measures	Mean (±SD) Retained	Withdrawn	*p* value
Autonomy	3.81 (0.53)	3.67 (0.46)	= 0.032
Social Connectedness	94.50 (14.13)	91.41 (13.45)	= 0.112

Baseline Physical Activity Results

The following tables present the baseline results for physical activity level. Table 37 outlines the baseline sample sizes of the PASE measure for gender, intervention, SES and withdrawal status groups. There were a total of 251 valid PASE questionnaires collected at baseline. Table 38 shows the baseline means and standard deviations for the physical activity levels of the population. The mean sample total PASE score for the population in the present study (100.43 ± 43.27) was similar to the total PASE score (102.9 ± 64.1) in a random sample of 314 adults over the age of 65 (Washburn, Smith, Jette, and Janney, 1993). A study using 847 participants (M = 54.7 yrs of age, ±13.05 yrs) recruited from the general population through health care providers reported mean total PASE score as M = 101.5 ± 67.85 (Norris, Grothaus, Buchner, & Pratt, 2000), also similar to the total PASE score reported in the present study. The mean sample leisure time PASE score for the population in the present study was much less (M = 7.31, ±8.84) than the leisure time PASE scores reported by Washburn et al. (1993) (M = 20.5) and Norris et al. (2000) (M = 19.6 ± 28.1).

At baseline there were no significant differences between intervention, gender, withdrawal or SES groups (Table 39, 43, 44, and F7 respectively) in physical activity level.

Table 37

Sample sizes of baseline physical activity levels for each intervention, gender, socio economic status (SES), and withdrawal status group

	Intervention			Gender			SES				Withdrawal Status		
Measure	Self managed	Behavioural Intervention	Total	Males	Females	Total	Low	Medium	High	Total	Retained	Withdrawn	Total
Total Physical Activity	115	136	251	66	185	251	87	84	80	251	193	58	251
Leisure Time Physical Activity	115	136	251	66	185	251	87	84	80	251	193	58	251

Table 38

Total unadjusted means and standard deviations for baseline physical activity level

Measure	Mean (±SD)
	Total
Total Physical Activity	100.43 (43.27)
Leisure Time Physical Activity	7.31 (8.84)

Table 39

Unadjusted self managed and intervention group means for baseline physical activity levels. Differences between groups (p values) are adjusted for clustering effects

Measure	Mean (±SD)		*p* value
	Self Managed	Behavioural Intervention	
Total Physical Activity	98.52 (43.60)	102.05 (43.09)	= 0.423
Leisure Time Physical Activity	7.47 (8.46)	7.18 (9.19)	= 0.499

Table 40

Unadjusted male and female group means for baseline physical activity levels. Differences between groups (p values) are adjusted for clustering effects

Measure	Mean (±SD)		*p* value
	Males	Females	
Total Physical Activity	102.54 (52.25)	99.68 (39.71)	= 0.643
Leisure Time Physical Activity	8.02 (9.12)	7.06 (8.76)	= 0.174

Table 41

Unadjusted retained and withdraw group means for baseline physical activity levels. Differences between groups (p values) are adjusted for clustering effects

Measure	Mean (±SD) Retained	Withdrawn	*p* value
Total Physical Activity	100.81 (43.75)	99.18 (41.99)	= 0.904
Leisure Time Physical Activity	7.49 (8.90)	6.71 (8.70)	= 0.538

Baseline Functional Fitness Results

Table 42 shows the sample size of the baseline functional fitness results for each gender, intervention and SES group. Of the 254 participants at baseline eight participants did not complete the arm curl, back scratch dominant and non-dominant, chair stand, sit and reach, and the 6-min walk tests. Of the 254 participants at baseline seven did not complete the 2.5m up and go test. Missing data in the functional fitness parameters was due to illnesses or injuries in participants that were contra-indications for participation in the functional fitness test. In Table 43 the baseline means and standard deviations for each functional fitness parameter are presented.

There were no significant differences between the self managed and behavioural intervention groups on any of the baseline functional fitness parameters (Table 44). At baseline males had significantly more arm strength (F = 23.75), leg strength (F = 20.54), and aerobic endurance (F = 40.43) than females. Males also had better agility compared to females (F = 16.98). Females showed better baseline shoulder flexibility on their dominant (F = 22.89), and non-dominant (F = 16.30) sides compare to males. Also females had much better hamstring flexibility (F = 5.96) compared to males (Table 45). There were no significant differences between the retained and withdrawn participants in any of the baseline functional fitness parameters (Table 46). The participants in the High SES group had more arm strength than participants in the Low

SES group ($F = 7.18$, $t = 3.67$, $p = 0.003$). The participants in the Low SES group had better agility than participants in the High SES group ($F = 4.05$, $t = 2.81$, $p = 0.016$) (Table F8).

Table 42

Sample sizes of baseline functional fitness parameters for each intervention, gender, socio economic status (SES), and withdrawal status group

Functional Fitness Parameter	Intervention			Gender			SES				Withdrawal Status		
	Self Managed	Behavioural Intervention	Total	Males	Females	Total	Low	Medium	High	Total	Retained	Withdrawn	Total
Arm Strength	112	134	246	65	181	246	86	82	78	246	189	57	246
Agility	113	134	247	65	182	247	87	82	78	247	190	57	247
Shoulder Flexibility Dominant Side	113	133	246	65	181	246	87	81	78	246	189	57	246
Shoulder Flexibility Non-Dominant Side	113	133	246	65	181	246	87	81	78	246	189	57	246
Leg Strength	112	134	246	65	181	246	86	82	78	246	189	57	246
Hamstring Flexibility	112	134	246	64	182	246	87	81	78	246	190	56	246
Aerobic Endurance	113	133	246	65	181	246	87	81	78	246	189	57	246

Table 43

Total unadjusted mean and standard deviation at baseline for each functional fitness parameter

Functional Fitness Parameter	Mean (±SD) Total
Arm Strength	13.80 (2.84)
Agility	5.47 (0.86)
Shoulder Flexibility Dominant Side	-3.65 (7.94)
Shoulder Flexibility Non-Dominant Side	-8.58 (8.95)
Leg Strength	11.93 (2.76)
Hamstring Flexibility	1.24 (12.48)
Aerobic Endurance	582.14 (65.90)

Table 44

Unadjusted self managed and intervention group means at baseline for each functional fitness parameter. Differences between groups (p values) are adjusted for clustering effects

	Mean (±SD)		
		Behavioural	
Functional Fitness Parameter	Self Managed	Intervention	*p* value
Arm Strength	14.00 (2.95)	13.63 (2.75)	= 0.352
Agility	5.48 (0.78)	5.46 (0.92)	= 0.866
Shoulder Flexibility Dominant Side	-3.80 (8.18)	-3.52 (7.76)	= 0.817
Shoulder Flexibility Non-Dominant Side	-9.11 (9.09)	-8.13 (8.83)	= 0.288
Leg Strength	11.91 (2.79)	11.94 (2.74)	= 0.967
Hamstring Flexibility	2.54 (12.32)	0.16 (12.55)	= 0.134
Aerobic Endurance	576.03 (57.96)	587.33 (71.78)	= 0.395

Table 45

Unadjusted male and female group means at baseline for each functional fitness parameter. Differences between groups (p values) are adjusted for clustering effects

Functional Fitness Parameter	Mean (±SD)		
	Males	Females	*p* value
Arm Strength	15.15 (2.65)	13.32 (2.76)	= 0.005
Agility	5.12 (0.59)	5.59 (0.91)	= 0.001
Shoulder Flexibility Dominant Side	-6.35 (9.25)	-2.68(7.21)	= 0.0006
Shoulder Flexibility Non-Dominant Side	-11.93 (9.49)	-7.38 (8.45)	= 0.002
Leg Strength	13.35 (2.60)	11.41 (2.64)	= 0.0009
Hamstring Flexibility	-1.21 (14.06)	2.10 (11.79)	= 0.03
Aerobic Endurance	623.30 (72.24)	567.36 (56.79)	<0.0001

Table 46

Unadjusted retained and withdrawn group means for baseline functional fitness parameter. Differences between groups (p values) are adjusted for clustering effects

Functional Fitness Parameter	Mean (±SD)		
	Retained	Withdrawn	*p* Value
Arm Strength	13.83 (2.74)	13.70 (3.20)	= 0.752
Agility	5.43 (0.82)	5.58 (0.98)	= 0.142
Shoulder Flexibility Dominant Side	-3.40 (8.04)	-4.47 (7.63)	= 0.378
Shoulder Flexibility Non-Dominant Side	-8.19 (9.18)	-9.86 (8.08)	= 0.166
Leg Strength	12.03 (2.67)	11.59 (3.02)	= 0.227
Hamstring Flexibility	1.44 (13.10)	0.56 (10.16)	= 0.531
Aerobic Endurance	586.14 (65.25)	568.89 (66.90)	= 0.174

Post Intervention Results

The effect sizes for all variables analysed in hypotheses 1(a), 1(b), 1(c) and 1(d) are presented in Table 47. It should be noted that it is necessary to use and adjusted N value to calculate the effect size in cluster design studies. This adjusted *N* was achieved by decreasing the original *N* by a factor of 1.5. The post intervention results are presented under headings that relate to the three purposes the study. The first purpose of the study was to determine the effect of the intervention on several outcome variables. Hypotheses 1(a), 1(b), 1(c) and 1(d) were generated from this purpose and the results are presented in this order. The second purpose of the study was to investigate the relative contribution of psychosocial predictors of adherence and physical activity scores in the behavioural intervention and self managed groups. Hypotheses 2(a), 2(b), and 2(c) were developed from this purpose and the results are presented in this order. The third purpose of this study was to employ structural equation modelling in order to estimate the directional relationships between psychosocial predictors of adherence. From this purpose hypothesised models 3(a), 3(b), and 3(c) were generated and are presented in this order.

Table 47

Effect sizes for variables analysed in hypothesis 1(a), 1(b), 1(c), and 1(d)

Post Intervention Variables	Δ Between Groups	Pooled *SD*	Adjusted *N*	Effect Size
Perceived Athletic Competence	0.2182	0.69	41	0.289
Perceived Physical Appearances	0.05	0.65	41	0.063
Perceived Sociability	0.1896	0.64	41	0.259
Perceived Job Competence	0.05	0.50	41	0.072
Perceived Nurturance	0.1042	0.58	41	0.124
Perceived Adequacy as a Provider	0.0743	0.55	41	0.091
Perceived Morality	0.0423	0.48	41	0.067
Perceived Household Management	0.0618	0.64	41	0.07
Perceived Intimacy in Relationships	0.1135	0.67	41	0.116
Perceived Intelligence	0.176	0.54	41	0.304
Perceived Sense of Humour	0.0713	0.61	41	0.08
Perceived Global Self-Worth	0.0662	0.53	41	0.0853
Amotivation	0.0358	0.80	41	0.0544
Extrinsic Regulation	0.0292	1.01	41	0.0518
Introjected Regulation	0.0811	1.15	41	0.061
Identified Regulation	0.0357	0.82	41	0.0541
Integrated Regulation	0.0048	0.91	41	0.05
Intrinsic Motivation to Learn	0.0647	1.11	41	0.0575
Intrinsic Motivation to Achieve	0.046	0.89	41	0.0567
Intrinsic Motivation to Experience	0.0533	0.92	41	0.0574
Autonomy	0.0394	0.48	41	0.065
Social Connectedness	4.9415	13.80	38	0.338

Table 47 (continued)

Effect sizes for variables analysed in hypothesis 1(a), 1(b), 1(c), and 1(d)

Post Intervention Variables	Δ Between Groups	Pooled SD	Adjusted N	Effect Size
Number of Sessions	6.2895	21.73	55	0.321
Missing Sessions	1.2	8.09	77	0.151
Walking Sessions	19.45	24.42	77	0.998
Activities other than walking	2.87	9.25	77	0.486
Exercise Intensity (% HRR)	4.11	16.50	52	0.238
Exercise Intensity (RPE)	0.67	1.37	53	0.702
Leisure Time Physical Activity	1.915	12.65	51	0.116
Total Physical Activity	1.183	43.82	51	0.0518
Weight	1.0569	12.59	51	0.069
Body Mass Index	0.0647	4.00	51	0.05
Circumference waist	0.2329	12.08	51	0.05
Circumference hip	0.1294	7.78	51	0.05
Waist to Hip Ratios	0.0009	0.09	51	0.051
Arm Strength	1.0278	3.07	43	0.332
Agility	0.2062	0.83	43	0.203
Shoulder Flexibility Dominant Side	0.9524	8.13	43	0.082
Shoulder Flexibility Non-Dominant Side	0.0258	9.02	42	0.05
Leg Strength	0.704	2.88	42	0.194
Hamstring Flexibility	3.4466	13.46	43	0.212
Aerobic Endurance	33.3547	72.36	41	0.538

Hypothesis 1(a)

Hypothesis 1(a) stated that the behavioural intervention would be more effective at improving self-perceptions, exercise motivation, autonomy and social connectedness, compared to the self-managed intervention.

Self-Perceptions

The following tables show the 6-month self-perception means and standard deviations, and the *p* values for the differences between groups. The deltas and 95% confidence intervals are also shown. After 6 months there were no differences between the self managed and behavioural intervention groups in any of the self-perception sub-domain scores, although there was a trend toward a significant difference in perceptions of nurturance. This trend is observed as an increase in perceptions of nurturance the behavioural intervention group (Δ 0.04) and a decrease in the self-managed group (Δ -0.04) (Table 48).

Following the 6-month intervention males were higher than females in perceptions of physical appearance (F = 9.08), adequacy as a provider (F = 5.28), and morality (F = 5.41), after accounting for baseline values. This indicates that males responded to the intervention with increases in these domains. It should be noted that males were also higher than females in perceptions of physical appearance at baseline. Differences in the perceptions of adequacy as a provider must be treated with some degree of caution as the 95%CI for Δ in perceptions of adequacy as a provider for males and females both crossed zero (Table 49). In addition the effect sizes for perceptions of physical appearance, adequacy as a provider, and morality were small; 0.063, 0.091, and 0.067 respectively, therefore the magnitude of the change may not be practically significant.

Table 48

Unadjusted self-managed and behavioural intervention group changes and means, in 6-month self-perception sub-domain scores. Differences between group's 6-month means (p values) are adjusted for clustering effects and baseline values

Self-Perception Sub-Domains	Self Managed		Behavioural Intervention		Between group
	Δ (95% CI)	Mean (±SD)	Δ (95% CI)	Mean (±SD)	*p* value
Athletic Competence	0.12 (0.01, 0.24)	2.07 (0.65)	0.15 (0.06, 0.23)	2.29 (0.71)	= 0.801
Physical Appearance	0.10 (0.00, 0.20)	2.81 (0.58)	0.11 (0.03, 0.19)	2.86 (0.68)	= 0.981
Sociability	0.12 (0.02, 0.22)	2.98 (0.63)	0.13 (0.06, 0.21)	3.17 (0.64)	= 0.288
Job Competence	0.06 (-0.03, 0.17)	3.31 (0.46)	0.03 (-0.06, 0.12)	3.36 (0.52)	= 0.718
Nuturance	-0.04 (-0.16, 0.08)	3.23 (0.58)	0.04 (-0.03, 0.12)	3.34 (0.58)	= 0.061
Adequacy as a Provider	-0.03 (-0.14, 0.07)	3.34 (0.57)	0.00 (-0.08, 0.08)	3.41 (0.53)	= 0.570
Morality	0.02 (-0.05, 0.09)	3.55 (0.52)	0.06 (-0.02, 0.14)	3.59 (0.45)	= 0.765
Household Management	0.03 (-0.06, 0.13)	3.12 (0.67)	0.03 (-0.06, 0.12)	3.18 (0.62)	= 0.881
Intimacy in Relationships	0.10 (-0.03, 0.24)	2.79 (0.65)	0.07 (-0.03, 0.17)	2.90 (0.67)	= 0.905
Perceived Intelligence	0.09 (-0.02, 0.20)	3.05 (0.51)	0.08 (0.00, 0.16)	3.23 (0.55)	= 0.451

Table 48 (continued)

Unadjusted self-managed and behavioural intervention group changes and means, in 6-month self-perception sub-domain scores. Differences between group's 6-month means (p values) are adjusted for clustering effects and baseline values

Self-Perception	Self Managed		Behavioural Intervention		Between group
Sub-Domains	Δ (95% CI)	Mean (±SD)	Δ (95% CI)	Mean (±SD)	*p* value
Sense of Humour	0.04 (-0.04, 0.13)	3.17 (0.62)	0.02 (-0.06, 0.10)	3.24 (0.60)	= 0.762
Global Self-Worth	0.05 (-0.01, 0.13)	3.30 (0.51)	0.11 (0.03, 0.18)	3.23 (0.55)	= 0.364

Table 49

Unadjusted male and female group changes and means, in 6-month self-perception sub-domain scores. Differences between group's 6-month means (p values) are adjusted for clustering effects and baseline values

Self-Perception	Males		Females		Between group
Sub-Domains	Δ (95% CI)	Mean (±SD)	Δ (95% CI)	Mean (±SD)	*p* value
Athletic Competence	0.24 (0.10, 0.37)	2.50 (0.76)	0.10 (0.02, 0.17)	2.07 (0.63)	= 0.086
Physical Appearance	0.18 (0.08, 0.29)	3.09 (0.63)	0.07 (0.00, 0.15)	2.73 (0.62)	= 0.011
Sociability	0.11 (0.00, 0.22)	3.17 (0.54)	0.13 (0.06, 0.21)	3.06 (0.68)	= 0.778
Job Competence	0.03 (-0.06, 0.14)	3.44 (0.49)	0.04 (-0.03, 0.13)	3.29 (0.50)	= 0.138
Nuturance	0.00 (-0.14, 0.14)	3.25 (0.62)	0.01 (-0.06, 0.09)	3.32 (0.56)	= 0.716
Adequacy as a Provider	0.07 (-0.03, 0.19)	3.54 (0.56)	-0.05 (-0.13, 0.03)	3.32 (0.52)	= 0.042
Morality	0.14 (0.02, 0.27)	3.61 (0.43)	0.00 (-0.06, 0.06)	3.56 (0.50)	= 0.040
Household Management	0.13 (0.16, 0.24)	3.15 (0.59)	-0.01 (-0.09, 0.07)	3.16 (0.66)	= 0.061
Intimacy in Relationships	0.15 (0.01, 0.28)	2.92 (0.64)	0.05 (-0.04, 0.16)	2.83 (0.67)	= 0.328
Perceived Intelligence	-0.17 (-0.15, 0.12)	3.32 (0.44)	0.12 (0.05, 0.20)	3.09 (0.56)	= 0.753

Table 49 (continued)

Unadjusted male and female group changes and means, in 6-month self-perception sub-domain scores. Differences between group's 6-month means (p values) are adjusted for clustering effects and baseline values

Self-Perception	Males		Females		Between group
Sub-Domains	Δ (95% CI)	Mean (±SD)	Δ (95% CI)	Mean (±SD)	*p* value
Sense of Humour	0.04 (-0.07, 0.16)	3.38 (0.58)	0.02 (-0.04, 0.09)	3.14 (0.61)	= 0.467
Global Self-Worth	0.07 (-0.02, 0.17)	3.51 (0.46)	0.09 (0.03, 0.16)	3.27 (0.54)	= 0.516

Exercise Motivation

The following tables show the means and standard deviations for 6-month exercise motivation scores and the *p* values for differences between intervention and gender groups. After 6 months there were neither differences between intervention groups nor were there differences between the gender groups in any of the exercise motivation sub-domain scores (Table 50 and 54, respectively).

Table 50

Unadjusted self managed and intervention group changes and means, in 6-month exercise motivation sub-domain scores. Differences between group's 6-month means (p values) are adjusted for clustering effects and baseline values

Exercise Motivation	Self Managed		Behavioural Intervention		Between group
Sub-Domains	Δ (95% CI)	Mean (±SD)	Δ (95% CI)	Mean (±SD)	*p* value
Amotivation	-0.05 (-0.27, 0.16)	1.7 (0.70)	-0.03 (-0.21, 0.13)	1.69 (0.85)	= 0.594
Extrinsic Regulation	0.11 (-0.12, 0.35)	2.20 (1.04)	-0.06 (-0.24, 0.11)	2.23 (0.99)	= 0.191
Introjected Regulation	-0.05 (-0.36, 0.26)	3.06 (1.04)	0.02 (-0.15, 0.20)	3.14 (1.21)	= 0.965
Identified Regulation	0.07 (-0.10, 0.26)	4.88 (0.71)	0.11 (-0.02, 0.26)	4.84 (0.88)	= 0.508
Integrated Regulation	0.04 (-0.15, 0.23)	4.46 (0.83)	0.06 (-0.11, 0.23)	4.45 (0.94)	= 0.998
Intrinsic Motivation to Learn	0.00 (-0.30, 0.30)	4.37 (1.00)	-0.01 (-0.21, 0.19)	4.30 (1.18)	= 0.617
Intrinsic Motivation to Achieve	0.02 (-0.16, 0.22)	4.59 (0.78)	0.03 (-0.14, 0.21)	4.54 (0.95)	= 0.980
Intrinsic Motivation to Experience	-0.05 (-0.25, 0.14)	4.83 (0.83)	0.01 (-0.15, 0.17)	4.77 (0.96)	= 0.987

Table 51

Unadjusted male and female group changes and means, in 6-month exercise motivation sub-domain. Differences between group's 6-month means (p values) are adjusted for clustering effects and baseline values

Exercise Motivation	Males		Females		Between group
Sub-Domains	Δ (95% CI)	Mean (±SD)	Δ (95% CI)	Mean (±SD)	*p* value
Amotivation	-0.15 (-0.41, 0.10)	1.71 (0.90)	0.00 (-0.16, 0.16)	1.70 (0.74)	= 0.255
Extrinsic Regulation	-0.12 (-0.37, 0.13)	2.24 (1.05)	0.05 (-0.11, 0.23)	2.20 (0.99)	= 0.406
Introjected Regulation	-0.03 (-0.25, 0.19)	2.94 (1.29)	0.01 (-0.21, 0.22)	3.18 (1.08)	= 0.532
Identified Regulation	0.21 (0.02, 0.39)	4.77 (0.89)	0.05 (-0.08, 0.19)	4.89 (0.78)	= 0.508
Integrated Regulation	0.19 (-0.05, 0.45)	4.34 (0.95)	-0.01 (-0.16, 0.15)	4.50 (0.87)	= 0.577
Intrinsic Motivation to Learn	0.01 (-0.26, 0.30)	4.13 (1.16)	-0.02 (-0.23, 0.19)	4.41 (1.08)	= 0.581
Intrinsic Motivation to Achieve	0.07 (-0.18, 0.33)	4.27 (0.97)	0.01 (-0.14, 0.17)	4.68 (0.82)	= 0.087
Intrinsic Motivation to Experience	0.13 (-0.12, 0.38)	4.61 (0.93)	-0.07 (-0.22, 0.06)	4.87 (0.90)	= 0.747

Autonomy and Social Connectedness

The following tables show the means and standard deviations for 6-month autonomy and social connectedness and the *p* values for differences between intervention groups and differences between gender groups. After 6 months there were no significant differences between the intervention groups on autonomy. However, the behavioural intervention group was significantly higher in social connectedness compared to the self managed group (F = 17.00) after 6 months (Table 52). On closer examination it is apparent that the social connectedness for participants in the behavioural intervention increased (Δ = 2.92) while for the self-managed group, social connectedness fell (Δ = -2.47). These simultaneous changes lead to the significant difference between groups. However, the effect size for social connectedness could be considered small (0.338). Following the 6-month intervention there were no significant differences between genders in 6 month autonomy and social connectedness (Table 53).

Table 52

Unadjusted self managed and intervention group changes and means, in 6-month autonomy and social connectedness. Differences between group's 6-month means (p values) are adjusted for clustering effects and baseline values

	Self Managed		Behavioural Intervention		Between group
Measures	Δ (95% CI)	Mean (±SD)	Δ (95% CI)	Mean (±SD)	*p* value
Autonomy	0.04 (-0.04, 0.12)	3.88 (0.45)	0.02 (-0.04, 0.09)	3.85 (0.49)	= 0.902
Social Connectedness	-2.47 (-5.64, 0.70)	93.51 (15.70)	2.92 (1.14, 4.70)	98.57 (12.52)	= 0.001

Table 53

Unadjusted male and female group changes and means, in 6-month autonomy and social connectedness. Differences between group's 6-month means (p values) are adjusted for clustering effects and baseline values

Measures	Males		Females		Between group
	Δ (95% CI)	Mean (±SD)	Δ (95% CI)	Mean (±SD)	*p* value
Autonomy	-0.06 (-.017, 0.04)	3.91 (0.48)	0.07 (0.01, 0.13)	3.84 (0.49)	= 0.087
Social Connectedness	0.34 (-4.39, 5.08)	97.86 (15.23)	0.93 (-0.64, 2.5)	96.09 (13.50)	= 0.701

Hypothesis 1(b)

Hypothesis 1(b) stated that, compared to the self-managed group, the behavioural intervention group would have greater retention (number of participants who completed the 6-months), adherence (total number of sessions over 6 months), and physical activity levels (PASE score). There was significantly lower retention in the self managed group (n = 38 or 32.8% of participants withdrew) compared to the behavioural intervention group (n = 22 or 15.9% of participants withdrew) over the 6-months of the study ($\chi^2 = 9.47$, CI = 0.21, 0.71, $p < 0.05$) (Figure 14). When the type of activity was analysed by withdrawal status it was revealed that those who withdrew during the first 6-months, compared to those retained, had engaged in significantly fewer walking sessions (M = 10.17 versus M = 43.27) and until they had withdrawn these participants had missed significantly fewer sessions (M = 1.74 versus M = 5.97). There were no differences between withdrawal status in the number of sessions in activities other than walking, or exercise intensity (% HRR and RPE) (Table 54).

With respect to adherence, the self-managed group completed, on average, M = 42.50 sessions across the 6-months compared to M = 48.78 sessions in the behavioural intervention condition (Figure 15). This difference in adherence was not significant (p = 0.128). When the type of activity completed was considered, compared to the self-managed group the behavioural intervention group had engaged in a significantly greater number of walking sessions (M = 44.59 compared to M = 25.14), and a significantly lower number of sessions in activities other than walking (M = 2.02 and M = 4.89). There was no difference between these groups on the number of sessions missed, or exercise intensity (% HRR and RPE). However, the self-managed group did report significantly higher exercise intensity (measured by RPE) compared to the intervention group (M = 11.87 and M = 11.17, respectively) (Table 55). After 6 months

there were no significant differences between intervention groups in 6 month total and leisure time physical activity levels (Table 56).

In this population there were no differences in retention between gender; 15.2% of males and 26.6% of females withdrew (p = 0.249), although, males had significantly higher adherence compared to females; M = 51.51 and M = 44.40 sessions respectively (F = 5.30, p = 0.041) (Figure 16). Examination by gender showed that females, compared to males, participated in a significantly lower number of walking sessions (M = 33.04 versus M = 43.30). There were no differences between gender on the number of missing sessions, number of sessions in activities other than walking, or exercise intensity (measured by % HRR) (Table 57). After 6 months there were no significant differences between genders in the 6 month total or leisure time physical activity levels (Table 58).

Figure 14. Number of withdrawals compared between self managed and behavioural intervention groups.

Table 54

Unadjusted withdrawal status group means in missing sessions, activity type, and exercise intensity. Differences between group's means (p values) are adjusted for clustering effects

	Mean (±SD)		
Measure	Retained	Withdrawn	*p* value
No. of missing sessions	5.97 (8.56)	1.74 (5.04)	= 0.0005
No. of walking sessions	43.27 (24.57)	10.17 (11.38)	< 0.0001
No. of sessions in activities other than walking	3.72 (9.95)	2.00 (6.76)	= 0.053
%HRR	47.32 (16.27)	45.79 (18.19)	= 0.521
RPE	11.36 (1.36)	11.75 (1.60)	= 0.214

Figure 15. Total number of sessions compared between self managed and behavioural intervention groups (±Standard Error of the Mean).

Table 55

Unadjusted self-managed and behavioural intervention group means, in missing sessions, activity type, and exercise intensity. Differences between group's means (p values) are adjusted for clustering effects

Measure	Mean (±SD)		*p* value
	Self-Managed	Behavioural Intervention	
No. of missing sessions	4.35 (9.01)	5.55 (7.21)	= 0.328
No. of walking sessions	25.14 (26.83)	44.59 (22.19)	= 0.0003
No. of sessions in activities other than walking	4.89 (11.46)	2.02 (6.85)	= 0.0464
%HRR	44.48 (15.53)	48.59 (17.03)	= 0.104
RPE	11.87 (1.30)	11.17 (1.40)	= 0.007

Table 56

Unadjusted self managed and intervention group changes and means, in 6-month physical activity levels. Differences between group's 6-month means (p values) are adjusted for clustering effects and baseline values

	Self Managed		Behavioural Intervention		Between group
Measures	Δ (95% CI)	Mean (±SD)	Δ (95% CI)	Mean (±SD)	*p* value
Total Physical Activity	18.52 (10.47, 26.58)	115.87 (43.75)	10.93 (1.07, 20.79)	114.69 (43.86)	= 0.721
Leisure Time Physical Activity	9.12 (6.10, 12.14)	17.41 (12.59)	8.11 (5.53, 10.70)	15.49 (12.68)	= 0.589

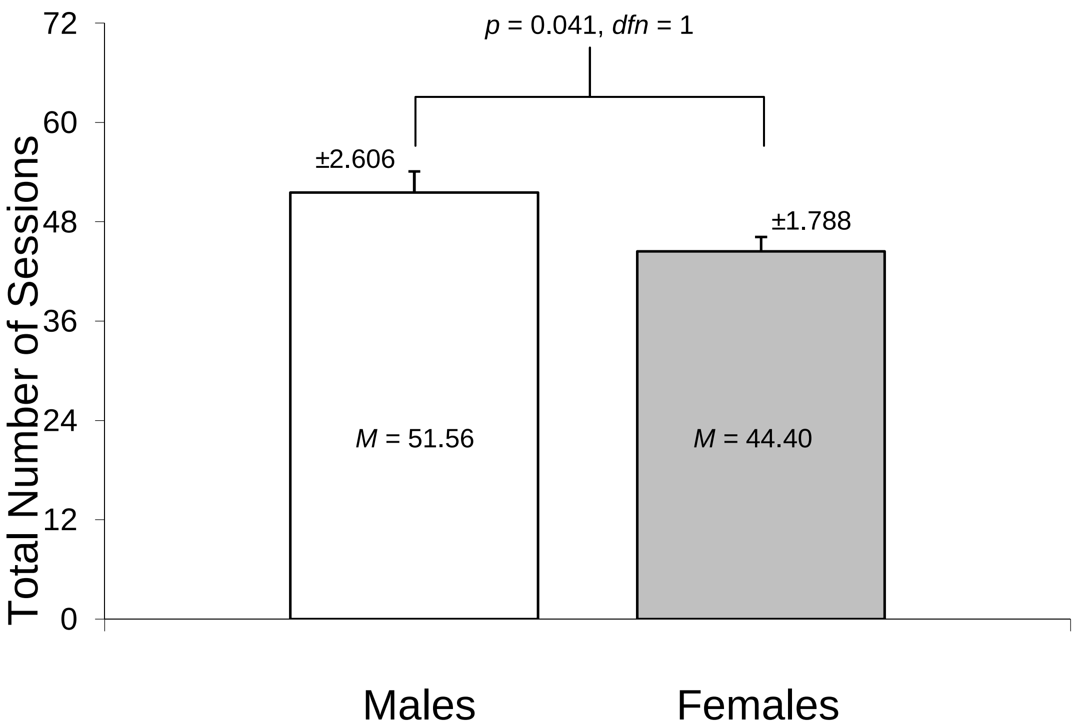


Figure 16. Total number of sessions compared between males and females (±Standard Error of the Mean).

Table 57

Unadjusted male and female group means, in missing sessions, activity type, and exercise intensity. Differences between gender's means (p values) are adjusted for clustering effects

Measure	Mean (±SD) Male	Mean (±SD) Female	*p* value
No. of missing sessions	4.46 (6.89)	5.19 (8.48)	= 0.305
No. of walking sessions	43.30 (25.43)	33.04 (26.05)	= 0.0096
No. of sessions in activities other than walking	3.33 (8.95)	3.33 (9.49)	= 0.998
%HRR	49.82 (18.44)	46.00 (15.72)	= 0.149
RPE	11.25 (1.62)	11.49 (1.31)	= 0.427

Table 58

Unadjusted male and female group changes and means, in 6-month physical activity levels. Differences between gender's 6-month means (p values) are adjusted for clustering effects and baseline values

Measures	Males		Females		Between group
	Δ (95% CI)	Mean (±SD)	Δ (95% CI)	Mean (±SD)	*p* value
Total Physical Activity	20.65 (6.75, 34.55)	121.54 (49.66)	11.25 (3.70, 18.80)	112.52 (40.87)	= 0.054
Leisure Time Physical Activity	7.38 (4.23, 10.54)	15.98 (12.54)	9.00 (6.55, 11.45)	16.39 (12.73)	= 0.776

Hypothesis 1(c)

Hypothesis 1(c) stated that the behavioural intervention group would exhibit a greater reduction in weight, BMI, waist and hip girth, and waist to hip ratio compared to the self-managed group. The following tables show the means and standard deviations for 6-month weight, BMI, hip and waist girths, and waist-to-hip ratio and the *p* values for between group changes. After 6 months there was no significant difference between the intervention groups on any of these physiological measures (Table 59). Following the 6-month intervention males had a significantly lower BMI ($p = 0.040$, $F = 5.40$) than females ($M = 27.36$ and 27.55, respectively). One would expect similar results for BMI in comparison to body weight at 6-months. However, inspection of the Δ in BMI for males and females gives some indication why BMI was different at 6-months, between genders and not body weight. The results shows that the mean change in BMI for males (-0.13) was below the lower limit of the 95% CI for females (-0.08, 0.21). Also the mean change in BMI for females (0.06) was above the upper limit of the 95% CI for males (-0.31, 0.03). As the analyses of differences in BMI between males and females adjusted for baseline values the significant *p* value is a result of the differential changes experienced by men and women, with respect to BMI. This should be interpreted with some caution as the 95%CI for the Δ in BMI for males and females did cross zero (Table 60).

Table 59

Unadjusted self managed and intervention group changes and means, in 6-month anthropometric variables. Differences between group's 6-month means (p values) are adjusted for clustering effects and baseline values

Measures	Self Managed		Behavioural Intervention		Between group
	Δ (95% CI)	Mean (±SD)	Δ (95% CI)	Mean (±SD)	*p* value
Weight (kg)	-0.15 (-0.67, 0.35)	73.85 (11.81)	-0.10 (-0.46, 0.25)	74.91 (13.09)	= 0.693
BMI (kg.m^2)	0.00 (-0.20, 0.20)	27.46 (4.08)	0.02 (-0.13, 0.15)	27.52 (3.93)	= 0.730
Waist Circumference (cm)	-0.37 (-1.30, 0.55)	91.23 (11.18)	-0.26 (-1.04, 0.51)	90.99 (12.65)	= 0.628
Hip Circumference (cm)	-0.26 (-0.91, 0.38)	103.52 (7.16)	-0.19 (-0.72, 0.34)	103.39 (8.16)	= 0.604
Waist to Hip Ratio	0.00 (-0.1, 0.1)	0.88 (0.08)	0.00 (-0.01, 0.01)	0.87 (0.09)	= 0.835

Table 60

Unadjusted male and female group changes and means, in 6-month physiological results. Differences between group's 6-month means (p values) are adjusted for clustering effects and baseline values

	Males		Females		Between group
Measures	Δ (95% CI)	Mean (±SD)	Δ (95% CI)	Mean (±SD)	*p* value
Weight (kg)	-0.44 (-0.93, 0.03)	82.20 (12.27)	0.01 (-0.35, 0.38)	71.18 (11.20)	= 0.389
BMI (kg.m^2)	-0.13 (-0.31, 0.03)	27.36 (3.53)	0.06 (-0.08, 0.21)	27.55 (4.18)	= 0.040
Waist Circumference (cm)	-1.03 (-1.73, -0.33)	98.75 (9.56)	0.00 (-0.78, 0.78)	87.86 (11.54)	= 0.444
Hip Circumference (cm)	-0.33 (-1.10, 0.44)	101.28 (6.29)	-0.17 (-0.66, 0.31)	104.36 (8.14)	= 0.239
Waist to Hip Ratio	-0.01 (-0.01, 0.00)	0.97 (0.05)	0.00 (-0.01, 0.01)	0.84 (0.07)	= 0.062

Hypothesis 1(d)

Hypothesis 1(d) stated that the behavioural intervention group would experience greater improvements in functional fitness compared to the self-managed group. The following tables show the means and standard deviations for 6-month functional fitness parameters and the p values for between group differences between gender and intervention groups. After 6 months the behavioural intervention group exhibited more arm strength ($p = 0.002$, $F = 14.62$) than the self managed group ($M = 16.30$ and $M = 15.28$, respectively) (Table 61). Following the 6-month intervention males had significantly better arm strength ($p = 0.048$, $F = 4.91$) than females ($M = 17.51$ and $M = 15.21$, respectively). Additionally, females had significantly better hamstring flexibility ($p = 0.017$, $F = 7.79$) compared to males ($M = 6.54$ and $M = -0.50$, respectively) (Table 62).

Table 61

Unadjusted self managed and intervention group changes and means, in 6-month functional fitness parameters. Differences between group's 6-month means (p values) are adjusted for clustering effects and baseline values

Functional Fitness Parameters	Self Managed Δ (95% CI)	Self Managed Mean (±SD)	Behavioural Intervention Δ (95% CI)	Behavioural Intervention Mean (±SD)	Between group *p* value
Arm Strength	1.38 (0.80, 1.97)	15.28 (3.25)	2.66 (2.19, 3.12)	16.30 (2.96)	= 0.002
Agility	-0.17 (-0.14, 0.10)	5.50 (0.83)	-0.13 (-0.22, -0.03)	5.30 (0.82)	= 0.058
Shoulder Flexibility Dominant Side	0.58 (-0.48, 1.64)	-2.43 (8.10)	0.34 (-0.37, 1.06)	-3.38 (8.13)	= 0.542
Shoulder Flexibility Non-Dominant Side	0.49 (-0.62, 1.61)	-7.57 (9.47)	0.14 (-0.62, 0.90)	-7.59 (8.74)	= 0.341
Leg Strength	1.11 (0.59, 1.63)	13.14 (2.69)	1.90 (1.49, 2.32)	13.84 (2.98)	= 0.139
Hamstring Flexibility	3.19 (1.26, 5.11)	6.55 (12.23)	2.94 (0.95, 4.94)	3.10 (14.11)	= 0.414
Aerobic Endurance	12.26 (-4.87, 29.40)	593.46 (78.10)	32.65 (23.56, 41.75)	626.82 (68.83)	= 0.184

Table 62

Unadjusted male and female group changes and means, in 6-month functional fitness parameters. Differences between group's 6-month means (p values) are adjusted for clustering effects and baseline values

	Males		Females		Between group
Functional Fitness Parameters	Δ (95% CI)	Mean (±SD)	Δ (95% CI)	Mean (±SD)	*p* value
Arm Strength	2.54 (1.82, 3.26)	17.51 (3.00)	2.04 (1.60, 2.48)	15.21 (2.88)	= 0.048
Agility	-0.11 (-0.23, 0.01)	5.00 (0.67)	-0.07 (-0.17, 0.01)	5.54 (0.85)	= 0.129
Shoulder Flexibility Dominant Side	0.09 (-0.96, 1.15)	-6.12 (8.94)	0.58 (-0.14, 1.31)	-1.63 (7.33)	= 0.073
Shoulder Flexibility Non-Dominant Side	0.16 (-1.24, 1.57)	-11.26 (10.52)	0.31 (-0.34, 0.98)	-5.93 (7.71)	= 0.221
Leg Strength	1.45 (0.87, 2.03)	14.70 (2.98)	1.70 (1.29, 2.10)	13.09 (2.71)	= 0.633
Hamstring Flexibility	0.80 (-1.80, 3.40)	-0.50 (14.04)	4.03 (2.31, 5.74)	6.54 (12.75)	= 0.017
Aerobic Endurance	30.66 (9.29, 52.02)	652.77 (82.44)	22.58 (14.71, 30.45)	596.65 (62.26)	= 0.128

Hypothesis 2(a)

Development of a Regression Model to Predict Adherence

Hypothesis 2 (a) stated that physical self-perceptions, self-determined motivation, and intrinsic motivation would be positively related to adherence, while amotivation and extrinsic motivation would be negatively related. There were some significant correlations between adherence and baseline psychological and sociological variables. Refer to Table 63 for the correlations for the intervention groups and Table 64 for the correlations for each gender. After examining these correlations, two regression models were conducted to reveal the potential covariate predictors of adherence. In addition to gender, the covariate predictors in model 1 were baseline BMI and baseline autonomy. Intervention group was introduced into model 2 with gender, baseline BMI and baseline autonomy. However the intervention group had no effect therefore it was not included in subsequent analyses (Table 65).

In the regression of baseline self-perceptions on adherence, baseline household management and adequacy as a provider were the only significant predictors of adherence (R^2 = 0.20). After removing variables with $p > 0.1$ the final regression model (accounting for gender, baseline BMI, and autonomy) demonstrated that baseline perceptions of household management (β = 11.22, $p < 0.001$) significantly predicted 18% of the variance in adherence (R^2 = 0.18) (Table 66).

In the regression of exercise motivation on adherence, gender and amotivation were the only significant predictors of adherence (R^2 = 0.10). After removing variables with $p > 0.1$ the final regression model (accounting for gender, BMI and autonomy) showed that amotivation (β = -3.90, p = 0.006) significantly predicted 7% of the variance in adherence (R^2 = 0.07) (Table 67).

These regression models show that higher self-perceptions in household management, at baseline, was associated with higher adherence, meanwhile it was also

demonstrated that higher amotivation was associated with lower adherence. With both models a large amount of the variance in adherence scores remains unexplained.

Table 63

Unadjusted psychological and sociological correlates to adherence in self managed and behavioural intervention groups

Correlates	*r* value	
	Self Managed	Behavioural Intervention
Baseline Perceived Physical Appearance	0.250*	0.294**
Baseline Perceived Adequacy as a Provider	0.243	0.231*
Baseline Perceived Sociability	0.020	0.203*
Baseline Perceived Job Competence	0.340**	0.371**
Baseline Perceived Nurturance	0.232*	0.143
Baseline Perceived Morality	0.243*	0.110
Baseline Perceived Household Management	0.374**	0.351**
Baseline Perceived Intimacy	0.096	0.180*
Baseline Perceived Humour	-0.020	0.177*
Baseline Perceived Global Self Worth	0.266*	0.334**
Baseline Amotivation	-0.099	-0.191*
Baseline Social Connectedness	0.074	0.297**
Baseline BMI	-0.101	-0.178*
Age of the rec centre (yrs)	-0.060	0.192*
Baseline distance from rec centre (km)	-0.220	-0.195*
Baseline cost getting to rec centre ($)	-0.164	-0.422**

* $p < 0.05$, ** $p < 0.01$

Table 64

Unadjusted psychological and sociological correlates to adherence in males and females

Correlates	*r* value	
	Males	Females
Baseline Perceived Physical Appearance	0.325*	0.288**
Baseline Perceived Adequacy as a Provider	0.196	0.165*
Baseline Perceived Sociability	0.313*	0.080
Baseline Perceived Job Competence	0.292*	0.356**
Baseline Perceived Athletic Competence	0.365**	0.038
Baseline Perceived Morality	0.089	0.205*
Baseline Perceived Household Management	0.276*	0.381**
Baseline Perceived Intimacy	0.336*	0.087
Baseline Perceived Global Self Worth	0.421**	0.217**
Baseline Social Connectedness	0.314*	0.171*
Baseline Body Mass Index	-0.341**	-0.082
Baseline Waist Girth (cm)	-0.262*	-0.117
Baseline Hip Girth	-0.318*	-0.126
Baseline distance from rec centre (km)	-0.207	-0.196*
Baseline cost getting to rec centre ($)	-0.103	-0.338**

* $p < 0.05$, ** $p < 0.01$

Table 65

Regression model effects for covariate predictors of adherence (adjusted for clustering effects)

	F value	*p* value
Model 1		
Intercept	2.96	0.116
Gender	2.53	0.142
Age	2.63	0.135
Baseline BMI	4.95	0.050
Baseline Walk Score	0.01	0.937
Years of Competitive Sport	0.82	0.386
Years Since Vigorous Activity	0.43	0.528
Years of Education	1.22	0.295
Baseline Social Connectedness	2.30	0.160
Baseline Autonomy	4.02	0.072
Model 2		
Intercept	9.92	0.009
Gender	4.08	0.068
Baseline BMI	3.71	0.080
Baseline Autonomy	1.64	0.227
Group	2.62	0.133

Table 66

Estimated regression coefficients for baseline self-perceptions predicting adherence (adjusted for clustering effects)

	B	SE	*t* value	*p* value
Model 1				
Intercept	35.06	21.60	1.62	0.132
Gender	-6.49	2.38	-2.72	0.019
Baseline BMI	-0.59	0.40	-1.46	0.172
Baseline Autonomy	-1.41	4.01	-0.35	0.730
Baseline Job Competence	9.66	4.48	2.16	0.054
Baseline Household Management	8.29	3.17	2.61	0.024
Baseline Adequacy as a Provider	3.66	2.61	-1.40	0.188
Model 2				
Intercept	41.10	18.01	2.28	0.043
Gender	-7.55	2.65	-2.85	0.015
Baseline BMI	-0.61	0.40	-1.51	0.158
Baseline Autonomy	0.24	3.28	0.07	0.94
Baseline Household Management	11.22	2.46	4.55	0.000

Table 67

Estimated regression coefficients for baseline exercise motivation predicting adherence (adjusted for clustering effects)

	B	SE	*t* value	*p* value
Model 1				
Intercept	67.72	24.22	2.80	0.017
Gender	-8.31	3.13	-2.65	0.022
Baseline BMI	-0.63	0.45	-1.38	0.194
Baseline Autonomy	4.08	4.16	0.98	0.348
Baseline Amotivation	-4.08	1.70	-2.40	0.035
Baseline Extrinsic Regulation	0.08	1.28	0.07	0.948
Baseline Introjected Regulation	1.29	1.66	0.78	0.454
Baseline Identified Regulation	-4.65	2.85	-1.63	0.131
Baseline Integrated Regulation	0.76	2.85	0.27	0.793
Intrinsic Motivation to Learn	0.29	1.61	0.18	0.860
Intrinsic Motivation to Achieve	4.16	3.08	1.35	0.203
Intrinsic Motivation to Experience	-0.47	3.70	-0.13	0.900
Model 2				
Intercept	70.98	22.65	3.13	0.009
Gender	-7.18	3.20	-2.24	0.046
Baseline BMI	-0.63	0.45	-1.39	0.191
Baseline Autonomy	4.09	3.27	1.25	0.236
Baseline Amotivation	-3.90	1.17	-3.32	0.006
Baseline Identified Regulation	-0.51	2.06	-0.25	0.806

Hypothesis 2(b)

Development of a Regression Model to Predict 6-month Total Physical Activity

Hypothesis 2(b) stated that physical self-perceptions, self-determined motivation, and intrinsic motivation would be positively related to 6-month total physical activity, while amotivation and extrinsic motivation would be negatively related. On initial investigation there were some significant correlations between 6-month total physical activity and baseline psychological and sociological variables. Refer to Table 68 for the correlations by intervention group and Table 69 for the correlations by gender. After examining these correlations two regressions were used to reveal the potential covariate predictors of 6-month total physical activity, in addition to gender. There were no significant predictors of 6-month total physical activity, therefore only years of competitive sport was kept as it was the only covariate with a $p \leq 0.01$. In addition gender was included in as a covariate due to the likelihood of the potential interaction with self-perceptions. Group was introduced into the second model. However, the inclusion of group had no effect therefore it was excluded from subsequent analyses (Table 70).

In the regression of baseline self-perceptions on 6-month total physical activity , years of competitive sport, baseline perceptions of physical appearance, and nurturance were the only significant predictors of 6-month total physical activity ($R^2 = 0.16$). After removing variables with $p > 0.1$, in the final regression model accounting for gender the years of competitive sport ($\beta = 0.75$, $p = 0.041$), baseline perceptions of physical appearance ($\beta = -19.71$, $p = 0.014$), and nurturance ($\beta = 31.68$, $p = 0.002$) still significantly predicted 16% of the variance in 6-month total physical activity level ($R^2 = 0.16$) (Table 71).

In the regression of baseline exercise motivation on 6-month total physical activity there were no individual significant predictors of 6-month total physical

activity. After removing variables with $p > 0.1$, the final regression model (accounting for gender) demonstrated that 6% of the variance in 6-month total physical activity was predicted by intrinsic motivation to learn ($\beta = -9.21$, $p = 0.027$) ($R^2 = 0.06$) (Table 72).

These regression models were able to demonstrate that, in both males and females, lower perceptions of physical appearance, higher perceptions of nurturance, and greater number of years of competitive sport, were significant predictors of higher total physical activity level at 6-months. Interestingly lower intrinsic motivation to learn about physical activities at baseline was associated with higher total physical activity level. It should be noted that with both the self-perceptions and exercise motivation models tested here, a large amount of the variance in 6-month total physical activity level is unexplained.

Table 68

Unadjusted psychological and sociological correlates to 6-month total physical activity in self managed and behavioural intervention groups

	r value	
Correlates	Self Managed	Behavioural Intervention
Baseline Perceived Nurturance	0.241*	0.143
Baseline Perceived Athletic Competence	0.131	0.299*
Baseline BMI	0.124	-0.260*
Baseline waist girth (cm)	0.147	-0.218*
Total years of education	0.243*	0.099
Number of programs for over 60's	0.477**	0.065
Age of the recreation centre	-0.089	-0.215*
Years since the centre was last renovated	-0.206	-0.257**

* $p < 0.05$, ** $p < 0.01$

Table 69

Unadjusted psychological and sociological correlates to 6-month total physical activity in males and females

Correlates	*r* value	
	Males	Females
Baseline Perceived Nurturance	0.254	0.181*
Baseline Intrinsic Motivation to Learn	0.122	-0.186*
Baseline waist girth (cm)	-0.081	-0.176*
Baseline waist to hip ratio	-0.309*	-0.196*
Years since last vigorous activity	0.049	-0.221*
Number of programs for over 60's	0.392**	0.243**
Years since the centre was last renovated	-0.294*	-0.221*

* $p < 0.05$, ** $p < 0.01$

Table 70

Regression model effects for covariate predictors of 6-month total physical activity (adjusted for clustering effects)

	F value	*p* value
Model 1		
Intercept	0.17	0.690
Gender	1.30	0.281
Age	2.20	0.168
Baseline BMI	0.00	0.956
Baseline Walk Score	2.52	0.143
Years of Competitive Sport	4.45	0.061
Years Since Vigorous Activity	0.64	0.441
Years of Education	0.09	0.770
Baseline Social Connectedness	1.90	0.198
Baseline Autonomy	0.07	0.802
Model 2		
Intercept	73.97	<0.0001
Gender	1.08	0.323
Years of Competitive Sport	2.99	0.114
Group	1.04	0.331

Table 71

Estimated regression coefficients for baseline self-perceptions predicting 6-month total physical activity (adjusted for clustering effects)

	B	SE	*t* value	*p* value
Model 1				
Intercept	61.53	23.47	2.62	0.025
Gender	-7.82	6.48	-1.21	0.255
Years of Competitive Sport	0.70	0.30	2.29	0.045
Baseline Perceived Physical Appearance	-21.37	7.24	-2.95	0.014
Baseline Perceived Job Competence	6.37	3.19	2.00	0.073
Baseline Perceived Nurturance	29.90	7.26	4.11	0.002
Model 2				
Intercept	71.40	24.02	2.97	0.014
Gender	-7.81	6.17	-1.26	0.234
Years of Competitive Sport	0.75	0.32	2.34	0.041
Baseline Perceived Physical Appearance	-19.71	6.68	-2.95	0.014
Baseline Perceived Nurturance	31.68	8.11	3.91	0.002

Table 72

Estimated regression coefficients for baseline exercise motivation predicting 6-months total physical activity (adjusted for clustering effects)

	B	SE	*t* value	*p* value
Model 1				
Intercept	115.94	17.51	6.62	<0.0001
Gender	-1.12	5.85	-0.19	0.851
Years of Competitive Sport	0.51	0.26	1.93	0.082
Baseline Amotivation	2.10	4.71	0.45	0.664
Baseline Extrinsic Regulation	-3.42	5.47	-0.63	0.545
Baseline Introjected Regulation	-5.77	3.46	-1.67	0.125
Baseline Identified Regulation	10.63	7.81	1.36	0.203
Baseline Integrated Regulation	9.30	10.17	0.92	0.381
Intrinsic Motivation to Learn	-8.98	5.16	-1.74	0.112
Intrinsic Motivation to Achieve	-1.38	10.18	-0.14	0.894
Intrinsic Motivation to Experience	-5.56	5.90	-0.94	0.368
Model 2				
Intercept	110.60	15.79	7.00	<0.0001
Gender	-1.82	5.07	-0.36	0.726
Years of Competitive Sport	0.50	0.25	1.99	0.074
Baseline Introjected Regulation	-4.80	3.43	-1.40	0.191
Baseline Identified Regulation	12.38	8.61	1.44	0.181
Intrinsic Motivation to Learn	-9.21	3.55	-2.59	0.027

Hypothesis 2(c)

Development of a Regression Model to Predict 6-month Leisure Time Physical Activity

Hypothesis 2(c) stated that physical self-perceptions, self-determined motivation, and intrinsic motivation would be positively related to 6-month leisure time physical activity, while amotivation and extrinsic motivation would be negatively related. On initial investigation there were some significant correlations between 6-month leisure time physical activity and baseline psychological and sociological variables. Refer to Table 73 for the correlations split by intervention group and Table 74 for the correlations split by gender. After examining these correlations two regressions were used to reveal the potential covariate predictors of 6-month leisure time physical activity, in addition to gender. The only covariate of significance was years since vigorous activity ($p = 0.017$). Gender was kept in as a covariate in subsequent analysis due to the potential interaction with self-perceptions. Group was introduced into the second model. However it had no effect therefore it was not included in subsequent analyses (Table 75).

In the regression analysis of baseline self-perceptions on 6-month leisure time physical activity, years since vigorous activity was the only significant predictor ($\beta = -0.16$, $p = 0.015$) of 6-month leisure time physical activity ($R^2 = 0.07$). After removing variables with $p > 0.1$ the final regression model accounting for gender; the years since vigorous activity remained the only significant predictor of 6-month leisure time physical activity, ($\beta = -0.17$, $p = 0.020$), accounting for 7% of the variance ($R^2 = 0.07$) (Table 76).

For the regression analysis of baseline exercise motivation on 6-month leisure time physical activity; there were no individual significant predictors of 6-month leisure time physical activity. None of the predictor variables had a $p > 0.1$ therefore no further models were generated (Table 77).

These regression analysis show that the greater the years since participants were last involved in vigorous physical activity the lower the leisure time physical activity levels after 6 months in a physical activity intervention. Admittedly only a small amount of total variance in 6-month leisure time physical activity level is explained by this model.

Table 73

Unadjusted psychological and sociological correlates to 6-month leisure time physical activity in self managed and behavioural intervention groups

	r value	
Correlates	Self Managed	Behavioural Intervention
Baseline distance from rec centre (km)	0.285*	0.095
Baseline Perceived Job Competence	0.278*	0.050
Baseline Perceived Athletic Competence	0.108	0.304**
Baseline Perceived Physical Appearance	0.242*	-0.070
Baseline Perceived Household Management	0.282*	0.130
Baseline Amotivation	-0.136	-0.292**
Baseline Extrinsic Regulation	-0.039	-0.233*
Baseline Autonomy	0.266*	-0.109
Years in competitive sport	0.047	0.235*

* $p < 0.05$, ** $p < 0.01$

Table 74

Unadjusted psychological and sociological correlates to 6-month leisure time physical activity in males and females

Correlates	*r* value	
	Males	Females
Baseline Perceived Athletic Competence	0.306*	0.174*
Baseline Perceived Household Management	0.177	0.181*
Baseline Amotivation	-0.326*	0.055
Baseline Extrinsic Regulation	-0.071	-0.191*
Baseline BMI	-0.346**	-0.036
Hip girth (cm)	-0.265*	-0.065
Years of education	-0.048	0.218*
Years since last vigorous activity	0.101	-0.323**
Age of the rec centre	-0.328*	-0.050
Years since the centre was last renovated	-0.291*	-0.073

* $p < 0.05$, ** $p < 0.01$

Table 75

Regression model effects for covariate predictors of 6-month leisure time physical activity (adjusted for clustering effects)

	F value	*p* value
Model 1		
Intercept	0.83	0.384
Gender	1.06	0.327
Age	0.00	0.999
Baseline BMI	2.34	0.157
Baseline Walk Score	0.44	0.523
Years of Competitive Sport	0.80	0.393
Years Since Vigorous Activity	20.21	0.001
Years of Education	0.53	0.483
Baseline Social Connectedness	0.01	0.944
Baseline Autonomy	0.51	0.492
Model 2		
Intercept	9.77	0.009
Gender	0.33	0.577
Years Since Vigorous Activity	7.78	0.017
Group	0.02	0.890

Table 76

Estimated regression coefficients for baseline self-perceptions predicting 6-month leisure time physical activity (adjusted for clustering effects)

	B	SE	*t* value	*p* value
Model 1				
Intercept	8.69	8.50	1.02	0.328
Gender	0.83	2.96	0.28	0.783
Years Since Vigorous Activity	-0.16	0.05	-2.85	0.015
Baseline Perceived Household Management	3.18	1.66	1.92	0.081
Model 2				
Intercept	16.91	5.35	3.16	0.009
Gender	1.79	3.01	0.59	0.564
Years Since Vigorous Activity	-0.17	0.06	-2.71	0.020

Table 77

Estimated regression coefficients for baseline exercise motivation predicting 6-month leisure time physical activity (adjusted for clustering effects)

	B	SE	*t* value	*p* value
Model 1				
Intercept	17.24	5.84	2.95	0.013
Gender	2.30	3.18	0.72	0.484
Years Since Vigorous Activity	-0.17	0.08	-2.00	0.070
Baseline Amotivation	-0.91	1.74	-0.52	0.610
Baseline Extrinsic Regulation	-0.58	1.48	-0.40	0.699
Baseline Introjected Regulation	-1.78	1.40	-1.27	0.228
Baseline Identified Regulation	0.27	1.51	0.18	0.858
Baseline Integrated Regulation	0.17	3.03	0.06	0.955
Intrinsic Motivation to Learn	-0.56	1.32	-0.42	0.680
Intrinsic Motivation to Achieve	1.52	2.45	0.62	0.546
Intrinsic Motivation to Experience	0.15	1.72	0.09	0.929

Structural Equation Model 1: From Baseline Physical Self-Perceptions and Environment to Adherence via Motivation

It was hypothesised in structural equation model 1 (version 1.0) that physical self-perceptions and distance from the recreation centre at baseline would directly and indirectly affect adherence through level of amotivation, non self-determined, self-determined and intrinsic motivation at baseline. The covariance matrix of the observed variables for structural equation model 1 is presented in Table 78. The original hypothesised model (version 1.0, presented earlier in Figure 9) was compared to the observed data and did not converge; the fit indices show that it was a poor match to the observed data (Table 79). Therefore, adjustments were made to the model based on the calculated modification indices. The modified model (version 1.1) was then compared to the data, and the fit indices compared to those of the original model (Table 79). The fit values indicate that the modified model, while it converged and some pathways were significant, represented a poorer fit to the data than structural equation model version 1.0. The modified model with standardised path coefficients and respective T values (in parenthesis alongside the path coefficient), is presented in Figure 17. While it is not common practice to interpret the findings from a non-convergent model, Figure 17 will be used as an example to explain how future models within this thesis are read. Interpretation of the standardised path coefficient is similar to that of a regression. Take as an example, the standardised path coefficient for baseline physical self-perceptions → baseline intrinsic motivation, 0.17 (T value = 2.29). This means that the latent dependent variable (baseline intrinsic motivation) will increase by 0.17 of a standard unit for each unit increase in the latent independent (baseline physical self-perceptions). The T value is an indicator of the significance of the path coefficient; only values above 2.00 are considered significant at the $p \leq 0.05$. For the model in Figure 17 the

significant pathways are indicated by red lines. A simplified version of model 1.1 showing only the significant pathways is presented in Figure 18.

Table 78

Covariance matrix for the observed variables in structural equation model 1

Adherence	Baseline Intrinsic Motivation to Learn	Baseline Intrinsic Motivation to Achieve	Baseline Intrinsic Motivation to Experience	Baseline Identified Regulation	Baseline Integrated Regulation	Baseline Extrinsic Regulation	Baseline Introjected Regulation	Baseline Perceived Physical Abilities	Baseline Distance from the Rec Centre
480.442									
1.731	1.272								
1.604	0.652	0.799							
1.298	0.659	0.624	0.843						
-0.988	0.383	0.440	0.417	0.651					
1.531	0.565	0.603	0.541	0.509	0.831				
-1.312	0.071	0.017	-0.081	0.035	0.064	0.968			
-1.149	0.140	0.263	0.112	0.381	0.439	0.569	1.336		
2.010	0.153	0.055	0.100	-0.019	0.104	-0.078	-0.112	0.446	
-5.680	-0.265	0.616	-0.137	0.577	0.650	0.824	1.104	-0.772	52.671

Sample Size N = 200

Table 79

Root mean square error of approximation (RMSEA) and non-normed fit index (NNFI) for the structural equation models version 1.0 and version 1.1

Measure of Fit	Acceptable Level	Version 1.0	Version 1.1
RMSEA (90% CI)	0.05 or below	0.19 (0.17-0.21)	0.19 (0.17-0.22)
NNFI	0.95 or above	0.55	0.48

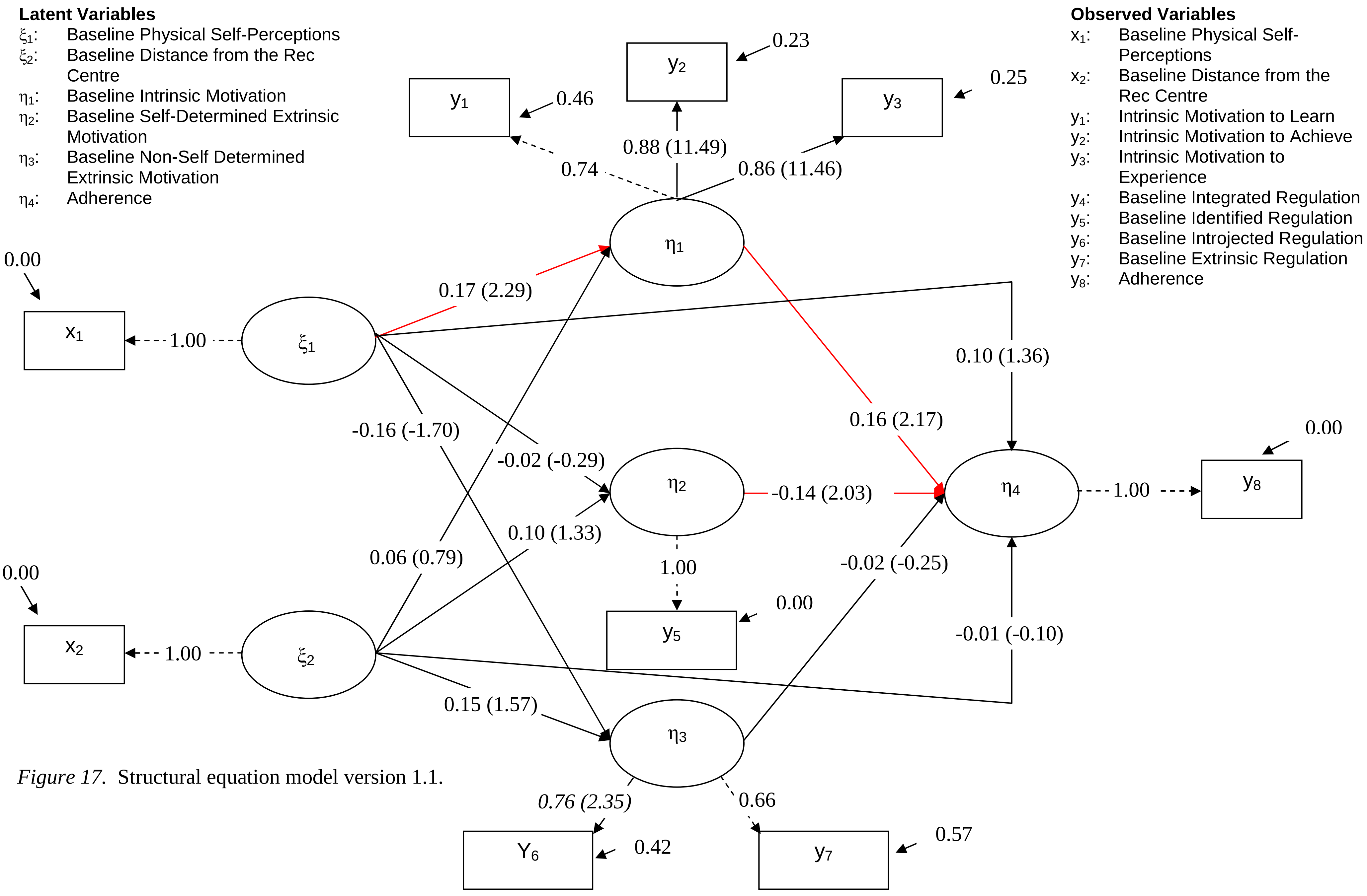


Figure 17. Structural equation model version 1.1.

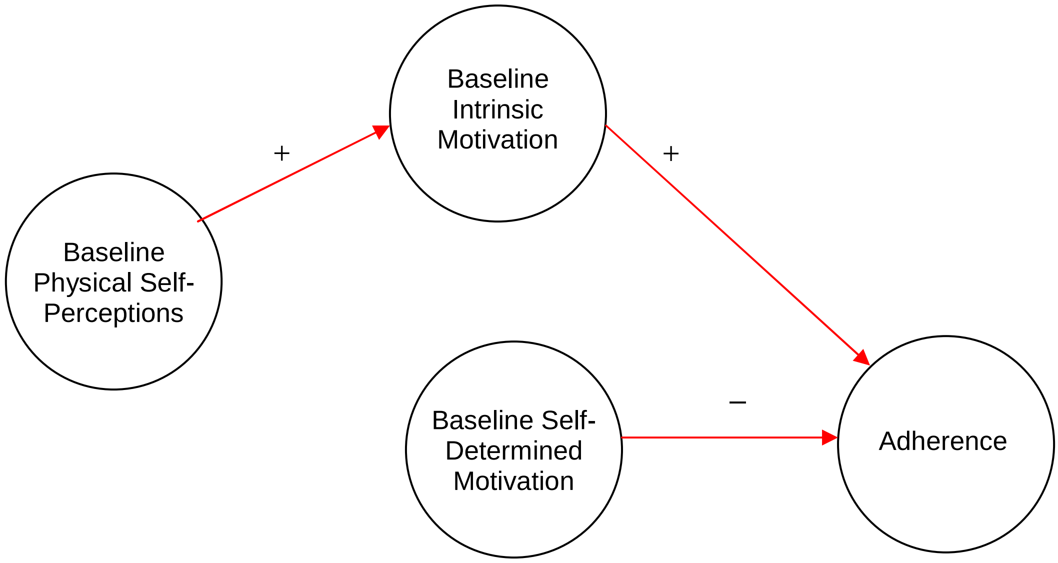


Figure 18. Simplified version of structural equation model 1.1 showing only significant pathways.

Structural Equation Model 2: From Baseline Physical Self-Perceptions, Autonomy and Social Connectedness to Adherence

It was hypothesised in structural equation model 2 that baseline perceived physical abilities, autonomy and social connectedness would directly affect adherence. While, the strength of these pathways is unknown it was hypothesised that physical self-perceptions would be more strongly related to adherence compared to autonomy and social connectedness. The covariance matrix for structural equation model 2 is presented in Table 80.

Table 80

Covariance matrix for the observed variables in structural equation model 2

Baseline Perceived Physical Abilities	Baseline Autonomy	Baseline Social Connectedness	Adherence
0.459			
0.061	0.276		
1.999	2.445	204.116	
1.982	1.470	65.634	487.50

Sample Size *N* = 182

It should be noted that the original model was saturated, that is, the number of parameters estimated was equivalent to the number of predictor variables. To determine whether baseline perceived physical abilities, social connectedness, or autonomy was the strongest predictor of adherence, 3 models were compared each with a different parameter held constant. The fit indices for each version of model 2.0 indicate that the model holding autonomy constant (version 2.2) was the best representation of the data (Table 81). The standardised path coefficients and respective T values (in parenthesis alongside path coefficients) for the model constraining autonomy are presented in Figure 19. Contrary to the hypothesis, this model indicates that baseline social connectedness was the only significant predictor of adherence in this population of older adults. The significant pathway is indicated by a red line. A simplified version of model 2.2 is presented in Figure 20 with only the significant pathway shown

Table 81

for structural equation models 2.1, 2.2, and 2.3

Measure of Fit	Acceptable Level	Versions of Model 2.0		
		Version 2.1	Version 2.2	Version 2.3
RMSR	closer to 0 the better	0.57	0.23	92.97
SRMSR	closer to 0 the better	0.017	0.0089	0.15

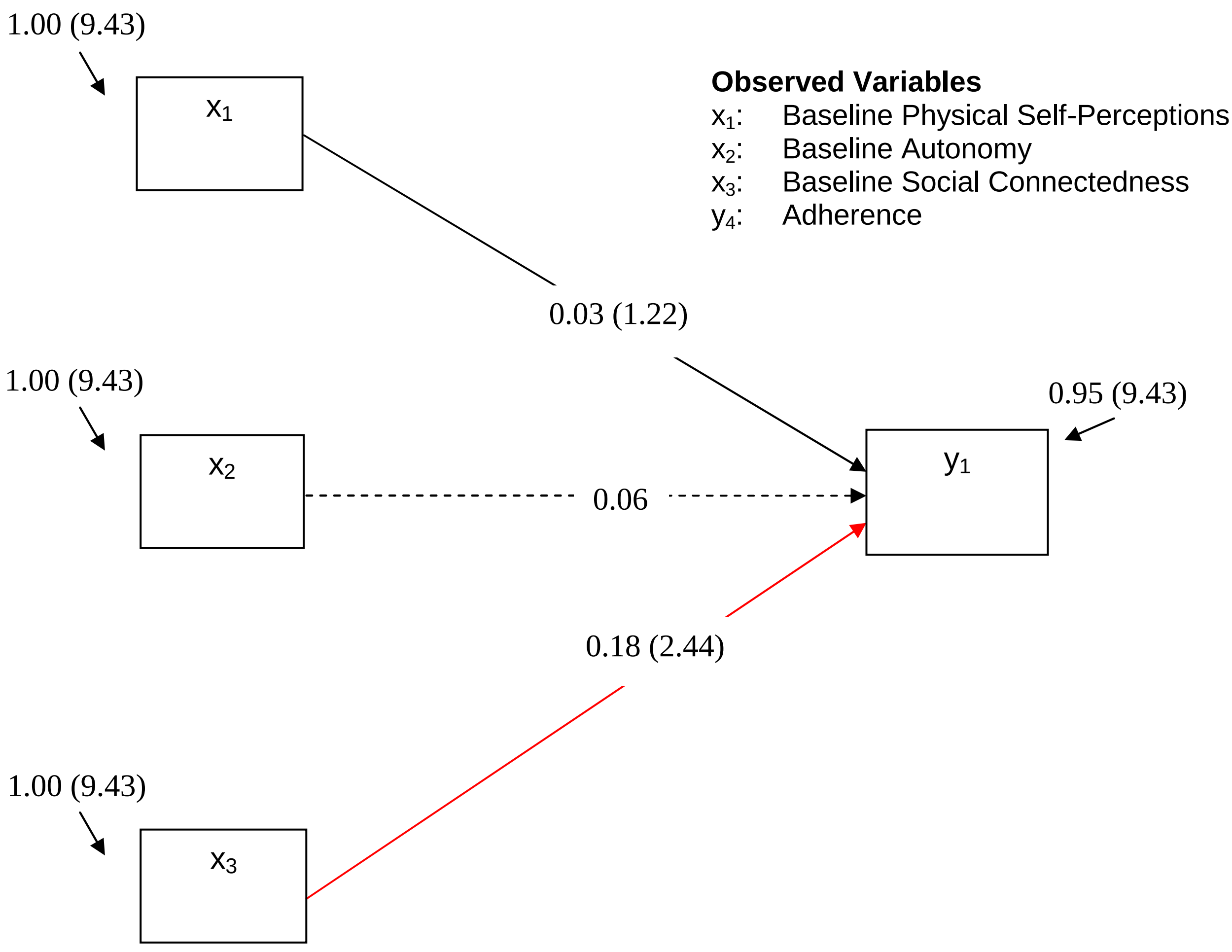


Figure 19. Structural equation model 2.2 is shown (autonomy → adherence constrained).

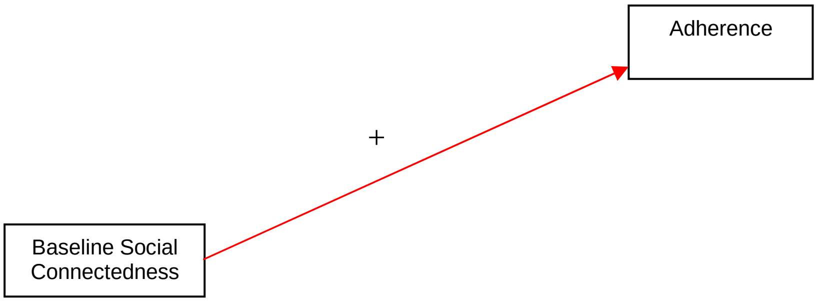


Figure 20. A simplified version of structural equation model 2.2 showing only significant pathways.

Structural Equation Model 3: From Adherence to 6-month Social, Cognitive and Physical Self-Perceptions

It was hypothesised in structural equation model 3.0 that adherence would be most strongly related to self-perceptions in the physical domain at 6-months, and to a lesser extent may have been related to scores the social and cognitive domains at 6-months. To develop the latent physical, social and cognitive variables it was necessary to identify, from the domains in the Adult Self-Perception Profile (ASPP), those that related best to these three constructs. A factor analysis using the correlation matrix for the self-perception domains (Table 82) revealed that the self-perception domains converged into three separate factors. A hypothetical model was constructed and tested to determine how well the 11 domains in the ASPP converged into three, pre-specified, latent variables. Global Self Worth is not included in this analysis as it was not deemed appropriate to compare a measure of global self-perceptions with measures of domain specific self-perceptions. The fit indices for the first and second confirmatory factor analyses are presented in Table 83. The second CFA model does not include perceptions of intelligence as this domain did not load well in the first CFA model and was subsequently removed. The second Confirmatory Factor Analysis (CFA) model represents the best fit to the self-perception data, the standardised solutions and T values

(in parenthesis alongside path coefficients) for this model are presented in Figure 21 (significant pathways are shown in red). The next step was to test structural equation model 3.0 using the covariance matrix of the self-perception domains from the second CFA model (Table 84), the fit indices in Table 85 show that this model was a good fit to the data. The standardised solutions and T values show that adherence to the intervention programs was significantly related to social, cognitive and physical self-perceptions at 6-months (Figure 22) (significant pathways are shown in red). Contrary to the hypothesis that adherence would be most strongly related to physical self-perceptions, the model indicates the strongest relationship was between higher adherence and higher social self-perceptions at 6-months. A simplified version of model 3.0 showing only the significant pathways is presented in Figure 23.

Table 82

Correlation matrix of the self-perception domain scores at 6-months

Perceived Sociability	Perceived Job Competence	Perceived Nurturance	Perceived Physical Abilities	Perceived Physical Appearance	Perceived Adequacy as a Provider	Perceived Morality	Perceived Household Management	Perceived Intimacy	Perceived Intelligence	Perceived Humour
1.000										
0.399	1.000									
0.581	0.440	1.000								
0.218	0.153	0.161	1.000							
0.532	0.410	0.396	0.298	1.000						
0.441	0.687	0.400	0.180	0.424	1.000					
0.284	0.556	0.357	0.074	0.241	0.587	1.000				
0.284	0.495	0.320	0.045	0.248	0.407	0.463	1.000			
0.691	0.333	0.540	0.179	0.457	0.342	0.268	0.245	1.000		
0.532	0.510	0.422	0.217	0.507	0.499	0.312	0.305	0.435	1.000	
0.514	0.365	0.370	0.086	0.265	0.414	0.281	0.171	0.520	0.437	1.000

Sample Size *N* = 151

Table 83

Root mean square error of approximation (RMSEA) and non-normed fit index (NNFI) for the first and second Confirmatory Factor Analyses (CFA) on the self-perception domains at 6-months

Measure of Fit	Acceptable Level	First CFA	Second CFA
RMSEA (90%CI)	0.05 or below	0.11 (0.08-0.13)	0.019 (0.0-0.06)
NNFI	0.95 or above	0.93	0.99

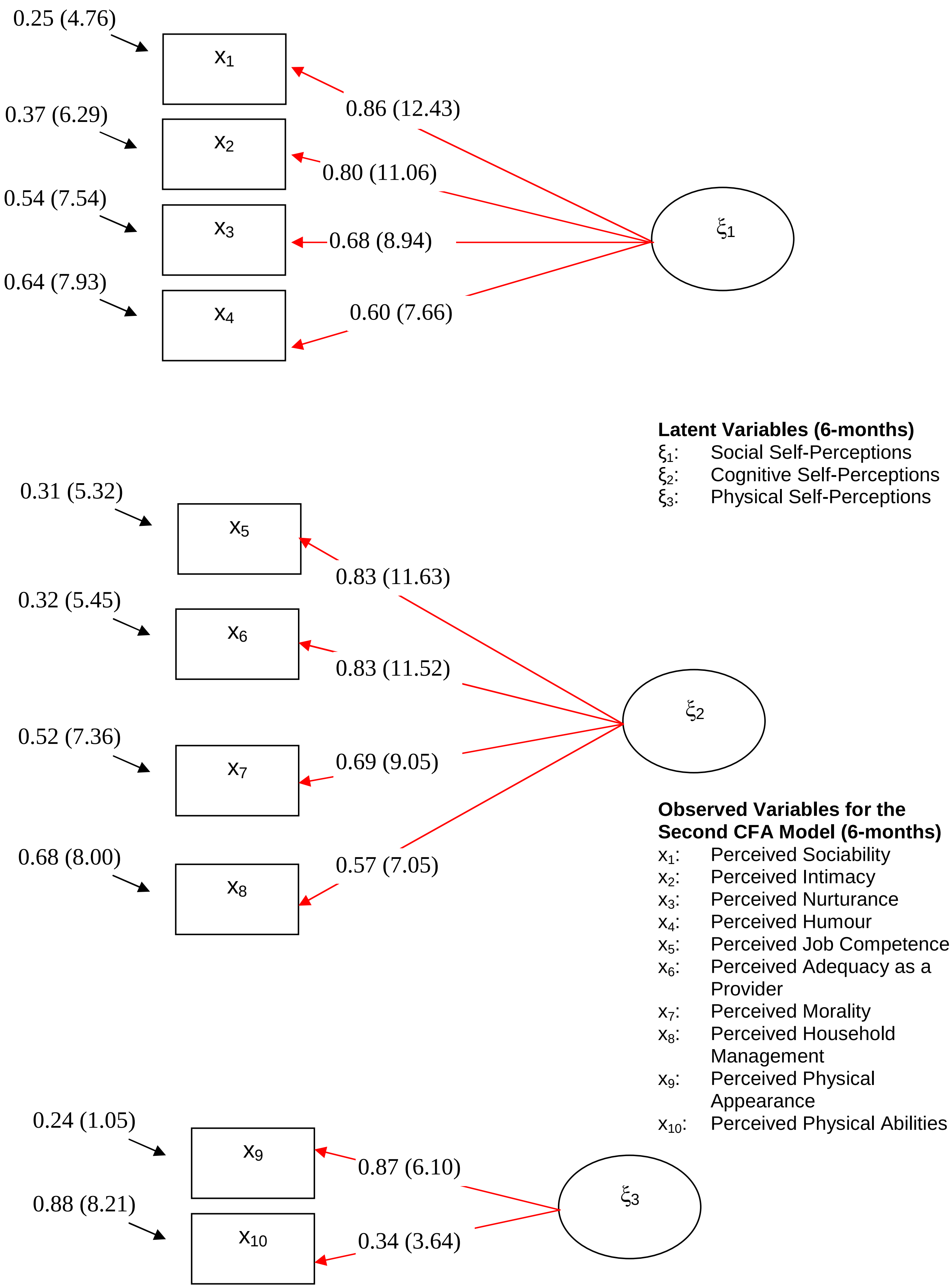


Figure 21. The second CFA model for the self-perception domains at 6-months (note that perceived of intelligence has been removed).

Table 84

Covariance matrix for the observed variables in structural equation model 3.0

Perceived Sociability	Perceived Job Competence	Perceived Nurturance	Perceived Physical Abilities	Perceived Physical Appearance	Perceived Adequacy as a Provider	Perceived Morality	Perceived Household Management	Perceived Intimacy	Perceived Humour	Adherence
0.415										
0.128	0.249									
0.215	0.126	0.330								
0.099	0.054	0.065	0.496							
0.221	0.132	0.147	0.135	0.416						
0.151	0.182	0.122	0.067	0.145	0.283					
0.089	0.135	0.100	0.025	0.076	0.152	0.239				
0.116	0.156	0.116	0.020	0.101	0.137	0.143	0.400			
0.301	0.112	0.210	0.085	0.199	0.123	0.088	0.104	0.456		
0.203	0.111	0.130	0.037	0.105	0.135	0.084	0.066	0.215	0.376	
2.219	1.944	2.838	0.110	2.358	2.937	1.409	4.283	2.163	1.955	334.176

Sample Size N = 151

Table 85

Root mean square error of approximation (RMSEA) and non-normed fit index (NNFI) for structural equation model 3.0

Measure of Fit	Acceptable Level	Model 3.0
RMSEA (90% CI)	0.05 or below	0.041 (0.0-0.073)
NNFI	0.95 or above	0.98

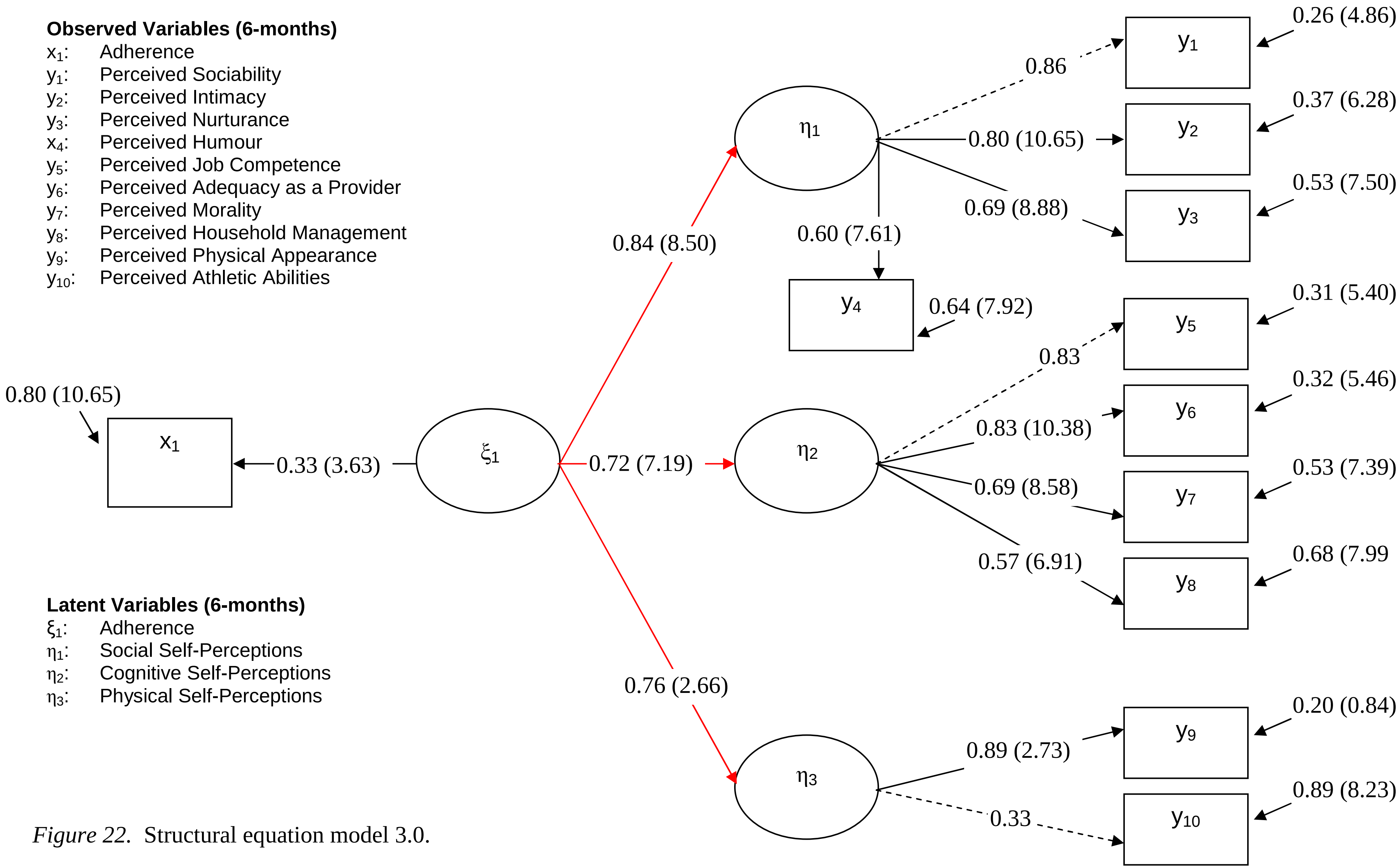


Figure 22. Structural equation model 3.0.

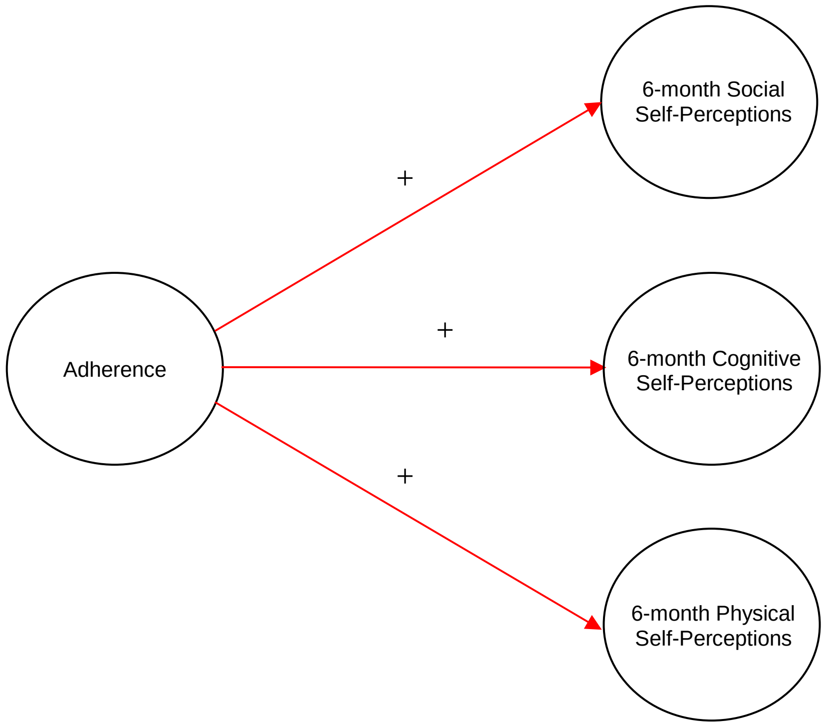


Figure 23. Simplified version of structural equation model 3.0 showing only significant pathways.

Results Summary

Baseline Results Summary

Internal Consistency of Psychosocial Questionnaires

The ASPP, EMS and SCS-R scales, at baseline and 6-months, had acceptable levels of internal consistency. While the MAP-A scale was internally consistent at baseline, at the 6-month measurement the alpha level fell below the acceptable threshold of 0.70.

Baseline Distribution and Population Demographics

There was no significant difference in the distribution of gender or SES across the intervention groups. At baseline there were no significant differences between the intervention groups on (a) physiological measures or (b) sociological background, with the exception that participants in the self-managed group had significantly higher identified regulation at baseline compared to those enrolled in the behavioural intervention. A greater percentage of participants in the behavioural intervention group had participated in competitive sport and also had significantly more years experience in competitive sport compared to the self-managed group. Interestingly, participants in the self-managed group had more recently participated in vigorous physical activity when compared to participants in the behavioural intervention group. There was no significant difference between the intervention groups in self ratings of walk ability.

In this population males were significantly older, taller, heavier, had larger waist girth, larger waist-to-hip ratio, and smaller hip girth compare to females. There was a significant difference between men and women in marital status and educational background. Also males had significantly greater number of years of education compared to females. When physical activity background was examined it was revealed that men and women did not differ in (a) the percentage that enjoyed physical

activity when younger or attempted a physical activity program in the last 12-months, (b) number of years since they were last involved in vigorous physical activity, and (c) rating of walk ability. However, a greater percentage of men had participated in competitive sport, and had significantly more years experience in competitive sport, compared to women.

The retained participants had significantly lower hip girth at baseline compared to the withdrawn participants. There was no significant difference between the retained and withdrawn participants in marital status, educational background, or years of education. Additionally, there was no difference in the percentage of retained and withdrawn participants who had (a) enjoyed physical activity when younger, (b) previously participated in competitive sport, or (c) attempted to start a physical activity program in the last 12-months. Furthermore, there was no difference between withdrawal status groups in the number of years involved in competitive sport, or the number of years since they were last involved in vigorous physical activity. However, participants who withdrew from the study reported lower self rated walk ability at baseline as compared to those who remained.

When examined by SES, it was shown that the High SES group had significantly smaller BMI the Low SES group. While there was no significant difference in SES group on baseline marital status or number of years of education, a significant interaction effect for SES by educational background was apparent at baseline. There were no significant differences between SES groups in participant's years of competitive sport or years since they were last involved in vigorous physical activity. Nor was there a difference in the percentage of participants who had (a) enjoyed physical activity when younger or (b) attempted to start a physical activity program in the last 12-months. There was a significant interaction between SES group and the percentage of participants who had been involved in competitive sport.

Psychosocial Variables

There was no significant difference between the intervention groups at baseline in (c) self-perceptions, (d) exercise motivation, (e) autonomy, or (f) social connectedness, with the exception of higher identified regulation in participants from the self-managed group compared to those in the behavioural intervention.

When the baseline psychosocial results were examined by gender, males exhibited higher perceptions of athletic competence, physical appearance, intelligence, and global self-worth; while females had significantly higher intrinsic motivation to experience. There were no other gender differences in the remaining exercise motivation domains, autonomy, or social connectedness.

Participants who withdrew from the study had lower perceptions of (a) job competence, (b) physical appearance, (c) intelligence, (d) humour, (e) global self-worth, and (f) autonomy than those who remained. Those participants that withdrew also had higher identified regulation compared to those that stayed.

When analysed by SES it was revealed that participants in the Medium SES group reported lesser perceptions of adequacy as a provider compared to the Low and High SES groups. Participants in the High SES group had greater identified regulation than the medium SES group. Also while participants in the Low SES group reported lesser integrated regulation than the Medium SES group, it was greater than that reported by the High SES group.

Physical Activity Level

At baseline there were no significant differences in total physical activity or leisure time physical activity between intervention, gender, withdrawal, or SES groups.

Functional Fitness

In functional fitness, at baseline, there were no significant differences between intervention or withdrawal groups. Males did have greater (a) arm strength, (b) leg strength, (c) agility, and (d) aerobic endurance compared to females. Females, however, had significantly better (a) shoulder flexibility on the dominant and non-dominant sides, and (b) hamstring flexibility. Participants in the high SES group had greater arm strength than participants in the Low SES group. However, participants in the Low SES group had better agility than those in the High SES group.

Post Intervention Results Summary

Psychosocial Variables

There were no differences in self-perceptions, exercise motivation, or autonomy between the intervention groups after 6 months. However, the behavioural intervention group exhibited significantly greater social connectedness compared to the self-managed group after 6 months.

When analysed by gender there were no significant differences between males and females in self-perceptions, exercise motivation, autonomy, or social connectedness after 6 months, with the exception that males were higher than females in perceptions of physical appearance, adequacy as a provider, and morality.

Retention, Adherence, and Physical Activity Level

The self-managed group exhibited a significantly higher number of withdrawals compared to the behavioural intervention group. However, there was no significant difference between the intervention groups on adherence and physical activity levels after 6 months. Detailed analysis of the exercise diary data demonstrated that participants in the behavioural intervention group had a significantly greater number of

walking sessions, and a significantly lower number of sessions other than walking compared to the self-managed group. While there was no difference between intervention groups in number of missed sessions or % HRR, participants in the self-managed group reported significantly higher RPE compared to those in the intervention. It should be noted that the mean %HRR for both groups was below the target range set for participants (55% - 65% of HRR).

While analysis by gender showed no significant difference in physical activity levels, males had better adherence compared to females. Analysis of the exercise diary data showed that females participated in significantly less walking sessions than males, and there were no gender differences in the number of (a) missed sessions, (b) activities other than walking, (c) %HRR, or (d) RPE.

When the exercise diary data were examined by withdrawal status, it was revealed that those who withdrew had engaged in significantly fewer walking sessions. Interestingly, for the time that withdrawn participants were in the study, they had missed significantly fewer sessions compared to those who completed the full 6-months. There were no significant differences between withdrawal status groups in the number of sessions in activities other than walking, %HRR, or RPE.

Anthropometric Variables

There were no significant differences between the behavioural intervention and self-managed groups in body weight, BMI, hip and waist girths, or waist-to-hip ratio after 6 months. Following 6 months males exhibited a significantly lower BMI compared to females.

Functional Fitness

After 6 months the behavioural intervention group was not any better than the self-managed group in any of the functional fitness parameters, with the exception of arm strength. Following the 6-month interventions males had significantly better arm strength compared to females, and females had significantly better hamstring flexibility compared to males.

Regression Models to Predict Adherence

The first regression model used baseline self-perceptions, along with pre-established covariates, to predict adherence. The model indicated that higher baseline perception of household management was associated with higher adherence in this population of older adults.

The second regression model used baseline exercise motivation, with pre-established covariates, to predict adherence. This model established that lower amotivation was associated with higher adherence in this population of older adults.

Regression Models to Predict 6-month Total Physical Activity

The first regression model used baseline self-perceptions, with established covariates, to predict 6-month total physical activity. This model revealed that greater years in competitive sport, lower baseline perceptions of physical appearance and higher baseline perceptions of nurturance were associated with higher total physical activity level at 6-months.

The second regression model used baseline exercise motivation, with pre-determined covariates, to predict 6-month total physical activity. It was discovered that higher intrinsic motivation to learn about physical activity at baseline was associated with lower 6-month total physical activity level.

Regression Models to Predict 6-month Leisure Time Physical Activity

The first regression model used baseline self-perceptions, with established covariates, to predict 6-month leisure time physical activity. This model revealed that the lower the years since participants were involved in vigorous physical activity the higher the leisure time physical activity at 6-months.

The second regression model used baseline exercise motivation, with pre-determined covariates, to predict 6-month leisure time physical activity. Using this model it was discovered that there were no individual significant predictors of 6-month leisure time physical activity level.

Structural Equation Model 1: From Baseline Physical Self-Perceptions and Environment to Adherence via Motivation

Goodness of fit indices demonstrated that structural equation model version 1.0 was a poor fit to the data. The model was modified, and model version 1.1 represented a similarly poor fit to the data. While, version 1.1 did have significant pathways between physical self-perceptions, intrinsic motivation, and adherence, this is immaterial as the complete model did not fit the data.

Structural Equation Model 2: From Baseline Physical Self-Perceptions, Autonomy and Social Connectedness to Adherence

As structural equation model 2 was a saturated design, each parameter was held constant and the fit indices compared to determine the best model. The model that most fitted the data was model 2.0 with autonomy held constant (version 2.2). Contrary to the hypothesis, physical self-perceptions were not significantly related to adherence, nor

was autonomy. In version 2.2 the only significant predictor of adherence was social connectedness.

Structural Equation Model 3: From Adherence to 6-month Social, Cognitive and Physical Self-Perceptions

To test structural equation model 3.0 it was necessary to determine if the 10 self-perception domains could be grouped into social, cognitive, and physical domains. The refined confirmatory factor analysis model demonstrates how the 10 domains loaded onto three pre-determined latent variables representing social cognitive and physical self-perceptions. Structural equation model 3.0 shows that while adherence was significantly related to social, cognitive and physical self-perceptions after 6 months, the relationship was strongest with social self-perceptions, rather than physical self-perceptions as previously hypothesised.

CHAPTER SIX: DISCUSSION

The purpose of the parent project (PATH) was to compare two strategies to increase physical activity in a sedentary sample of Australian older adults. The present study outlined in this thesis examined the role of Self-Determination Theory (SDT) in explaining the motivation of these participants to engage in physical activity. There were three broad purposes to the present study. First, to determine the effect of a behavioural intervention compared with a self-managed approach on psychosocial and physiological outcomes in the uptake of physical activity. Second, to investigate the relative contribution of psychosocial predictors of adherence and physical activity score across the behavioural intervention and self managed exercise programs. Third, to estimate the directional relationships between self-determination constructs and adherence. From this purpose three separate structural equation models were hypothesised.

By employing SDT in this context, this thesis first, provides novel insights into motivation for physical activity in an older population. Second, it also informs health practitioners of key psychosocial components that could be used to increase retention and adherence in physical activity programs for older populations. Third, it affords state and local governments with evidence for policy and program initiatives based on findings from a community based intervention. This discussion will be presented under the following headings: (a) effect of the intervention, (b) gender differences (c) psychosocial predictors of adherence and physical activity, (d) relevance of the hypothesised models, (e) implications for Self-Determination Theory, and (f) summary of discussion points.

Effect of the Intervention

It was important to establish the effect of the intervention on the psychosocial constructs related to SDT and outcome variables measured in this study. In this section the effect of the intervention on (a) psychosocial constructs, (b) anthropometric variables, (c) functional fitness parameters, (d) physical activity level, and (e) retention and adherence will be discussed.

Psychosocial Constructs

In order to further understand how the psychosocial constructs of SDT (competence, autonomy, and connectedness) relate to adherence in physical activity programs, it was important that this thesis examine any potential effects of the behavioural intervention on these constructs. In this population of older adults it was found that using a behavioural intervention did not improve self-perceptions, self-determined exercise motivation or autonomy over a self-managed intervention. Literature indicated that both interventions had the potential to increase self-perceptions, self-determined exercise motivation, and autonomy over the 6-months.

Self Perceptions

In this study it was hypothesised that there would be changes in physical self-perceptions associated with participation in the behavioural intervention condition. Within the present study, increases in participant's perceptions of physical ability and physical appearance were similar between the behavioural intervention and self-managed approaches. In a randomised controlled diet and exercise trial Sorensen, Anderssen, Hjerman, Holme, and Ursin (1997) reported increases in the ASPP sub-domains of athletic ability and physical appearance in an exercise condition, compared to a control. The larger magnitude of changes in physical self-perceptions in the

Sorensen et al. study, compared to the present study, are possibly due to differences in the interventions employed in the two studies. The Sorensen et al. study was supervised for 12 months rather than 6 months. Furthermore, the amount of exercise completed per week was 180 minutes per week, compared with 122 minutes per week for the present study. Therefore, it could be beneficial to conduct longer term testing of behavioural interventions and self-managed strategies at a community level with higher physical activity targets to determine the magnitude of changes in self-perceptions that are achievable in older populations and the potential benefits that result.

In this study it also was hypothesised that participants exposed to the behavioural intervention compared to those in the self-managed condition would experience greater increases in self-perceptions outside the physical domain. As evidenced by similar changes in scores, it appears that participants in the behavioural intervention and self-managed groups experienced similar changes in perceptions of (a) sociability, (b) job competence, (c) morality, (d) household management, (e) intimacy in relationships, (f) intelligence, (g) sense of humour, and (h) global self-worth. It is acknowledged that each self-perception domain had a small effect size. This indicates that the sample size per cluster may not have been sufficient to achieve a level of power to demonstrate significant differences between groups. Therefore one may speculate as to how practically relevant the magnitude of these changes are. Sorensen et al. (1997) reported changes in the ASPP sub-domains of sociability and global self worth of 0.20 in an exercise only group compared to changes of 0.07 (global self-worth) and 0.01 (sociability) in a null-intervention control. The changes in the exercise group reported by Sorensen et al. (1997) are nearly double the changes in sociability and global self-worth reported for the present study. This could be due to the longer more intense intervention delivered by Sorensen et al. (1997).

It should be noted that in the present study perceptions of adequacy as a provider actually decreased in participants in the self-managed group, while for those in the behavioural intervention group this was unchanged. The trend towards a significant difference between the two interventions in perceptions of nurturance (p = 0.061) was due to an increase in the behavioural intervention group and a corresponding decrease in the self-managed group. This difference may be tied to a similar change in social connectedness, as discussed later. According to Kohut's developmental stages of belongingness (1984) nurturance is a key factor in earlier stages of companionship, and relevant to the more mature stage termed social connectedness. It is possible that participants in the behavioural intervention group experienced increases in nurturance, akin to the changes in social connectedness, while participants in the self-managed condition experienced decreases in both constructs. This difference could be due to the prescribed group-based exercise component that was present only in the behavioural intervention program. While it was not investigated, the social nature of the intervention groups could have had flow on effects into social self-perception domains such as nurturance.

Randomised controlled trials using a null-intervention control comparison have demonstrated physical activity associated increases in physical self-perceptions (Bonhauser et al, 2005; Taylor & Fox, 2005; Tsutsumi, Don, Zaichkowsky, & Delizonna, 1997). It is recognised that null-intervention control studies are advantageous as they are ideally suited to show significant differences between groups. However, in behavioural research, control groups do not accurately represent the usual standard of care present in a population. To achieve a null-intervention control, participants are instructed to avoid regular physical activity. As health promotion agencies and government departments are constantly trying to change the physical activity behaviour of a population, it is very rare that a control condition truly exists in

the general population. This is the major disadvantage of using null-intervention control designs. For example, when an intensive intervention is tested against a null-intervention control, significant results can be found. However, when the same program is conducted in a community setting, the effect above the standard care approach may be minimal. Essentially, studies that have employed a null-intervention control lack applicability to the general population. If the present study had employed a null-intervention control group it may have been possible to demonstrate increases in physical self-perceptions, although the findings would have had little relevance to Australian older adults in the general population. The use of control groups in physical activity research also raises ethical considerations. That is, it would be considered unethical to advise physical inactive older adults to remain physically inactive for the duration of a 6-month intervention. Health promotion researchers should take from this the understanding that ethical practice in research is essential. Also, that study design should follow good ethical practice in physical activity research while still being robust enough to clearly demonstrate the impact on variables linked to physical activity behaviour.

Exercise Motivation

In this study it was hypothesised that after 6 months the exercise behaviour of participants in the behavioural intervention group would be significantly more regulated by intrinsic and self-determined motivations compared to participants in the self-managed condition. However, in this population there was no difference between the behavioural intervention and self-managed participants in any of the exercise motivation domains after 6 months. On close inspection there appears to be little change from baseline in exercise motivation scores across both groups, the largest change was a 0.11 increase in identified regulation in behavioural intervention participants. Levy and

Cardinal (2004) also found no effects of an SDT based mail-mediated physical activity intervention on exercise motivation in men and women (mean age 46.8 years, ±12.8) after 2-months. The baseline values reported by Levy and Cardinal were similar to those in the present study, indicating that there could be a *ceiling effect* for the Exercise Motivation Scale (EMS; Li, 1999). In the present study the self-determined and intrinsic motivation scores were all greater than 72% of the total possible score and 62% of the total possible score for the Levy and Cardinal study. It is also possible that the intervention used in the present study was too minimal to generate a shift in the exercise motivation of participants as measured using the EMS and that future studies may need to develop and test strategies that focus more on developing exercise motivation. Health promotion researchers and practitioners must be made aware that not all measures maybe sensitive enough to detect the changes they hypothesise as a result of physical activity behaviour interventions.

Baseline scores in both groups were similar on all exercise motivation domains with the exception that participants in the self-managed group reported significantly higher identified regulation compared to those in the behavioural intervention. An explanation of this difference may reside with the nature of participants who did not wish to participate in a self-managed physical activity program. Even though potential participants did not know what type of intervention the centre had been allocated to until after they were screened, they did have the opportunity to decline participation before baseline. It is possible that when confronted with the prospect of maintaining a self-managed physical activity program, people low in identified regulation chose not to participate, leaving only those with higher identified regulation in the self-managed group. Meanwhile participants allocated to the group-based, supervised behavioural intervention program, who may also have been low in identified regulation, may not have felt as equally compelled to withdraw compared to their self-managed

counterparts. The net result was significantly higher identified regulation in the self-managed participants at baseline. In partial support of this proposition Standage, Duda, and Ntoumanis (2003) found that self-determined motivation was a significant predictor of intention to be physically active in secondary school students. Other cross sectional studies have shown that self-determined and intrinsic motivation are related to improved levels of physical activity participation (Thogersen-Ntoumani & Ntoumanis, 2006) and later stages of behavioural change (Mullan & Markland, 1997). However, results from the current study provide no support for the view that a behavioural intervention can affect changes in these exercise motivation domains as measured using the Exercise Motivation Scale. Whilst it would seem intuitive that a behavioural intervention would cause a change in behavioural regulations towards the self-determined or intrinsic end of the spectrum, there is a lack of research investigating SDT and physical activity in randomised controlled settings. Levy and Cardinal (2004) reported similar findings to the present study when employing the Exercise Motivation Scale (Li, 1999). Importantly they acknowledged a lack of fidelity of treatment and small sample size as key limitations of their study. They also posit that the exercise motivation measure may have not been sensitive enough to change, and the mail mediated intervention may have lacked the intensity necessary to affect changes in exercise motivation. The present study also had some limitations that may have influenced these findings. It is possible that behavioural and self-managed interventions used in the PATH Project had little effect on improving self-determined exercise motivation of older adults in the selected time frame (6 months). This is longer than the 2-month intervention employed by Levy and Cardinal. Therefore, future studies may benefit from investigating exercise motivation using longer term interventions. In addition, there was the potential for a *ceiling effect* for self-determined exercise motivation in this population. However, as there were no age related norms for the measure of self-determined exercise motivation

employed in this study, it was not possible to determine the maximum score for this population. Additionally, the Exercise Motivation Scale may not been sensitive enough to detect changes in exercise motivation. Changes in the motivational orientation toward exercise may differ depending on the time frame. In the Exercise Motivation Scale the participant is asked to provide the reasons for the last time they engaged in regular physical activity. It is possible that changing the point of reference when asking about motivation for exercise to cover the last week, month, or 6 months could elicit very different responses. Future studies may investigate state and trait perspectives of self-determined exercise motivation, and whether the point of reference impacts on self-determined motivation scores.

Autonomy

It was hypothesised that autonomy would significantly increase over the course of the 6 months in the behavioural intervention group, compared to that of participants allocated to the self-managed condition. Contrary to this hypothesis, the findings of this study indicated that the behavioural intervention had no significant impact on autonomy compared to the self-managed intervention. Inspection of the change in autonomy revealed that the behavioural intervention and self managed participants exhibited similar changes in this construct.

While there are some cross-sectional studies that demonstrate a positive relationship between autonomy and physical activity (Bagoien & Halvari, 2005; Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005) few studies have attempted to establish the effect of a behavioural intervention on autonomy. In a randomised controlled trial with 126 middle aged adults, Levy and Cardinal (2004) were not able to demonstrate any significant effect of an SDT based intervention on autonomy, over that of a null-intervention control condition. As previously discussed

Levy and Cardinal do offer several limitations within their study to explain their findings. In the present study there were some possible reasons as to why there was no difference in autonomy between groups, after 6 months. First, the behavioural intervention may simply not have been effective at increasing autonomy, over the self-managed intervention. Participants in the behavioural intervention began exercising as a group at 3 sessions per week. This was decreased after 3 months to 1 group based session per week; additional sessions were left to be managed by participants themselves. Participants in the self-managed program were given advice and instructions on how to manage their own physical activity program without supervision. As both programs were designed to increase self-managed activity, although via different mechanisms, it is not unreasonable to suggest that there could be similar effects on autonomy in both groups. Second, the autonomy level in the participants may have been as high as it could go at baseline; therefore it was not possible for further changes to have taken place. At baseline the level of autonomy in the behavioural intervention group and the self-managed group represented 76% and 75% of the maximum possible score for the MAP-A, respectively. It is possible the recruitment strategy used in the present study attracted people with high autonomy. That is, people participated of their own accord and were not coerced or forced to participate in the study. Third, there may not have been sufficient power to detect a difference between groups using the MAP-A. This measure had an effect size of 0.065, indicating that the sample size per cluster may have been insufficient (in a cluster randomised design) to detect any potential changes. Additionally, while the MAP-A was deemed valid and reliable, the 6-month alpha coefficient indicates the measure could have had reduced internal consistency in this population and may also have lacked the necessary sensitivity to demonstrate a change in either of the interventions.

Within this population of older adults it was observed that baseline autonomy was significantly lower in participants who withdrew in the first 6-months, compared to those who completed the intervention programs. Both strategies in this study asked participants to self-manage their physical activity. However, the behavioural intervention program experienced significantly better retention. It is therefore possible that the self-managed intervention perhaps did not meet the autonomy needs of those participants with low levels of autonomy at baseline. From this it can be concluded that the behavioural intervention strategy employed in this study may have provided a more autonomy supportive environment compared to the self-managed condition. In support of this other studies among athletes have found that autonomy supportive environments are strong predictors of perceived autonomy and vitality (Reinboth & Duda, 2006; Reinboth, Duda, & Ntoumanis, 2004). This does have implications for the design of physical activity interventions. Health promotion researchers and practitioners should be looking at strategies that create autonomy supportive environments. This includes increasing perceived control people feel over their physical activity engagement. Future research may investigate how best to create autonomy supportive environments in community based settings.

While the present study provides some evidence of the relationship between autonomy and retention in physical activity programs future studies could examine potential sources of autonomy support in older adults and how this in turn affects adherence to physical activity. From a practical perspective providing older adults who have low levels of perceived autonomy with environments that support the development of autonomy for physical activity is likely to increase retention rates. Environments high in autonomy support are achieved by removing extrinsic rewards based performance, and providing feedback that prompts participants to take ownership for improvements in performance (Deci & Ryan, 1984).

Social Connectedness

It was proposed that participants in the behavioural intervention would exhibit greater increases in social connectedness compared to those participating in the self-managed intervention. The results show that over the course of the study participants in the behavioural intervention experienced increases in social connectedness, while participants enrolled the self-managed intervention experienced a decrease in social connectedness. These changes led to higher social connectedness in the behavioural intervention group compared to the self-managed group after 6 months. While other studies have demonstrated a relationship between social support and adherence (Brown, Brown, Miller, & Hansen, 2001; King et al., 2006; Raglin, 2001), to the author's knowledge this is the first study to show convincing evidence that a behavioural intervention can potentially change social connectedness. It is likely that increases in social connectedness in the behavioural intervention condition are a result of the group exercise component included in that program. This group exercise component was intensive for the first 3 months and even though the last 3 months were less intensive the effect was maintained to the end of the 6 months. There exists partial support for the length of the group-based intervention component being a factor contributing to the high social connectedness in the behavioural intervention. A recent study employing a behavioural intervention program with 137 older women reported no changes in social support or connectedness with an 8 week unstructured exercise intervention (Robinson-Whelan et al., 2006). Likewise, Levy and Cardinal (2004) reported no changes in social connectedness using an SDT based mail-mediated approach without any group based components. In the present study there was a moderate effect size for social connectedness, lending further weight to the magnitude of the difference between the behavioural intervention and self-managed groups. These findings suggest that social

connectedness may only be affected through group based components in exercise interventions. It is acknowledged that this finding only applies to healthy, under-active older adults, exercising in a community based setting. Future research may further investigate social connectedness in other populations.

The findings in this study indicate that group based walking in a community recreation centre is an effective method for increasing social connectedness in older adults. This is an important finding as epidemiological studies show that high levels of social connectedness are associated with better physical and psychological health, while feeling socially isolated is a contributing factor to the development of depression in older adults (Callen & Wells, 2003; Kinsel, 2005; Laditka & Laditka, 2003; Ong & Allaire, 2005). From a behavioural change perspective, physical activity interventions that are designed to meet the need for connectedness in older adults could potentially effect longer-term changes in physical activity levels than programs which ignore this fundamental need. Therefore, there is need for the development and testing of strategies that use social connectedness to influence adherence to behavioural changes in physical activity.

It is important that more research is conducted to further explain how social connectedness is developed in older adults, and the optimal conditions under which social connectedness can be developed. With respect to SDT, it is possible that participant’s needs for connectedness were being met by engaging in physical activity in group context, an integral part of the behavioural intervention. It is also possible that participant’s needs for connectedness were less likely to be met in the self-managed intervention, as evidenced by a decrease in social connectedness. The better retention rate in the behavioural intervention group compared to the self-managed group, as discussed later, could also be a result of connectedness needs being more readily met in

the behavioural intervention participants, compared to those in the self-managed condition.

Anthropometric Variables

It was hypothesised that due to greater adherence in the behavioural intervention, participants allocated to that group would experience more positive changes in anthropometric characteristics compared to those allocated to the self-managed intervention. The results of the study indicate that the behavioural intervention participants did not exhibit greater reductions in any of the anthropometric measures used in this study compared to those in the self-managed intervention. As there was no difference in adherence or exercise intensity between intervention groups, any changes in anthropometric variables likely to be similar. An in-depth analysis of the data showed that there were similar changes for the self-managed and behavioural intervention groups in weight, BMI, waist circumference, hip circumference, and waist-to-hip ratio. Interventions in other randomised controlled trials have shown significant improvements in anthropometric variables with diet and physical activity (Eriksson, Westborg, & Eliasson, 2006). However, consistent with findings of the present study, past behavioural interventions that target physical activity in isolation (i.e. without a dietary intervention) have found no significant effect on anthropometric variables (Albright et al., 2005; de Jong et al., 2006; Pinto, Frierson, Rabin, Trunzo, & Marcus, 2005; Yancey et al., 2006).

A further explanation for no differences in anthropometric measures relates to the exercise intensity participants were asked to maintain. Current American College of Sports Medicine (ACSM) guidelines state that for effective weight maintenance with physical activity, an exercise intensity of no less than 55% of maximum heart rate must be maintained for a minimum duration of 150 minutes per week (Jakicic et al., 2001). In order to achieve weight loss the ACSM state that an increased intensity of at least

70% of heart rate max or an increase in duration to above 200 minutes per week (Jakicic et al., 2001) is necessary. Participants in this study exercised at an average intensity of 46% of heart rate reserve, equating to 71% of their heart rate max, a level deemed sufficient to achieve weight loss. However, they averaged only 122 minutes of physical activity per week, significantly less than the stated ACSM guideline. Additionally, most studies have found that weight loss with exercise only occurs with interventions lasting longer than 6 months (Jakicic et al., 2001).

Lastly it is possible that this finding could be due to the lack of power to detect a difference between the groups, as indicated by the small effect sizes for weight, BMI, waist circumference, hip circumference, and waist-to-hip ratio. These small effect sizes maybe due to the small sample size per cluster.

Functional Fitness Parameters

It was hypothesised that as the behavioural intervention participants would have better adherence to the prescribed program, the resulting increases in functional fitness would be greater for these participants compared to those in the self-managed condition. The results indicate that the behavioural intervention group showed a 19% improvement in arm strength from baseline to 6-months, compared to 10% in the self-managed group. There was also a trend toward significantly better agility in the behavioural intervention group compared to the self-managed group. The difference in fitness parameters could be due to the type of exercise and/or the intensity of exercise completed by each group. In terms of the type of exercise the behavioural intervention group completed significantly more walking sessions than the self-managed group. The greater the number of walking sessions would also mean that participants in the behavioural intervention also completed more stretching sessions as their walks were supervised. However, this difference may be compensated for by the significantly higher number of

sessions in activities other than walking, engaged in by self-managed participants, compared to those in the behavioural intervention group. Examples of these activities included swimming, cycling, and resistance or circuit training classes. This compensatory effect is partly reflected in the similarity in total number of sessions between the behavioural intervention and self-managed groups. There was no difference between the behavioural intervention and self-managed groups in exercise intensity as measured by percentage of heart rate reserve, although the self-managed group did report higher ratings of perceived exertion (RPE) compared to the behavioural intervention group. However both of these measures were self-reports and subject to participants abilities to measure their own heart rate and, in the instance of the RPE, also subject to social pressure and conformity in the presence of other group members.

Another possible explanation for the difference in arm strength is that the participants in the intervention group, who had been regularly exercising with each other for 6 months, provided each other with more encouragement or social pressure to perform well during the test. Even though the researchers maintained similar conditions at all testing sites, those participants in the self-managed intervention would have only met the other participants being tested with them once or twice before. This concept is substantiated by a cross-sectional study that similarly found support from social networks was associated with better performance in physical function tests (Seeman et al., 1995). The fact that participants in the behavioural intervention group had significantly higher social connectedness at 6 months compared to the self-managed participants also lends some support to the argument that increases in arm strength, in this study, may have been caused by socially based motivators to increase performance. Future studies that employ measures of functional fitness in a group setting, must keep to testing protocols and maintain similar testing environments to account for the potential impact of socially based covariates on test performance.

Physical Activity Level

In the present study it was hypothesised that participants in the behavioural intervention, due to better adherence to the weekly targets, would report better levels of total and leisure time physical activity, compared to those in the self-managed intervention. The results showed that participants in the behavioural intervention did not have larger total physical activity levels compared to those in the self-managed intervention after 6 months, nor was there any significant difference in leisure time physical activity between the two groups. This study compared the effectiveness of two strategies to increase physical activity. Other studies have shown that self-managed behavioural intervention programs can work just as effectively as structured exercise interventions (Sevick et al., 2000). Therefore, it is not unreasonable to suggest that equivalent effectiveness of both the interventions used in the present study resulted in similar levels of activity for those who completed the 6-month intervention. This finding is supported by the similar changes in total and leisure time physical activity in the self-managed intervention and behavioural intervention in the present study. This finding is also supported by Norris, Grothaus, Buchner, and Pratt (2000) who found, in 812 adults, similar effects on leisure time physical activity level (leisure time PASE) using a physician delivered exercise behaviour intervention compared to a usual care control.

The lack of specificity for walking in the PASE questionnaire could also partly explain why there was no significant difference observed between the intervention and self-managed groups in the present study. As previously mentioned participants in the behavioural intervention group engaged in significantly more walking sessions compared to those in the self-managed group. However, this is not reflected in the leisure time PASE scores. The PASE asks participants about leisure, work and

household physical activity, although there is little weight given to walking. As participants in this study mostly engaged in walking, there was little impact on the total PASE score. If the behavioural intervention in this study had focussed on resistance training, and vigorous physical activities, this may have resulted in higher total PASE scores as more weight is given to these items in this questionnaire. Other authors in the area of physical activity measurement have also commented on the concept of sensitivity and specificity of measure (Shephard, 2003) arguing that in order for the effects of a particular intervention to be measured accurately, the outcome measures must be specific to the targeted behaviour. Due to the varied nature of physical activity Shephard (2003) recommended that researchers employ measures of physical activity, specific to their intervention. It should be noted that it is possible to over-specify a measure to the point that it can reduce the ability to generalise findings and the impact of interventions on physical activities excluded from the measure.

With respect to sensitivity, it is possible that the PASE questionnaire may not have been sensitive enough to detect changes in physical activity levels. This view is supported by King, Oka, Pruitt, Phillips, and Haskell (1997), who found that the PASE questionnaire was not sensitive enough to detect any change, when compared to other measures in a behavioural intervention tested in older adults. There is constant debate over the veracity of one week self-report physical activity questionnaires. The PASE questionnaire was specifically developed for use in older populations (Washburn et al., 1993). This measure has been repeatedly shown to correlate well with more objective measures of physical activity level including portable accelerometer (Washburn & Ficker, 1999) and outcome measures such as functional fitness (Washburn et al., 1993). The PASE has also been shown to correlate well to predictors of physical activity in cross-sectional studies (Gretebeck et al., 2007). However according to Altman and Bland (1983), it is not statistically sound to base validity of a measure on correlation

alone. Bland and Altman (1999) propose that to establish the agreement between two measures researchers must employ an approach that accounts for the variation within each measure. There also remains some doubt over the ability of self-report measures to detect changes in physical activity behaviour (King et al, 1997; Shephard, 2003). There is also the possibility that due to low numbers in each cluster there was not sufficient power to detect a change in this measure of physical activity.

Given that there were equal changes in physical activity level it should also be mentioned that conducting a self-managed physical activity program is far less expensive than a structured, monitored, group based physical activity intervention (Sevick et al., 2000). Therefore, health promoters and advocacy groups may wish to explore using self-managed programs that encourage individuals to seek out and maintain group based activity options. Although before implementation, such interventions should be evaluated in populations of Australian older adults in order to understand their full potential.

Retention and Adherence

In the present study it was hypothesised that the behavioural intervention group would exhibit higher retention and adherence compared to the self-managed intervention. In partial support of this hypothesis it was found that the behavioural intervention group did have significantly better retention compared to the self-managed intervention (84.0% compared to 67.2% respectively). In this population of older adults the behavioural intervention was more successful at retaining participants compared to the self-managed intervention. Other studies have also shown that interventions with supervised components result in greater retention compared to those that do not. Martin and Sinden (2001) in a meta analysis of randomised controlled trials to increase physical activity report an average withdrawal rate of 13.7%, compared to 15.9% in the

behavioural intervention and 37.2% in the self-managed intervention in the present study. This finding highlights the strength of behavioural interventions compared to information only approaches and has strong implications for physical activity programs in older adults. Furthermore, participants in the behavioural intervention had significantly improved social connectedness after 6 months than those in the self-managed intervention, indicating that the social aspects of the behavioural intervention could have also play an important role in changing physical activity behaviour.

Contrary to the hypothesis, participants in the behavioural intervention and self-managed programs demonstrated similarly good adherence based on an intention to treat (66% and 59%, respectively). In a review of physical activity interventions shorter than 1 year, Van Der Bij et al. (2002) reported a mean participation rate of 83% in group based and 90% in home based physical activity interventions. The authors state that some of these studies did not employ an intention to treat principle, hence the higher participation rates when compared to the present study.

Participants who withdrew had significantly higher hip girth, lower ratings of walking ability, lower perceptions of job competence, physical appearance, intimacy in relationships, and global self-worth, lower autonomy, and higher identified regulation, than those who stayed. Given that participants who completed the 6-month intervention had higher perceptions of walking ability, job competence, physical appearance, intimacy in relationships, and global self-worth, indicates that physical and non-physical related self-perceptions may be an important factor in retention of participants in physical activity programs. This finding is of practical importance as it demonstrated the potential impact of self-perceptions in multiple domains on physical activity behaviour in older adults. Also, this finding directs future research that furthers the understanding the role of non-physical self-perceptions in physical activity programs in older populations.

Autonomy was higher in participants who stayed with the program compared to those who withdrew. This lends support to the concept within SDT that autonomy is important in maintaining behaviours, long-term. The higher perception of identified regulation in withdrawn participants seems counter intuitive as, according to SDT, higher identified regulation should relate to better retention. However on close examination it was revealed that this finding was possibly an artefact of the higher percentage of self-managed participants in the withdrawn group. At baseline, participants in the self-managed intervention had significantly higher identified regulation compared to those in the behavioural intervention group, and more self-managed participants withdrew from the study.

The behavioural intervention group did not have higher adherence compared to the self-managed intervention group. Other studies have also demonstrated older adult's similar adherence to self-managed and behavioural intervention physical activity programs (Cox et al., 2006; Dunn et al., 1998; Norris, Grothaus, Buchner, & Pratt, 2000). In this population of older adults the self-determined motivation was quite high at baseline in both groups. Expressed as a percentage of the total possible score, the behavioural intervention participants reported scores in identified regulation of 78.3%, and 71.3% for integrated regulation. Similarly participants in the self-managed intervention reported scores in identified regulation of 81.3%, and 73.5% for integrated regulation. According to the principles of SDT participants in the self-managed program had the potential to adhere just as well as those in the behavioural intervention program. This finding is congruent with SDT, in that people exhibiting high levels of self-determined motivation in exercise would be likely to adhere to a physical activity program, irrespective of whether there was a behavioural intervention component or not. Future studies could potentially target individuals with low levels of self-determined motivation for physical activity and test methodologies to increase this.

It is also possible that small numbers in each cluster may have limited the ability to demonstrate a difference in adherence behaviour in the two interventions. Larger sample sizes, per cluster, may have made it possible to detect differences between the behavioural and self-managed intervention groups.

Gender Differences

It was considered important in the present study to examine baseline differences in gender and potential differences in the responses of men and women to the intervention strategies. Therefore, this section will discuss gender effects on (a) psychosocial constructs, (b) anthropometric variables, (c) functional fitness parameters, (d) physical activity levels, and (e) adherence. In this study there were more women (n = 188) than men (n = 66). However, men and women were equally distributed between the behavioural and self-managed intervention groups. As expected, men at baseline, compared to women, were significantly older, taller, heavier, and had larger waist girth, waist-to-hip ration and smaller waist circumference. Also, at baseline, there was a significant gender effect for marital status and educational background with men having had more years of education compared to women. As one would expect in a population of older adults a greater percentage of men had previously participated in competitive sport, and had more years previous experience in competitive sport compared to women. These education and sporting background differences are typical of an older population. In the past, males were more encouraged and socially pressured to participate in competitive sport and attain higher levels of education (Alexander & Ekland, 1974), compared to females. At baseline men exhibited higher perceptions of athletic competence, physical appearance, intelligence, and global self-worth. It is possible that these differences in self-perceptions are related to the differences in physical activity and educational background referred to earlier and that women

generally have lower positive self-perceptions of body image and are subjected to greater body image pressures. It should also be noted that women reported higher baseline intrinsic motivation to experience exercise compared to men.

Psychosocial Constructs

The psychological data when analysed by gender revealed that men were higher in perceptions of (a) physical appearance, (b) adequacy as a provider, and (c) morality, when compared to women, after 6 months intervention. This indicates that, irrespective of the treatment allocation, the physical activity interventions may have increased certain domains of self-perceptions in this population of older men. These findings provide some preliminary evidence that men, compared to women, had more positive changes in self-perceptions outside as well as within the physical domain, after participating in a physical activity intervention.

The present study extends the knowledge regarding gender differences in self-perceptions. The findings are supported in an earlier study by Rejeski et al. (2003) who found that at 3 and 12 months men had greater levels of self-efficacy for 6 minute walk mobility compared to women independent of treatment type. Conversely, while McAuley et al. (1999) found that there was no gender effect on changes in physical self-efficacy or perceived physical ability, they did find that higher levels at baseline were predictive of greater changes over the course of the exercise intervention. As men in the present study did report higher baseline perceptions of athletic competence, physical appearance, intelligence, humour, and global self worth, it is possible that this predisposed them toward changes in other domains over the course of the intervention.

The capacity for change in physical self-perceptions in men may be due to different socialisation experiences regarding physical activity in these age groups. In the present study a greater percentage of men reported engaging in competitive sport,

and had more years experience in competitive sport, when compared to women. Therefore, it is possible that this type of background could have made men more receptive to positive changes in self-perceptions as a result of engaging in a physical activity intervention. This could occur as a result of experiencing positive changes in self-perceptions due to mastering physical skills in younger years, and re-experiencing these when engaging in a process of re- acquiring physical skills in later years. Albeit the physical skills may be different health promotion practitioners could draw on these dormant physical self-perceptions as a mediator for promoting physical activity to older men. There were no differences between men and women on exercise motivation, autonomy or social connectedness after 6 months.

Anthropometric Variables

Analysis by gender demonstrated that men had significantly lower BMI scores after the intervention when compared to women. While there was no significant gender difference in exercise intensity, men did have significantly higher adherence compared to women. With respect to type of exercise, men also engaged in significantly more walking sessions compared to women. Therefore, it is possible that this type of physical activity was responsible for the significantly greater reductions in BMI for men compared to women.

There is evidence to suggest that men also may lose weight more readily through physical activity compared to women. Similar findings in a diet and exercise based weight loss study in 674 women and 288 men, showed that while a decrease in fat intake contributed significantly to weight loss in both genders, physical activity in isolation conferred weight loss for males only (Dunn et al., 2006). In further support of these findings Paul, Novotny, and Rumpler (2004) showed that in men greater physical activity energy expenditure was associated with lower % body fat, while this

relationship was not significant in women. Additionally, Westerterp, Meijer, Janssen, Saris, and Ten Hoor (1992) found a significantly greater decrease in the fat mass of men compared to women over the course of a 40-week physical activity training program. The authors state that this difference was due to women engaging in a compensatory increase in energy intake resulting in a smaller effect on fat mass compared to men over the course of the training program (Westerterp et al., 1992). These findings show that the form of exercise used in the present study was a benefit to men. However, for women it is concluded that where weight loss is a target other strategies need to be that combine physical activity and dietary control components. Dietary advice in physical activity weight loss programs targeting men, while perhaps not essential, could still have added benefit.

Functional Fitness Parameters

There were differential effects between men and women in strength and flexibility after 6 months of the physical activity intervention. Men exhibited significantly greater increases in arm strength compared to women and women demonstrated significantly greater increases in hamstring flexibility compared to men. Men completed a significantly greater number of sessions of physical activity compared to women. Therefore, this may have led to improvements in arm strength, as it has been demonstrated in resistance training studies, that men are more responsive to muscle hypertrophy than women (Delmonico et al., 2005). The greater hamstring flexibility in women in this study could be due to a higher compliance to the stretching exercises given at the beginning of each session. However, as adherence to the stretching component of the training program was not measured, this is only speculative.

Physical Activity Level

There was no difference between men and women in physical activity levels at 6 months, indicating no potential gender effect on physical activity level as measured by PASE in this population. This is inconsistent with the adherence findings of the present study and could well relate to the efficacy of one week self-report physical activity questionnaires to accurately detect changes and differences in physical activity behaviours as previously discussed.

Adherence

It was found that men had significantly higher adherence when compared to women. It was noted that 75.8% of men were married compared to 57.4% of women, also that more women were widowed or divorced compared to men. Pettee et al. (2006) in a study of 3,075 men and women aged 70-79 found that married men and women reported higher levels of exercise participation, and spousal physical activity level was a strong predictor of physical activity level in this population of older adults. This is supported by the work of Satariano, Haight, & Tager (2002) who found in 2,073 men and women that spousal participation in exercise was the strongest predictor of leisure time physical activity. It is proposed that in the present study higher adherence in men is potentially tied to the difference in marital status between men and women. It is recommended that health practitioners design programs that encourage spouses to exercise together to increase adherence. This finding also points out a need to identify methods of increasing physical activity levels in unmarried men and women. Future research should investigate other sources of social support for unmarried participants in physical activity programs.

In the present study, a greater percentage of men had participated in competitive sport, and overall men had significantly more years experience in competitive sport

compared to women. Therefore it is reasonable to suggest that the higher adherence score for the males in this study could have also been due to past socialisation experiences more conducive to future engagement in physical activity. In support of this finding, a cross sectional study of 190 women and 86 men found that men had significantly higher current levels of leisure time physical activity and significantly more previous exercise experience compared to women (Lee, 2005). Also other studies have shown that engagement in physical activity during childhood can, to some extent influence engagement in later life physical activity (Maurase, Kobaycishi, Kamei, 1981; Pyorala, et al., 1967; Telama, Yang, Laakso, & Viikari, 1997). Future research is necessary to fully understand the potential impact of past physical activity experiences on future engagement, for this would have implications for promotion and design of physical activity programs that target men and women. Possibly employing advocacy techniques that draw on past experience may be an effective method for increasing physical activity participation in older men. By the same token, due consideration should be given to the reduced likelihood of older women to have had positive socialisation experiences in physical activity during childhood and therefore greater initial barriers to future engagement.

Psychosocial Predictors of Adherence and Physical Activity

It has been established that psychosocial predictors of adherence to a physical activity program are potential mediators in the relationship, and offer points of leverage that future interventions could target (Brassington, Atienza, Perczek, DiLorenzo, & King, 2002). It is also important to note that while PASE questionnaire has not been associated with great sensitivity to change, physical activity level as measured by PASE does have strong associations with psychosocial predictors of physical activity such as self-efficacy and social support. A study by McAuley, Jerome, Elavsky, Marquez, and Ramsey (2003) found that affect and social support at baseline were associated with

self-efficacy immediately following an intervention and that in turn self-efficacy was related to physical activity levels at an 18-month (measured by PASE). However, as well as measuring physical activity level (PASE) the present study examined predictors of adherence using a continuous self-report of physical activity (exercise diaries). The relationships from baseline self-perceptions and exercise motivation to (a) adherence, (b) 6-month total physical activity, and (c) 6-month leisure time physical activity are discussed in this section.

Adherence

It was hypothesised that baseline physical self-perceptions would be the strongest predictors of adherence in this population of older adults. However, the results demonstrated that of the self-perception domains measured in this population of older adults, a perception of household management was the only significant predictor of adherence scores when adjusting for all covariates. This shows that irrespective of gender and intervention type, adherence to a physical activity program could be more strongly influenced by self-perceptions outside the physical domain compared to those in the physical domain. It has been noted that levels of physical self-perceptions may be lower in this population due to age related declines (Franzoi & Koehler, 1998).

According to SDT, meeting needs for competence and high self-perceptions are important in motivation to continue behaviour. However, this raises the question must perceived competencies be domain specific to have an effect on specific behaviours? Other studies have demonstrated predictive relationships between physical self-perceptions (measured using the ASPP) and compliance (Sorensen, Anderssen, Hjerman, Holme, & Ursin, 1997). However, the present study is the first in older adults to demonstrate that positive self-perceptions outside the physical domain could potentially influence exercise behaviour. In this study participants who adhered better

to their respective intervention programs may have been drawing on positive self-perceptions in other areas of their life, in this instance perception of household management. This would especially hold true for women in this population as it is likely they would have spent much of their adult lives managing a household. This disparity was also reflected in the types of past and present occupation. It was revealed that 13.2% of women listed their past occupation as home duties, compared to 0% of men. Additionally, 32.8% of women listed their current occupation as home duties, compared to 0% of men. It is also possible that women in this population who were highly organised in their household management would have the associated time management skills to find time to exercise.

There is very little research that investigates on what can affect changes in domain specific self-perceptions. However, a pilot study by Colchico, Zybert, and Basch (2000) in a younger population found that self-perceptions outside the physical domain increased over the course of a 12-week physical activity related intervention. Future research may investigate what types of intervention can change self-perceptions of older adults, and to what extent can physical activity alter self-perceptions outside the physical domain. From a SDT perspective one may ask, can fundamental needs for competence in physical activity be met outside the physical domain? Intuitively, the answer is no. However, these findings suggest that self-perceptions outside the physical domain could impact self-determined motivation for physical activity in older adults.

It was hypothesised in the present study that higher self-determined and intrinsic motivation for exercise would be related to adherence as would lower amotivation and non self-determined motivation. The results showed that of the exercise motivational orientations hypothesised to influence adherence in this population, baseline amotivation was the only significant predictor. This is consistent with SDT theory, that adherence to a physical activity program would be associated with low levels of

amotivation. Additionally, people with very high levels of amotivation would have been unlikely in the first instance to respond to a call for participants for a physical activity program and then more likely to have difficulty in adhering, long term, to a physical activity program.

Total Physical Activity

In the present study it was hypothesised that higher physical self-perceptions would be related to higher total physical activity level after the 6 months intervention. The results indicated that lower perceptions of physical appearance, higher perceptions of nurturance, and more years in competitive sport at baseline were the only significant predictors of physical activity levels after the intervention. This finding indicates that, older men and women in this study with lower perceptions of physical appearance and higher perceptions of nurturance were disposed toward higher general levels of physical activity. This lends further weight to the argument that, in addition to self-perceptions in the physical domain, self-perceptions outside the physical domain may also impact on the physical activity behaviours of older adults. This may be due to age-related declines in physical self-perceptions and a compensatory increase in perceptions in other areas. As mentioned previously Franzoi and Koehler (1998) have demonstrated age associated declines in physical self-perceptions. Therefore, when faced with the prospect of starting a physical activity program it is possible that, in older adults, perceptions outside the physical domain may provide a stronger source of competency. This could result in self-perceptions outside the physical domain being more salient to physical activity levels, than physical self-perceptions in older adults. Further research to identify which self-perceptions are related to physical activity participation in older men and women may provide those working in the area of physical activity promotion with better information to deign behavioural interventions that capitalise on this.

The present study also found that more experience in competitive sport contributed to higher physical activity levels at 6-months. This is supported by findings in other studies that have demonstrated the relationship between previous engagement and likelihood of future engagement in physical activity. A longitudinal study by Vanreusel et al. (2002) found that in 236 males, 78% of those who were inactive at age 30 were also inactive at the age of 17, of those who were active at age 17 only 28% became inactive at the age of 30. Additionally the authors of this study also found that involvement in sport for longer (up to the age of 18) was associated with greater activity at age 30. The findings of the present study also highlight the relationship between the length of engagement in competitive sport and future engagement in physical activity. Given that low participation in sport and physical activity during childhood and adolescence is a predictor of lower participation in later life, current high rates of physical inactivity in children and adolescents points a situation where in the problems associated with life-long physical inactivity are exacerbated. Policy to implement strategies to increase physical activity in Western Australian children and adolescents currently works through the education and sport and recreation departments. It is strongly recommended that future physical activity promotion initiatives developed by these departments do not neglect the importance of physical activity and sports participation during childhood and adolescence.

In the present study it was hypothesised that higher self-determined and intrinsic motivation, and lower amotivation and non self-determined motivation would be related to higher total physical activity level at 6-months. Contrary to this hypothesis the results indicated that that high baseline intrinsic motivation to learn and understand more about physical activity was associated with lower total physical activity after the intervention. There are three possibilities for this finding. First is that participants recruited into the study all had high levels of intrinsic motivation to learn, including

those participants who would be likely to have lower levels of physical activity (as measured by PASE) after the intervention. If this were the case one may expect to see a similar relationship between intrinsic motivation to learn and the adherence score. However, there was a positive relationship between intrinsic motivation and adherence in the present study as discussed later. The second possible explanation is that participants over reported their levels of intrinsic motivation to learn at baseline as a results of social conformity. That is, participants were reporting answers they though researchers wanted to hear. Social conformity has been noted in the literature as a potential weakness in using self-report questionnaires in organisational behaviour research (Donaldson & Grant-Vallone, 2002), dietary recall (Ventura, Loken, Mitchell, Smiciklas-Wright, & Birch, 2006), and depression (Hunt, Auriemma, & Cashaw, 2003). Lastly, it is possible that the self-report physical activity measure used in the present study (the PASE questionnaire) lacked the necessary specificity to distinguish between higher and lower total physical activity level. This finding highlights the limitations of relying on self-reported, restricted period, retrospective questionnaires to assess psychosocial constructs and physical activity behaviours in research. Of the two self-report measures used in this study it is recommended that future researchers employ measures that monitor behaviour over time (i.e., exercise diaries) rather than physical activity recall questionnaires to give a better indication of behavioural change. Future studies should investigate alternative methods for collecting psychosocial data that have less opportunity for self-reporting biases toward social conformity.

Leisure-Time Physical Activity

It was hypothesised that high physical self-perceptions at baseline would be related to higher leisure time physical activity after the intervention. However, in this population of older adults the results indicated that none of the self-perceptions domains

at baseline had any impact on the leisure time physical activity levels after the intervention. The results demonstrated that more recent engagement in vigorous activity was related to higher levels of leisure time physical activity after the intervention. This finding is supported by other research that indicates recent previous engagement in activity is a strong predictor of future participation. In a review of correlates to physical activity Sallis, Prochaska, and Taylor (2000) reported that previous physical activity was associated with current level of activity in children and adolescents. A study by Oman and King (1998) also reported that recent participation in physical activity was a good predictor of future engagement. That is, the shorter the break from activity, the easier it was for participants to get started again. From a population health perspective maintaining a *stay active* message through mass media presents an effective tool to prompt those who have recently become inactive to start exercising once more. However, it is important that strategies be developed to target those who are not being reached via these conventional methods. As alluded to earlier, incorporating physical activity into traditionally non-physical domains (book clubs, craft workshops) may be one such method of attracting people to physical activity.

It was hypothesised that higher baseline intrinsic and self-determined exercise motivation and lower amotivation and non self-determined exercise motivation would be related to higher leisure time physical activity after 6 months. However the results revealed that none of the exercise motivation domains measured in this population of older adults emerged as significant predictors, positive or negative, of leisure time physical activity scores post-intervention. As previously mentioned this could have been due to potentially poor specificity in the measure of leisure time physical activity employed in this study, as noted by King et al. (2000) in a comparative study using multiple measures of physical activity level.

Relevance of the Hypothesised Models

The purpose of developing and testing hypothetical models of exercise adherence is to locate potential leverage points that if acted on, could generate significant increases in exercise adherence. This section will discuss the relevance of each model tested in this thesis and outline the implications for health promotion practitioners and future research.

Structural Equation Model 1: From Baseline Physical Self-Perceptions and Environment, to Adherence via Motivational Orientation

In structural equation model 1 it was hypothesised that baseline physical self-perceptions and distance from the recreation centre would directly impact adherence, and act indirectly through motivational orientation. In this population of older adults, the proposed model did not fit the data; therefore modifications were made according to relevant indices and theoretical guidelines. While the modified model demonstrated significant relationships between baseline physical self-perceptions to adherence, mediated by baseline levels of intrinsic motivation, the overall fit was still insufficient. Also, contrary to the hypothesis, self-determined motivation negatively predicted adherence. It should be noted that these findings are preliminary. Lee and Laffrey (2006) employed structural equation modelling that tested cognitive, social, and environmental predictors of physical activity level. In support of the findings in the present study Lee and Laffrey's final model showed that self-efficacy and motivation for physical activity, along with gender, income, and previous experience, were the only variables to directly influence physical activity level. According to OIT higher self-perceptions are more likely to lead to integrated (self-determined) behaviours and longer term adherence (Deci, 1980). The negative relationship between self-determined motivation and adherence was contrary to the hypothesised relationship. This is not

fully explained by other results in the study. However, it is possible that baseline levels of self-determined motivation were subject to an over reporting bias. As previously discussed this potential bias toward over reporting was also noted in a negative relationship between baseline intrinsic motivation to learn and physical activity level. It is also possible that the higher baseline identified regulation in participants who withdrew from the study may have also contributed to the negative relationship noted between baseline identified regulation and adherence in Model 1.1. Health promotion researchers should take into consideration the influence of the types of measure used when designing structural equation models for testing the psychosocial antecedents of physical activity behaviour.

Structural Equation Model 2: From Baseline Physical Self-Perceptions, Autonomy and Social Connectedness to Adherence

Structural equation model 2.0 hypothesised that physical self-perceptions would be the strongest predictor of adherence as compared to autonomy and social connectedness. However, it was revealed that physical self-perceptions and autonomy did not have any significant impact on adherence. Contrary to our hypothesis, social connectedness at baseline was found to significantly influence adherence to the program. In this population it appears that physical-self perceptions may only impact on adherence through enhanced intrinsic motivation (model 1.1), not via any direct effect. Whilst it is acknowledged that, in younger cohorts, physical self-perceptions play a significant role in physical activity behaviour (Cardon, 2005; Crocker, Eklund, & Kowalski, 2000); this may not be the case with older populations. The consensus of previous work is that it is difficult to establish links between socially based constructs and exercise adherence (Brassington, Atienza, Perzcek, Dilorenzo, & King, 2002; Chogahara, O'Brien Cousins, & Wankel, 1998; Rhodes, Martin, & Taunton, 2001). In

this study a strong relationship between a socially based construct and adherence to a physical activity program has been demonstrated. Further, it was also established that social connectedness was increased with the behavioural intervention, compared to the self-managed group. Coupled with this, the behavioural intervention group experienced significantly better retention compared to the self-managed group. These findings indicate that meeting needs for connectedness in older adults could be equally important to needs for competence or autonomy to enhance longer-term behavioural change in physical activity.

This model shows that social connectedness could be a potential mediator in the adherence of older adults to physical activity programs and further research should be undertaken to further elucidate this relationship. For practitioners, including components that capitalise on existing social connectedness and create new environments that allow for the development of social connectedness may present an effective tool for increasing the adoption of physical activity in older populations.

Structural Equation Model 3: From Adherence to 6-month Social, Cognitive and Physical Self-Perceptions

It was hypothesised in structural equation model 3.0 that adherence over the course of the 6-months would be more strongly related to physical self-perceptions compared to social or cognitive domains. However contrary to this, hypothesised model 3.0 demonstrated that while high adherence to the program did relate to higher physical self-perceptions at 6-months, and to a lesser extent cognitive self-perceptions the relationship was strongest from adherence to social self-perceptions at 6-months. Model 3.0 indicates that physical activity may have the potential to affect cognitive and social self-perceptions in healthy, underactive older adults. It has been shown that the intervention in this study was able to change social connectedness, and in model 2.2 adherence was also partly predicted by baseline levels in social connectedness.

Demonstrating that adherence to the program was related more strongly to social self-perceptions rather than physical domains is another clear indicator of the importance of socially related constructs in the physical activity behaviours of older adults. This finding also adds weight to the argument that, in older adults, programs which focus on meeting needs for connectedness may result in better adherence compared to those that do not. In this study the importance of social connectedness in behavioural interventions, the directional pathways to adherence, and the importance of social self-perceptions in older adults provide strong evidence of the important role of social connectedness in physical activity adherence in older adults. Future research may further investigate the full impact of physical activity on self-perceptions outside the physical domain by conducting randomised controlled trials that employ a null-intervention control. These findings can then be transferred to a more applied setting for use in community based interventions. From a practical perspective maintaining good psychosocial health and high perceptions of competence in multiple domains into older adulthood could be addressed through physical activity interventions.

Summary

The major finding of this study indicates that social connectedness may play a significant role in the adoption of physical activity in older adults. This is evidenced by the fact that participants in the behavioural intervention program experienced significantly greater increases in social connectedness compared to participants in the self-managed program who experienced a decrease in social connectedness. Given the importance of high social connectedness in the psychological health of older adults the present study has identified that group based behavioural intervention programs may provide a way of enhancing this. Further, the behavioural intervention program had better retention of participants compared to the self-managed program. In line with

Self-Determination Theory it is proposed that the group based components in the behavioural intervention condition served to meet the connectedness needs of participants in that group, therefore they were less likely to withdraw from the study. Conversely in the self-managed condition a lack of any group component resulted in a greater number of withdrawals as the connectedness needs of participants may not have been met. While adherence did not differ between the behavioural intervention and self-managed condition, the second structural equation model demonstrated that social connectedness, compared to physical self-perceptions and autonomy, was the only significant variable predicting adherence.

This study has found some evidence to suggest that in addition to physical self-perceptions, self-perceptions outside the physical domain may play an important role in exercise behaviour. It is acknowledged that perceptions in physical domains are important as retained participants also reported higher perceptions of self-rated walk ability, physical appearance, and global self-worth compared to those who withdrew. However, higher perceptions of job competence and intimacy in relationships in participants who stayed in the program compared to those who withdrew indicate that self-perceptions outside the physical domain could also be important. Additional support for this model is provided by the finding that lower perceptions of physical appearance and higher perceptions of nurturance were associated with higher total physical activity levels after 6-months of the program. It may be that the effects of age associated decreases in physical self-perceptions on exercise behaviour are being countered by higher self-perceptions in other areas more salient to the individual at this stage of their life. Further evidence for this proposition is reflected by the third structural equation model. This model demonstrated that adherence was more strongly related to social self-perceptions than physical or cognitive self-perceptions after the intervention. It is important that future studies examining the role of physical self-

perceptions, also take into account self-perceptions in other domains. This finding raises a new question in Self-Determination Theory, that is, does perceived competence the development of self-determined motivation have to be domain specific? The findings of the present study allude to a potential *cross over effect* from perceptions in one domain (e.g. social) relating to behaviours in another domain (e.g. physical).

CHAPTER SEVEN: SUMMARY, FUTURE DIRECTIONS, AND CONCLUSION

This study was a unique application of Self-Determination Theory to explain motivation in sedentary older adults. While the strategies employed in the parent study were not based solely on SDT, the findings indicate that SDT partially explains motivation to adopt physical activity in this older population. In the literature reviewed for this thesis a table of randomised controlled trials testing interventions to change physical activity level was presented (Table 1, page 30). From the 71 studies included only 56 had employed a behavioural intervention component. Furthermore, only one study had used Self-Determination Theory to explain the behaviour change taking place (Levy & Cardinal, 2004). Further gaps of the previous studies were that only 17 had reported setting a physical activity target of 150mins/wk, and 40 of the studies had interventions that lasted less than 6 months. The present study addressed some of the gaps in the existing literature by, first, employing Self-Determination Theory to explain changes in physical activity behaviour; second by setting a target of 150mins/wk of moderate physical activity; and third, by employing a 6 month intervention. There are several conclusions that can be drawn from the findings in the present study. However, these should be viewed in light of the study's limitations and delimitations. From these conclusions future research directions and practical applications are outlined.

Summary and Future Research Directions

Psychosocial Constructs

Self-Perceptions

It was evident that participants in both interventions experienced similar changes in domain specific perceptions of competence and global self-worth. It is recommended that future research be conducted to determine the practical significance of these changes and their role in motivating or increasing physical activity adherence. There

also were limitations that need to be addressed in future research. These relate to (a) increasing the duration of interventions beyond 6-months; (b) specificity of physical self-perceptions measures; and (c) the development of a self-perception scale for older adults (60 years and over). Until such time as more accurate measures become available, researchers should exercise due consideration when selecting measures of physical self-perceptions in intervention studies.

To fully understand the potential effects of physical activity on self-perceptions outside the physical domain it is necessary to employ a non-intervention control condition. Findings from such prospective work would further clarify the effect of physical activity participation on multiple aspects in the lives of older adults. Furthermore, it would inform health promotion practitioners on better methods to achieve increases in the psychosocial health of older adults.

Important gender differences were highlighted in the present study. At baseline men exhibited higher perceptions of athletic competence, physical appearance, intelligence, and global self-worth compared to women. It was proposed that these differences arise from contrasting socialisation experiences in earlier life. This was supported by a more positive demographic profile towards physical activity in men that consisted of more years of education and more years experience in competitive sport. Health promotion practitioners may incorporate these differences in the design of physical activity intervention initiatives by targeting older men and women with different approaches.

After 6 months it was noted that men increased in perceptions of physical appearance, adequacy as a provider, and morality compared to women. It was proposed that in this setting as the men had higher self-perceptions in other domains, they could be more receptive to changes outside the physical domain compared to women. Potential future research may look at the gender differences in the capacity for change

in self-perceptions in similar and different settings. With respect to gender differences practical considerations regarding the reduced capacity for change in older women's' self-perceptions need to be made. Based on this it is strongly recommended that health promotion practitioners employ gender based physical activity programs or incorporate gender specific components into existing strategies.

Autonomy

Both interventions employed in this study were designed to increase autonomy by means of different strategies. Therefore it may not have been possible to detect differences between the groups in this particular construct. Future research designs are needed that enable examination of differences in the levels of autonomy support, and whether this can affect levels of autonomy in older adults. The results provide important evidence for the effects of autonomy support; that is, participants who withdrew in the first 6-months exhibited lower levels of autonomy compared to those who stayed. This may indicate that participants who withdrew were not having their autonomy needs met by either program. As there was a lower retention rate with the self-managed group it is possible that the self-managed condition did not meet the autonomy needs of participants as well as the behavioural intervention.

An important direction for future research is to evaluate high and low autonomy support interventions in sedentary older adults. Environments in which autonomy is supported, such as in the behavioural intervention in the present study, are achieved by removing extrinsic rewards based performance and providing feedback that develops a sense of ownership in participants. The intensity of the behavioural intervention may not have been strong enough to impact on autonomy over the self-managed program. From a practical perspective it is recommended that interventions include autonomy supportive environments to minimise withdrawal from physical activity by older adults.

Social Connectedness

A major and novel finding was that the behavioural intervention affected increased social connectedness compared to the self-managed intervention, which experienced decreased social connectedness. It is proposed that the group-based component of the behavioural intervention strategy affected increases social connectedness. The group contact was decreased after 12 weeks to encourage the development of self-management of physical activity behaviour. Despite this decrease in group contact, social connectedness persisted in the long-term. One of the key criticisms of group-based programs is the cost of personnel and resources in community settings. As the behavioural intervention approach reduced supervision over the course of the intervention, decreased costs can be achieved while maintaining the benefits in social connectedness of a group-based approach. It is of paramount importance that applications from this finding are implemented. Health promotion practitioners working with older adults in situations where social isolation is prevalent may look at employing group-based activities as a means to increase social connectedness. Practitioners looking to achieve behavioural changes in physical activity should incorporate group-based components as there is now evidence to show that this can result in better retention and potentially longer-term behavioural change.

It is recommended that future research examine the optimal conditions under which physical activity can cause increases in social connectedness. Whether this increased social connectedness leads to the development of longer-term behavioural changes in physical activity remains unanswered and is another important area for future research.

Exercise Motivation

The findings indicated that the Exercise Motivation Scale may have a *ceiling effect* in that there is little room for measurement of increases in exercise motivation domains. Future research is necessary to determine how sensitive to change this particular measure may be. The findings also demonstrate that people higher in identified regulation will initiate self-managed physical activity programs. If individuals with lower identified regulation for physical activity can be identified, health practitioners could match promotion strategies for group-based physical activity programs to these individuals. Future research should investigate the point of reference for the Exercise Motivation Scale as asking about exercise motivation over the last, week, month or 6 months could elicit different responses, based on the state or trait nature of exercise motivation. Furthermore, it is recommended that researchers develop methods to monitor fluctuations in self-determined motivation over the course of behavioural change interventions as this would significantly advance the understanding of behavioural change processes.

Physiological Parameters

Anthropometric Measures

It is possible that the lack of difference in anthropometric measures could be a result of similar intensities and adherence rates in both intervention strategies. The magnitude of the change in weight and BMI was small. This was not unexpected as the physical activity levels of participants in this study were below the ACSM recommendations for weight loss. However even with this level of activity, when gender was analysed, it was noted that males had lower BMI after 6 months compared to females. The changes in BMI in males could also be associated to significantly greater increase in perceptions of physical appearance in males compared to females.

This can be seen as a positive result as it provides health promotion practitioners with an effective strategy to advocate regular physical activity to underactive older males. It also highlights evidence that providing feedback regarding physical changes during a physical activity program could have additional motivating effects in older men.

The gender difference in BMI is likely due to the greater weight loss response to physical activity in men, compared to women. As several studies have shown a compensatory increase in energy intake with exercise in women, it is recommended that future physical activity programs, particularly for women, include dietary control components. Potentially the approach used in this study could be used to maintain weight. If weight loss was the goal in increase in the frequency and intensity of the activity to the ACSM guidelines would required. To achieve this, further strategies may need to be developed that promote higher intensity and increased frequency of physical activity.

Functional Fitness

It was concluded that as intensity and adherence were comparable in both intervention groups: improvements in arm strength in the behavioural intervention compared to the self-managed group were likely to be results of social pressure or encouragement from peers. Future studies that employ measures of functional fitness should utilise methods to further minimise the potential effects and/or conduct performance based functional fitness tests on an individual basis. It was suggested that greater arm strength in men compared to women at 6-months, was likely due to greater adherence to the physical activity target in men. It is possible that the greater hamstring flexibility scores in women compared to men was due to greater adherence to the stretching regime in women. However, it was not possible to determine the extent to which this occurred as adherence to the stretching regime was not recorded. These

findings suggest that promotional strategies based on physical health outcomes should be gender specific. It is likely that this would increase the motivation to continue with a physical activity program as performance-based feedback would be more relevant. To further explore the apparent differential gender effects of similar programs on strength and flexibility researchers will need to exert more control over the prescription of activity and obtain more detailed recording of session content.

Physical Activity

Physical Activity Level

Previous studies had shown that behavioural intervention and self-managed programs could result in similar increases in total and leisure time physical activity. This confirmed these findings, as was reflected in the similar increases in total and leisure time physical activity in both intervention strategies. As the magnitude of the change in PASE was not large compared with previous studies it was argued that the PASE could have potentially lacked the specificity or sensitivity to detect changes in physical activity behaviour. It is recommended that in physical activity intervention studies, researchers should use progressive monitoring of activity via exercise diaries or similar. This form of measuring physical activity gives a more accurate representation of the actual behaviour pattern over the course of the intervention, rather than a pre and post comparison. It is suggested that if researchers choose to employ restricted period, retrospective, physical activity questionnaires, these questionnaires should be specific to their interventions. However, this significantly reduces the ability to generalise findings beyond an immediate research perspective.

There was no difference between men and women in total or leisure time physical activity. As this is inconsistent with the adherence records, this also draws into question the accuracy of one week self-report questionnaires to accurately assess

behavioural changes. It is concluded that employing measures of physical activity that give an accurate representation of behavioural change allows researchers to better associate psychosocial constructs relevant to behavioural change processes.

If the similar levels in physical activity level are accurate there are implications for physical activity promotion. The self-managed program in this study was designed to be minimal in terms of resources and costs, compared to the behavioural intervention. Therefore, health promotion practitioners could look at promoting self-managed programs as a more cost efficient option and should be trialled more widely.

Retention

It was concluded in this study that as the behavioural intervention group had significantly better retention compared to the self-managed group, it is possible that program differences, (i.e., group-based components, behavioural change packages) impacted on the ability of older adults to stay committed to the program for longer. It was argued that the higher social connectedness scores for the intervention group compared to the self-managed program provided some support for this proposition. Given that social isolation increases with age and that increased social isolation is associated with mental health problems such as depression, this finding has major implications for the design and choice of programs appropriate for older adults. Additionally, retention in physical activity programs may be increased by including components that increase social connectedness (group-based activity) in participants. Future studies should investigate the potential links between retention in programs and social connectedness in older adults.

It was noted that participants who stayed in the program for the full 6-months had significantly higher perceptions of job competence, physical appearance, intimacy in relationships, global self-worth, and autonomy. It was concluded from this that there

is the potential that self-perceptions outside the physical domain could be important in the ability to commit to a longer-term behavioural change in healthy, underactive older adults. Future research should be directed toward further understanding the role of self-perceptions outside the physical domain in physical activity behaviour and in other populations. From a practical perspective, health promotion practitioners should design programs that capitalise on self-perceptions in other areas of people's lives as an adjunct to physical activity programs (e.g., book clubs and knitting groups that incorporate walking programs). In some of the recreation centres used in this study there was evidence that local government policy regarding multiple use facilities (i.e., locating libraries, community centres, and recreation centres on the same site) provides an ideal environment to trial this type of initiative. As a consequence of the findings in this study, it is strongly recommended that local and state governments employ a multiple use perspective when designing community facilities and develop programs to increase physical activity through programs that attract physically inactive older adults.

Adherence

The behavioural intervention and self-managed programs exhibited similar adherence to the set target. It was noted that participants in both groups had high levels of self-determined motivation at baseline, indicating that participants in the self-managed program were similarly motivated compared to those in the behavioural intervention condition. Concurrent with SDT high levels of self-determined motivation could account for the similarly high adherence in both strategies. There is a need for individuals with low levels of self-determined motivation to be identified. If this is achieved then one potential strategy would be for researchers to incorporate social aspects or group-based activity into programs that target people low in self-determined motivation. Group-based programs that are specifically designed to increase self-

determined motivation for physical activity could potentially increase the ability of participants to self-manage their activity and decrease reliance on the group structure. This would allow for such programs to be conducted in a more cost effective manner.

Men exhibited significantly better adherence to the physical activity target. It was concluded that these results could be due to a history of physical activity more conducive to future participation in males compared to women. More research is necessary to fully determine the impact of positive and negative past experiences on future engagement in physical activity. A negative past history of physical activity may be due to a lack of skills and success in sport and physical activities during formative years. From a practical perspective health promotion practitioners should be aware of the past experiences in older women that are less conducive to future participation. For individuals with no positive past experiences in physical activity it is recommended that programs incorporate initial low skill components and further skilled instruction, to enhance the potential for increased perceived competence.

The above finding has ramifications for the present generation of children and adolescents. Given that these populations do have higher obesity than past generations (Booth, Wake, Armstrong, Chey, Hesketh, Mathur, 2001; Booth et al, 2003), future participation in physical activity into older age may be less likely and should be addressed. Policy changes regarding the approach to sport and physical activity in children and adolescents must recognise the impact of positive and negative youth experiences in physical activity on life-span involvement in regular exercise. For example, government departments of education, and sport and recreation are in key positions to further develop and implement programs that promote positive engagement of children and adolescents in sport and physical activity.

More recent engagement in physical activity was a determinant of higher physical activity levels. For local governments this presents an area where significant

improvements in access to physical activity environments (e.g., parks, public open space, and recreation centres) and physical activity programs, can have positive impacts on keeping adults active in the long-term.

The Structural Equation Models

In employing structural equation modelling the present study was able to identify key psychosocial constructs that can be incorporated into existing health promotion practice to positively influence adherence to physical activity programs in older adults. The models tested in this study are only three examples of potential models that could explain adherence to physical activity. Testing the three models developed in this study with other target groups such as children and younger adults, inactive adults, or populations more at risk of chronic disease, would provide practitioners with a greater understanding of how broadly these models may be applied.

The first model was not deemed to be a good fit to the data and was rejected on this basis. It is possible that this poor fit may be related to an over reporting bias outlined earlier. Health promotion researchers should be aware of the importance of selecting robust measures when designing structural equation models to explain the psychosocial antecedents of physical activity behaviour.

The second model demonstrated that connectedness may be a more influential factor on behaviour change in physical activity with older adults, compared to competence or autonomy. As there are age-associated declines in competence and autonomy in physical activity, promoting exercise through social connectedness provides practitioners with an effective method for increasing physical activity in older adults. Researchers, in the past have had difficulty in establishing the importance of socially based constructs in physical activity behaviour. A novel finding from this study is the strong evidence of the importance of social connectedness to physical

activity adherence in older adults. Future researchers may wish to test the mediating effects of these variables so that intervention programs that best capitalise on these constructs can be designed.

The third model indicated that adherence to a physical activity program was more strongly related to social self-perceptions after the program, than either physical or cognitive. Changes were demonstrated in social connectedness using a group-based physical activity intervention. The third model reinforces just how important social contact and perceptions of sociability are to older adults. It is essential that future research focuses on the pervasive effects of physical activity across multiple domains in the lives of older adults. Practitioners must also recognise the innate need for social connection and social interaction of older adults, and employ physical activity strategies that enhance and meet this fundamental need.

Implications for Self-Determination Theory

The main purpose of this study was to employ Self-Determination Theory to explain the adoption of a physical activity intervention. Findings from this study highlight the importance of competence, autonomy, and connectedness constructs within the SDT theoretical framework with respect to the adoption of physical activity in older populations. First it was demonstrated that baseline levels of autonomy, a central construct important in long-term engagement, were higher in participants who stayed in the study compared to those who withdrew, indicating that this construct may be a key determinant of retention in exercise interventions.

Second, participants in the behavioural intervention experienced increases in social connectedness and better retention rates, compared to decreases and lower retention in the self-managed condition. This also indicates that connectedness, a second fundamental need in SDT, was a potential contributory factor to retention as a

result of group exercise. According to Kohut's developmental stages of belongingness (1984), social connectedness represents an internalised result of earlier forms of social support (companionship and affiliation) developed over one's life. This is very similar to the internalisation of behavioural regulations process proposed by Deci and Ryan (1985) in Self-Determination Theory. Therefore, further research investigating the nature and development of social connectedness in life stages leading into older age is strongly recommended.

Third, it was shown that self-perceptions outside the physical domain were important predictors of adherence. It was proposed that this may be due to age related declines in physical self-perceptions, therefore others domains were drawn on in a compensatory fashion.

Fourth, with respect to the motivation domains it was demonstrated that high baseline scores in self-determined motivation at baseline, could have been a potential explanation of the similarity in adherence scores in participants from both intervention strategies. Further, it was shown that low levels of amotivation were associated with better adherence to the program a fundamental proposition within SDT. Also, identified regulation was higher at baseline in the self-managed group. This indicates that high self-determined motivation is potentially associated with a willingness to be more self-managed, or autonomous, in physical activity behaviour.

Conclusions

First, it was clear from this study that social connectedness and socially related constructs are important in the lives of older adults. This finding provides solid evidence for health promotion practitioners to incorporate group-based components into physical activity programs. In addition, the nature of the behavioural intervention in the present study was such that as supervision was decreased, and costs minimised as a

result, levels of social connectedness persisted. This also gives practitioners further evidence that group-based programs, which reduce the support on supervision and resources, may be cost-effective and promote greater adherence over the long-term. It is imperative that future researchers investigate optimal conditions under which social connectedness may be developed. Furthermore, investigation into how social connectedness is developed throughout the lifespan must be conducted to identify factors that impact on engendering social connectedness.

Second, this study established preliminary evidence of the pervasiveness of physical activity to impact on various aspects in the lives of older adults and that this impact is gender specific. This finding gives health promotion practitioners a sound basis for advocating gender specific physical activity interventions, or incorporating gender specific components into existing strategies. In doing so, there is a clear likelihood that this will lead to longer-term adherence as programs and outcomes observed by participants are more relevant. These findings also provide a much needed impetus to extend the investigation between physical activity and self-perceptions to include multiple domains and further test the efficacy of Self-Determination Theory to explain physical activity behaviour in older adults. To investigate the full impact of physical activity on multiple domains of self-perceptions at different life stages, age appropriate multidimensional measures of self-perceptions, and methods to record detailed aspects of physical activity behaviour, must be developed and validated.

Third, the findings provide state and local governments with important information that could form the basis for developing of policies and programs to address physical inactivity in older adults. For those departments concerned with high levels of physical inactivity in all ages there is further evidence to show that policy which creates positive physical activity experiences in children and adolescents could relate to higher physical activity in later adulthood. Furthermore, this study has provided additional

support for state and local governments to increase access to physical activity opportunities to reduce extend periods of long-term physical inactivity as this was shown to be detrimental to the effects of an intervention of physical activity level.

Self-Determination Theory remains a powerful basis from which to examine a person's motivation to change exercise behaviour. Employing this theory to explain exercise motivation in an older population has provided novel findings to support the inclusion of socially based components into physical activity promotion campaigns for older adults.

REFERENCES

Ackermann, R. T., Deyo, R. A., & LoGerfo, J. P. (2005). Promoting primary providers to increase community exercise referrals for older adults: A randomized trial. *Journal of the American Geriatric Society, 53*, 283-289.

Adams, R. G., & Blieszner, R. (1995). Aging well with friends and family, *The American Behavioral Scientist, 39* (2), 209-224.

Ainsworth, M. D. (1989). Attachment beyond infancy, *American Psychologist*, *44,* 709-716.

Ajzen, I., & Madden, T. J. (1986). Prediction of goal directed behaviour: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology, 22*, 453-474.

Al-Ali, N., & Haddad, L. G. (2005). The effect of the health belief model in explaining exercise participation among Jordanian myocardial infarction patients. *Journal of Transcultural Nursing*, *15* (2), 114-121.

Albright, C. L., Pruitt, L., Castro, C., Gonzalez, A., Woo, S., & King, A. C. (2005). Modifying physical activity in a multiethnic sample of low-income women: One-year results from the IMPACT (Increasing Motivation for Physical ACTivity) project. *Annals of Behavioral Medicine, 30* (3), 191-200.

Alexander, K. L., & Eckland, B., E. (1974). Sex differences in the educational attainment process. *American Sociological Review, 39,* 668-682.

Allison, M. J., & Keller, C. (2004). Self-efficacy intervention effect on physical activity in older adults. *Western Journal of Nursing Research, 26,* 47-58.

Altman, D.G., & Bland, J.M. (1983). Measurement in Medicine: The Analysis of Method Comparison Studies. *The Statistician, 32,* 307-317.

American College of Sports Medicine (1998). *ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription* (3rd ed.). Baltimore, Maryland: Williams and Wilkins.

Anderson, R. T., King, A., Stewart, A. L., Camacho, F., & Rejeski, W. J. (2005). Physical activity counselling in primary care and patient well-being: Do patients benefit? *Annals of Behavioural Medicine, 30,* 146-154.

Armit, C. M., Brown, W. J., Ritchie, C. B., & Trost, S. G. (2005). Promoting physical activity to older adults: A preliminary evaluation of three general practice-based strategies. *Journal of Science and Medicine in Sport, 8,* 446-450.

Ashworth, N. L., Chad, K. R., Harrison, E. L., Reeder, B. A., & Marshall, S. C. (2005). Home versus centre based physical activity programs in older adults. *The Cochrane Database of Systematic Reviews*, Issue 1. Art. No.: CD004017.pub2. DOI: 10.1002/14651858.CD004017.pub2.

Australian Medical Association. (2006, November 16). *Position Statement on Physical Activity.* Retrieved February 1, 2007, from http://www.ama.com.au/web.nsf/doc/WEEN-6vkvur?opendocument.

Bagoien, T. E. and Halvari, H. (2005). Autonomous motivation: Involvement in physical activity, and perceived sport competence: Structural and mediator models. *Perceptual and Motor Skills, 100,* 3-21.

Baker, H. S., & Baker, M. N. (1987). Heinz Kohut's self psychology: An overview. *The American Journal of Psychiatry, 144,* 1-8.

Baker, K. R., Nelson, M. E., Felson, D. T., Layne, J. E., Sarno, R., & Roubenoff, R. (2001). The efficacy of home based progressive strength training in older adults with knee osteoarthritis: A randomized controlled trial. *Journal of Rheumatology, 28,* 1655-1665.

Ball, K., Salmon, J., Leslie, E., Owen, N., & King, A. C. (2005). Piloting the feasibility and effectiveness of print- and telephone-mediated interventions for promoting the adoption of physical activity in Australian adults. *Journal of Science and Medicine in Sport, 8,* 135-142.

Bandura, A. (1986). *Social foundations of thought and action.* New York: Prentice Hall.

Becker, M. H., & Maiman, L. A. (1975). Socio-behavioral determinants of compliance with health care and medical care recommendations. *Medical Care, 13,* 10-24.

Benjamin, K., Edwards, N. C., & Bharti, V. K. (2005). Attitudinal, perceptual, and normative beliefs influencing the exercise decisions of community-dwelling physically frail seniors. *Journal of Aging and Physical Activity, 13,* 276-293.

Berger, B. G., Pargman, D., & Weinberg, R. S. (2002). *Foundations of exercise psychology 1st ed.* Morgantown, WV: Fitness Information Technology.

Berke, E. M., Ackermann, R. T., Lin, E. H., Diehr, P. H., Maciejewski, M. L., Williams, B., Patrick, M. B., & LoGerfo, J. P. (2006). Distance as a barrier to using a fitness-program benefit for managed medicare enrolees. *Journal of Aging and Physical Activity, 14,* 313-323.

Biddle, S. J. (1999). Motivation and perceptions of control: Tracing its development and plotting its future in exercise and sport psychology. *Journal of Sport and Exercise Psychology, 21,* 1-23.

Bittner, V., Weiner, D. H., Yusuf, S., Rogers, W. J., McIntyre, K. M., Bangdiwala, S. I., Kronenberg, M. W., Kostis, J. B., Kohn, R. M., Guillotte, M., Greenberg, B., Woods, P. A., & Bourassa, M. G. (1993). Prediction of Mortality and Morbidity With a 6-Minute Walk Test in Patients With Left Ventricular Dysfunction. *Journal of the American Medical Association, 270* (14), 1702-1707.

Blalock, H. M. (1964). *Causal inferences in non-experimental research.* North Carolina: University of North Carolina Press.

Blalock, H. M. (1968). Theory building and causal inferences. In H. M. Blalock & A. Blalock (Eds.), *Methodology in social research* (pp. 155–198). New York, NY: McGraw-Hill.

Bland, J.M. (2008). Workshop on Cluster Randomised Trials. First Conference on Randomised Controlled Trials in the Social Sciences, University of York, September 2006. Available at: http://www-users.york.ac.uk/~mb55/clust/incent.htm

Bland, J. M., & Altman, D. G. (1997). Statistics notes: Cronbach's alpha. *British Medical Journal, 314,* 572.

Blissmer, B., & McAuley, E. (2002). Testing the requirements of stages of physical activity among adults: The comparative effectiveness of stage-matched, mismatched, standard care, and control interventions. *Annals of Behavioural Medicine, 24,* 181-189.

Blumenthal, J. A., & Gulette, E. C. (2002). Exercise interventions and aging: Psychological and physical health benefits in older adults. In K. W. Schaie & H. Leventhal (Eds.), *Effective health behaviour in older adults. Societal impact on aging* (pp. 157-177). New York, NY: Springer Publishing.

Blumenthal, J. A., Emery, C. F., Madden, D. J., Schniebolk, S., Walsh-Riddle, M., George, L. K., McKee, D. C., Higginbotham, M. B., Cobb, F. R., & Coleman, R. E. (1991). Long-term effects of exercise on psychological functioning in older men and women. *Journal of Gerontology, 46*, 352-361.

Bohrnstedt, G. W., & Borgatta, E. F. (1981). *Social measurement: Current issues.* Beverly Hills, CA: Sage Publications.

Bollen, K.A. (1990). Overall fit in covariance structure models: Two types of sample size effects. *Psychological Bulletin, 107,* 2, 256-259.

Bonhauser, M., Fernandez, G., Puschel, K., Yanez, F., Montero, J., Thompson, B., & Coronado, G. (2005). Improving physical fitness and emotional well-being in adolescents of low socioeconomic status in Chile: Results of a school-based controlled trial. *Health Promotion International, 20,* 113-122.

Booth, M.L., Wake, M., Armstrong, T., Chey, T., Hesketh. K., Mathur, S. (2001). The epidemiology of overweight and obesity among Australian children and adolescents, 1995-97. *Australian New Zealand Journal of Public Health, 25,* 2, 162-169.

Booth, M.L., Chey, T., Wake, M., Norton, K., Hesketh, K., Dollan, J., & Robertson, I. (2003). Change in the prevalence of overweight and obesity among young Australians, 1969–1997. *American Journal of Clinical Nutrition, 77,* 2, 29-36.

Borg, G. A. (1962). *Physical performance and perceived exertion.* Sweden: Gleerup Lund.

Brach, J. S., Simonsick, E. M., Kritchevsky, S., Yaffe, K., & Newman, A. B. (2004). The association between physical function and lifestyle activity and exercise in the health, aging and body composition study. *Journal of the American Geriatric Society, 52,* 502-509.

Bracken, B. A. (1996). *Handbook of self-concept: Developmental, social, and clinical considerations.* New York, NY: Wiley.

Brassington, G. S., Atienza, A. A., Perczek, R. E., DiLorenzo, T. M., & King, A. C. (2002). Intervention-related cognitive versus social mediators of exercise adherence in the elderly. *American Journal of Preventative Medicine, 23,* 80-86.

Bravo, G., Gauthier, P., Roy, P. M., Payette, H., Gaulin, P., Harvey, M., Peloquin, L., & Dubois, M. F. (1996). Impact of a 12-month exercise program on the physical and psychological health of osteopenic women. *Journal of the American Geriatric Society, 44,* 756-762.

Brophy, J. E. (1972). The role of rewards and reinforcement in early education programs: II: Fostering intrinsic motivation to learn. *Journal of School Psychology, 10,* 243-251.

Brown, P. R., Brown, W. J., Miller, Y. D., & Hansen, V. (2001). Perceived constraints and social support for active leisure among mothers with young children. *Leisure Sciences, 23,* 131-144.

Brownson, R. C., Eyler, A. A., King, A. C., Brown, D. R., Shyu, Y. L., & Sallis, J. F. (2000). Patterns and correlates of physical activity among US women 40 years and older. *American Journal of Public Health, 90*, 264-270.

Bull, F., Milligan, R., Rosenberg, M., & MacGowan, H. (2000). *Physical Activity Levels of Western Australians.* Published by the Health Department of Western Australia and Sport and Recreation Way2Go, Western Australian Government, Perth: Western Australia.

Callen, B. L., & Wells, T. J. (2003). Views of community-dwelling old-old people on barriers and aids to nutritional health. *Journal of Nursing Scholarship, 35,* 257-262.

Capodaglio, P., Capodaglio, E. M., Ferri, A., Scaglioni, G., Marchi, A., & Saibene, F. (2005). Muscle function and functional ability improves more in community-dwelling older women with a mixed-strength training programme. *Age and Ageing, 34,* 141-147.

Campbell, M. K., Tessaro, I., DeVellis, B., Benedict, S., Kelsey, K., Belton, L., & Sanhueza, A. (2002). Effects of a tailored health promotion program for female blue-collar workers: Health works for women. *Preventative Medicine, 34*, 313-323.

Cardon, G., Philippaerts, R., Lefevre, J., Matton, L., Wijndaele, K., Balduck, A., & Bourdeaudhuij, I. (2005). Physical activity levels in 10- to 11-year-olds: clustering of psychosocial correlates. *Public Health Nutrition, 8,* 896-903.

Chatzisarantis, N.L.M., & Biddle, S.J. (1998). Functional significance of psychological variables that are included in the Theory of Planned Behaviour: a Self-Determination Theory approach to the study of attitudes, subjective norms, perceptions of control and intentions. *European Journal of Social Psychology, 28,* 3, 303-322.

Chen, A. H., Sallis, J. F., Castro, C. M., Lee, R. E., Hickmann, S. A., William, C., & Martin, J. E. (1998). A home-based behavioural intervention to promote walking in sedentary ethnic minority women: Project WALK. *Women's Health, 4,* 19-39.

Chin A Paw, M. J., de Jong, N., Schouten, E. G., van Staveren, W. A., & Kok, F. J. (2002). Physical exercise or macronutrient supplementation for the wellbeing of the elderly? A randomised controlled trial. *British Journal of Sports Medicine, 36,* 126-131.

Chirkov, V., Ryan, R. M., Kim, Y., & Kaplan, U. (2003). Differentiating autonomy from individualism and independence: A self-determination theory perspective on internalization of cultural orientations and well-being. *Journal of Personality and Social Psychology, 84*(1), 97-110.

Chogahara, M., O'Brien Cousins S., & Wankel, L. M. (1998). Social influences on physical activity in older adults: A review. *Journal of Aging and Physical Activity, 6,* 1-17.

Colchico, K., Zybert, P., & Basch, C. E. (2000). Effects of after-school physical activity on fitness, fatness, and cognitive self-perceptions: A pilot study among urban, minority adolescent girls. *American Journal of Public Health, 90,* 977-978.

Conn, V. S., Minor, M. A., Burks, K. J., Rantz, M. J., & Pomeroy, S. H. (2003). Integrative review of physical activity intervention research with aging adults. *Journal of the American Geriatric Society, 52,* 1159-1168.

Conn, V. S., Tripp-Reimer, T., & Mass, M. L. (2003). Older women and exercise: Theory of planned behavior beliefs. *Public Health Nursing, 20,* 153-163.

Cordingley, L., & Webb, C. (1997). Independence and aging. *Reviews in Clinical Gerontology, 7,* 137-146.

Costa, P.T., & McCrae, P.R. (1992). Normal Personality Assessment in Clinical Practice: The NEO Personality Inventory. *Psychological Assessment, 4*, 1, 5-13.

Costanzo, C., Walker, S. N., Yates, B. C., McCabe, B., & Berg, K. (2006). Physical activity counselling for older women. *Western Journal of Nursing Research, 28,* 786-801.

Couture, M., Larviviere, N., & Lefrancois, R. (2005). Psychological distress in older adults with low functional independence: A multidimensional perspective. *Archives of Gerontology and Geriatrics, 41*, 1, 101-111.

Cox, K. L., Burke, V., Beilin, L. J., Grove, R. J., Blanksby, B. A., & Puddey, I. B. (2006). Blood pressure rise with swimming versus walking in older women: the Sedentary Women Exercise Adherence Trial 2 (SWEAT 2). *Journal of Hypertension, 24,* 307-314.

Cox, K. L., Burke, V, Gorely, T. J., Beilin, L. J., & Puddey, I. B. (2003). Controlled comparison of retention and adherence in home- vs centre-initiated exercise interventions in women ages 40-65 years: The S.W.E.A.T. (sedentary women exercise adherence trial). *Preventative Medicine, 36,* 17-29.

Cox, K. L., Gorely, T. J., Puddey, I. B., Burke, V., & Beilin, L. J. (2003). Exercise behaviour change in 40 to 65-year old women: The SWEAT study (sedentary women exercise adherence trial). *British Journal of Health Psychology, 8,* 447-495.

Crocker, P. E., Eklund, R. C., & Kowalksi, K. C. (2000). Children's physical activity and physical self-perceptions. *Journal of Sports Sciences, 18,* 383-394.

Csikszentmihalyi, M. (1990). *Flow: The Psychology of Optimal Experience.* New York, NY: Harper Collins.

Dean, R. N., Farrell, J. M., Kelley, M. L., Taylor, M. J., & Rhodes, R. E. (2007). Testing the efficacy of the theory of planned behavior to explain strength training in older adults. *Journal of Aging and Physical Activity, 15,* 1-12.

De Blok, B. M., de Greef, M. H., Ten Hacken, N. H., Sprenger, S. R., Postema, K., & Wempe, J. B. (2006). The effects of a lifestyle physical activity counselling program with feedback of a pedometer during pulmonary rehabilitation in patients with COPD: A pilot study. *Patient Education and Counselling, 61,* 48-55.

Deci, E. L. (1980). *The Psychology of Self-Determination.* Massachusetts: Lexington Books.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-Determination in Human Behaviour*. New York: Plenum Press.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and self-determination of behavior. *Psychological Inquiry, 11,* 227-268.

Deci, E. L., Koestner, R., & Ryan, R. M., (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin, 125,* 627-668.

De Jong, J., Lemmink, K. A., Stevens, M., De Greef, M. H., Rispens, P., King, A. C., & Mulder, T. (2006). Six-month effects of the Groningen active living model (GALM) on physical activity, health and fitness outcomes in sedentary and underactive older adults aged 55-65. *Patient Education and Counselling, 62,* 132-141.

Delmonico, M. J., Kostek, M. C., Doldo, N. A., Hand, B. D., Bailey, J. A., Rabon-Stith, K. M., Conway, J. M., Carignan, C. R., Lang, J., & Huley, B. F. (2005). Effects of moderate-velocity strength training on peak muscle power and movement velocity: Do women respond differently than men? *Journal of Applied Physiology, 99*, 1712-1718.

Dishman, R. K., & Buckworth, J. (1996). Increasing physical activity: A quantitative synthesis. *Medicine and Science in Sports and Exercise, 28,* 706-719.

Donaldson, S. I., & Grant-Vallone, E. J. (2002). Understanding self-report bias in organizational behaviour research. *Journal of Business Psychology, 17,* 245-260.

Duda, J. L., & Hayashi, C. T. (1998). Measurement issues in cross-cultural research within sport and exercise psychology. In J. L. Duda (Ed.), *Advances in sport and exercise psychology measurement* (1st ed., 471–483). Morgantown, WV: Fitness Information Technology Inc.

Duncan, K., & Pozhel, B. (2003). Effects of an exercise adherence intervention on outcomes in patients with heart failure. *Rehabilitation Nursing, 28,* 117-122.

Duncan, O. D. (1966). Path analysis: Sociological examples. *The American Journal of Sociology, 72,* 1-16.

Dunn, A. L., Garcia, M. E., Marcus, B. E., Kampert, J. B., Kohl, H. W., & Blair, S. N. (1998). Six-month physical activity and fitness changes in project active, a randomized trial. *Medicine and Science in Sports and Exercise, 30,* 1076-1083.

Eisenberg, N. (1982). The development of reasoning regarding prosocial behavior. In N. Eisenberg (Ed.), *The development of prosocial behavior* (pp. 219-249). New York: Academic Press.

Eisenberg, N. (1986). *Altruistic emotion, cognition, and behavior.* Hillsdale, NJ: Lawrence Erlbaum.

Engel, L., & Linder, H. (2006). Impact of using a pedometer on time spent walking in older adults with type 2 diabetes. *Diabetes Educator*, *32*, 98-107.

Epstein, L. H., Paluch, R. A., & Raynor, H. A. (2001). Sex differences in obese children and siblings in family-based obesity treatment. *Obesity Research, 9,* 746-753.

Eriksson, K. M, Westborg, C., & Eliasson, M.C. (2006). A randomized trial of lifestyle intervention in primary healthcare for the modification of cardiovascular risk factors: The Bjorknas study. *Scandinavian Journal of Public Health, 34,* 453-461.

Ferrer-Caja, E., & Weiss, M. R. (2000). Predictors of intrinsic motivation among adolescent students in physical education. *Research Quarterly for Exercise and Sport, 71,* 267-279.

Fillipas, S., Oldmeadow, L. B., Bailey, M. J., & Cherry, C. L. (2006). A six-month, supervised, aerobic and resistance exercise program improves self-efficacy in people with human immunodeficiency virus: A randomised controlled trial. *Australian Journal of Physiotherapy, 52,* 185-190.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research.* Reading, MA: Addison-Wesley.

Fisher, C.D. (1978). The effects of personal control, competence, and extrinsic reward systems on intrinsic motivation. *Organizational Behavior & Human Performance. 21,* 3, 273-288.

Fisher, K. J, & Li, F. (2004). A community-based walking trial to improve neighbourhood quality of life in older adults: A multilevel analysis. *Annals of Behavioural Research, 28,* 186-194.

Focht, B. C., Brawley, L. R., Rejeski, W. J., & Ambrosius, W. T. (2004). Group-mediated activity counselling and traditional exercise therapy programs: Effects on health-related quality of life among older adults in cardiac rehabilitation. *Annals of Behavioural Medicine, 28,* 52-61.

Fox, K. R. (1999). The influence of physical activity on mental well-being. *Public Health Nutrition, 2,* 411-418.

Fox, K. R. (2000a). Self-esteem, self-perceptions and exercise. *International Journal of Sport Psychology, 31*, 228-240.

Fox, K. R. (2000b). The effects of exercise on self-perceptions and self-esteem. In S.J. Biddle, K.R. Fox, & S.H. Boutcher (Eds.), *Physical activity and psychological well-being* (pp. 88-117). New York, NY: Routledge.

Franzoi, S. L., & Koehler, V. (1998). Age and gender differences in body attitudes: A comparison of young and elderly adults. *International Journal of Aging and Human Development, 47,* 1-10.

Frederick-Recascino, C. M., & Schuster-Smith, H. (2003). Competition and intrinsic motivation in physical activity: A comparison of two groups. *Journal of Sport Behaviour, 26,* 240-254.

Gary, R. (2006). Exercise self-efficacy in older women with diastolic heart failure: results of a walking program and education intervention. *Journal of Gerontology Nursing, 32,* 31-39.

Gardner, D. K., & Helmes, E. (1999). Locus of control and self-directed learning as predictors of well being in the elderly. *Australian Psychologist, 34,* 99-103.

Giles-Corti, B., Broomhall, M. H., Knuiman, M., Collins, C., Douglas, K., Ng, K., Lange, A., & Donovan, R. J. (2005). Increasing walking: How important is distance to, attractiveness, and size of public open space? *American Journal of Preventative Medicine, 28*, 169-176.

Giles-Corti, B., & Donovan, R. J. (2002). Socioeconomic Status Differences in Recreational Physical Activity Levels and Real and Perceived Access to a Supportive Physical Environment. *Preventative Medicine, 35,* 601-611.

Gilligan, C. (1982). *In a different voice.* Cambridge, MA: Harvard University Press.

Gitlin, L. N., Winter, L., Dennis, M. P., Corcoran, M., Schinfeld, S., & Hauck, W. W. (2006). A randomized trial of a multicomponent home intervention to reduce functional difficulties in older adults. *Journal of the American Geriatric Society, 54,* 809-816.

Gleeson-Kreig, J. M. (2006). Self-monitoring of physical activity: Effects of self-efficacy and behaviour in people with type 2 diabetes. *Diabetes Educator*, *32,* 69-77.

Goldberg, L. R. (1999). A broad-bandwidth, public domain personality, inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. Deary, F. De Fruyt, & F. Ostendorf (Eds.). *Personality Psychology in Europe, 7,* 7-28.

Gore, C. J., & Edwards, D. A. (1992). *Australian fitness norms: A manual for fitness assessors.* North Adelaide, SA: The Health Development Foundation.

Grant, S., Todd, K., Aitchison, T. C., Kelley, P., & Stoddart, D. (2004). The effects of a 12-week group exercise programme on physiological and psychological variables and function in overweight women. *Public Health, 118,* 31-42.

Green, B. B, McAfee, T., Hindmarsh, M., Madsen, L., Caplow, M., & Buist, D. (2002). Effectiveness of telephone support in increasing physical activity levels in primary care patients. *American Journal of Preventative Medicine, 22*, 177-183.

Gretebeck, K.A., Black, D.R., Blue, C.L., Glickman, L.T., Houston, S.A., & Gretebeck, R.J. (2007). Physical Activity and Function in Older Adults: Theory of Planned Behavior. *American Journal of Health Behaviour, 31,* 2, 203-214.

Griffin-Blake, C. S., & DeJoy, D. M. (2006). Evaluation of social-cognitive versus stage-matched, self-help physical activity interventions at the workplace. *American Journal of Health Promotion*, *20,* 200-209.

Grolnick, W. S, Ryan, R. M., & Deci, E. L. (1991). Inner resources for school achievement: Motivational mediators of children’s perceptions of their parents. *Journal of Education Psychology, 83,* 508-517.

Guthrie, J. T., Wigfield, A., & Von Secker, C. (2000). Effects of integrated instruction on motivation and strategy use in reading. *Journal of Educational Psychology, 92,* 331-341.

Hagger, M. S., Chatzisarantis, N. L., Barkoukis, V., Wang, C. K., & Baranowski, J. (2005). Perceived autonomy support in physical education and leisure-time physical activity: A cross-cultural evaluation of the trans-contextual model. *Journal of Educational Psychology, 97,* 376-390.

Hagger, M. S., Chatzisarantis, N. L., Culverhouse, T., & Biddle, S. (2003). The processes by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behaviour: A trans-contextual model. *Journal of Educational Psychology, 95,* 784-795.

Harland, .J., White., M., Drinkwater, C., Chinn, D., Farr, L., & Howel, D. (1999). The Newcastle exercise project: A randomised controlled trial of methods to promote physical activity in primary care. British Medical Journal, 319, 828-832.

Harter, S. (1978). Effectance motivation reconsidered: Toward a developmental model. *Human Development, 21,* 34-64.

Harter, S. (1999). *The Construction of the Self.* New York, NY: The Guildford Press.

Harter, S., & Kreinik, P. (1998). *The Self-Perception Profile for Late Adulthood.* Unpublished Manual, University of Denver, Denver, CO.

Harting, J., Van Assema, P., Van Limpt, P., Gorgels, T. Van Ree, J., Ruland, E., Vermeer, F., & De Vries, N. K. (2006). Effects of health counselling on behavioural risk factors in a high-risk cardiology outpatient population: A randomized clinical trial. *European Journal of Cardiovascular Preventative Rehabilitation, 13,* 214-221.

Harrison, R. A., Roberts, C., & Elton, P. J. (2005). Does primary care referral to an exercise program increase physical activity one year later? A randomized controlled trial. *Journal of Public Health, 37,* 25-32.

Hassandra, M., Goudas, M., & Chroni, S. (2003). Examining factors associated with intrinsic motivation in physical education: a qualitative approach. *Psychology of Sport and Exercise, 4,* 211-223.

Heesch, K. C., Masse, L. C., Dunn, A. L., Frankowski, R. F., & Mullen, P. D. (2003). Activity Intervention Predict Changes in Physical Activity? *Journal of Behavioral Medicine, 26,* 333-348.

Hillsdon, M., Thorogood, M., White, I., & Foster, C. (2002). Advising people to take more exercise is ineffective: A randomized controlled trail of physical activity promotion in primary care. *International Journal of Epidemiology, 31,* 808-815.

Hopman-Rock, M., & Westhoff, M. H. (2002). Health education and exercise stimulation for older people: Development and evaluation of the program "Healthy and Vital". *Tijdschrift voor Gerontologie en Geriatrie, 33,* 56-63.

Hosmer, D.W., & Lemeshow, J. (2000). *Applied Logistic Regression.* New York, NY: John Wiley & Sons, Inc.

Hu, L., & Bentler, P.M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria versus New Alternatives. *Structural Equation Modelling, 6,* 1, 1-55.

Hughes, S. L., Seymour, R. B., Campbell, R., Huber, G., & Sharma, L. (2004). Impact of the fit and strong intervention on older adults with older adults. *Gerontologist, 44*, 217.228.

Humpel, N., Marshall, A. L., Iverson, D., Leslie, E., & Owen, N. (2004). Trial of print and telephone delivered interventions to influence walking. *Preventative Medicine, 39,* 635-641.

Hunt, M., Auriemma, J., & Cashaw, A. C. (2003). Self-report bias and underreporting of depression on the BDI-II. *Journal of Personality Assessment, 80,* 26-30.

Hwang, H., Lin, H., Tung, Y., & Wu, H. (2006). Correlates of perceived autonomy among elders in a senior citizen home: A cross-sectional survey. *International Journal of Nursing Studies, 43,* 429.437.

Iestra, J. A., Kromhout, D., Van Der Schouw, Y. T., Grobbee, D. E., Boshuizen, H. C., & Van Staveren, W. A. (2005). Effect size estimates of lifestyle and dietary changes on all-cause mortality in coronary artery disease patients: A systematic review. *Circulation, 112,* 924-934.

Iso-Ahola, S. E. (1984). Social psychological foundations of leisure and resultant implications for leisure counselling. In T.E. Dowd (Ed.), *Leisure counselling: concepts and applications* (pp. 97-125). Springfield, IL: Charles C. Thomas.

Iyengar, S. S., & Devoe, S. E. (2003). Rethinking the value of choice: Considering cultural mediators of intrinsic motivation. In V. Murphy-Berman & J. J. Berman (Eds.), *Nebraska symposium on motivation: Cross-cultural differences in perspectives on self* (Vol. 49, pp. 129-174). Lincoln: University of Nebraska Press.

Jakicic, J. M., Clark, K., Coleman, E., Donnelly, J. E., Foreyt, J., Melanson, E., Volek, J., & Volpe, S. L. (2001). American College of Sport Medicine Position Stand: Appropriate intervention strategies for weight loss and prevention of weight regain for adults. *Medicine and Science in Sports and Exercise, 33,* 2145-2156.

Johnson, H. (2004). *Crime victimisation in Australia: Key results of the 2004 International Crime Victimisation Survey.* Canberra: Australian Institute of Criminology.

Jöreskog, K. G. (1973). Analysis of covariance structures. In P.R. Krishnaiah (Ed.), *Multivariate Analysis III* (pp. 263-285). New York, NY: Academic Press.

Jöreskog, K. G. (1977). Structural equation models in the social sciences: Specification, estimation and testing. In P.R. Krishnaiah (Ed.), *Application of statistics* (pp. 265-287). Amsterdam: North-Holland Publishing Co.

Jöreskog, K. G. (1979). Statistical estimation of structural models in longitudinal developmental investigations. In J.R. Nesselrode & P.B. Baltes (Eds.), *Longitudinal research in the study of behaviour and development* (pp. 303-351). New York, NY: Academic Press.

Jöreskog, K. G., & Sörbom, D. (1979). *Advances in factor analysis and structural equation models*. Cambridge, MA: Abt Books.

Jöreskog, K. G., & Sörbom, D. (1993). *LISREL 8: Structural equation modelling with the SIMPLIS command language.* Lincolnwood, IL: Scientific Software International.

Jöreskog, K. G., & Sörbom, D. (2001). *LISREL 8: User's reference guide.* Lincolnwood, IL: Scientific Software International.

Kavussanu, M., & Roberts, G. C. (1996). Motivations in physical activity contexts: The relationship of perceived motivational climate to intrinsic motivation and self-efficacy. *Journal of Sport and Exercise Psychology, 18*, 264-280.

Kelley, K., & Abraham, C. (2004). RCT of a theory-based intervention promoting health eating and physical activity among out-patients older than 65 years. *Social Science and Medicine, 59*, 787-797.

Kerry, S.M., & Bland, J.M. (1998). The intracluster correlation coefficient in cluster randomisation. *British Medical Journal, 316,* 1455-1460.

Kerse, N., Ellery, C. R., Robinson, E., & Arroll, B. (2005). Is physical activity counselling effective for older people? A cluster randomized, controlled trial in primary care. *Journal of the American Geriatric Society, 53,* 1951-1956.

Kerse, N. M., Flicker, L., Jolley, D., Arroll, B., & Young, D. (1999). Improving the health behaviours of elderly people: Randomised controlled trial of a general practice education programme. *British Medical Journal, 139*, 683-687.

Keyserling, T. C., Samuel-Hodge, C. D., Ammerman, A. S., Ainsworth, B. E., Henriques-Roldan, C. F., Elasy, T. A., Skelly, A. H., Johnston, L. F., & Bangdiwala, S. I. (2002). *Diabetes Care, 25,* 1576-1583.

King, A. C., Frey-Hewitt, B., Dreon, D. M., & Wood, P. D. (1989). Diet vs exercise in weight maintenance. The effects of minimal intervention strategies on long-term outcomes in men. *Archives of Internal Medicine, 149,* 2741-2746.

King, A. C., Haskell, W. L., Taylor, C. B., Kraemer, H. C., & DeBusk, R. F. (1991). Group vs home-based exercise training in healthy older men and women. *Journal of the American Medical Association, 266,* 1535-1542.

King, A. C., Haskell, W. L., Young, D. R., Oka, R. K., & Stefanick, M. L. (1995). Long-term effects of varying intensities and formats of physical activity on participation rates, fitness, and lipoproteins in men and women aged 50-65 years. *Circulation*, *91,* 2596-2604.

King, A. C, Marcus, B., Ahn, D., Dunn, A.L., Rejeski, W. J., Sallis, J. F., & Coday, M. (2006). *Health Psychology, 25,* 336-347.

King, A. C., Taylor, C. B., & Haskell, W. L. (1993). Effects of differing intensities and formats of 12 months of exercise training on psychological outcomes in older adults. *Health Psychology, 12,* 292-300.

King, A. C., Oka, R., Pruitt, L., Phillips, W., & Haskell, W. L. (1997) Developing optimal exercise regimens for seniors: A clinical trial. *Annals of Behavioural Medicine, 19,* (Suppl):S56.

King, A. C., Pruitt, L. A., Phillips, W., Oka, R., Rodenburg, A., & Haskell, W. L. (2000) Comparative effects of two physical activity programs on measured and perceived physical functioning and other health-related quality of life outcomes in older adults. *Journal of Gerontology: Medical Sciences, 55,* 74–83.

King, A. C., Rejeski, W. J., & Buchner, D. M. (1998). Physical activity interventions targeting older adults: A critical review and recommendations. *American Journal of Preventative Medicine, 15,* 316-333.

Kinsel, B. (2005). Resilience as adaptation in older women. *Journal of Women and Aging, 17,* 23-39.

Kinsella, K., & Volkov, V. A. (2001). *An aging world: 2001. U.S. Census Bureau, Series P95/01-1.* Washington, DC: U.S. Government Printing Office.

Kirk, A., & Rittner, B. (1993). Old and poor: Comparison of female and male meal program participants. *Journal of Gerontological Social Work, 19,* 207-222.

Kiviniemi, M. T., Voss-Humke, A. M., & Seifert, A. L. (2007). How do I feel about the behavior? The interplay of affective associations with behaviors and cognitive beliefs as influences on physical activity behavior. *Health Psychology, 26,* 152-158.

Kochevar, A. J., Smith, K. L., & Bernard, M. A. (2001). Effects of a community-based intervention to increase activity in American Indian elders. *Journal of the Oklahoma State Medical Association, 94,* 455-460.

Kohut, H. (1984). *How Does Analysis Cure?* Chicago, IL: University of Chicago Press.

Kohlberg, L. (1980). *The meaning and measurement of moral development.* Worcester, MA: Clark University Press.

Krause, N., Liang, J., & Gu, S. (1998). Financial strain, received support, anticipated support, and depressive symptoms in the People's Republic of China. *Psychology and Aging, 13,* 58-68.

Krause, N., & Shaw, B. (2000). Role-specific feelings of control and mortality. *Psychology and Aging, 15*, 617-626.

Kreuter, M. W., Chheda, S. G., & Bull, F. C. (2000). How does physician advice influence patient behaviour? Evidence for a priming effect. *Archives of Family Medicine, 9,* 426-433.

Lachmann, M. E., & Weaver, S. L. (1998). Sociodemographic variations in the sense of control by domain: Findings from the MacArthur studies of midlife. *Psychology and Aging, 13,* 553-562.

Laditka, J. N., & Laditka, S. B. (2003). Increased hospitalization risk for recently widowed older women and protective effects of social contacts. *Journal of Women and Aging, 15,* 7-28.

Land, K. C. (1969). Principles of path analysis. *Sociological Methodology, 1,* 3-37.

Laireiter, A., & Baumann, U. (1992). Network structures and support functions: Theoretical and empirical analyses. In H. O. F. Veiel & U. Baumann (Eds.), *The meaning and measurement of social support. The series in clinical and community psychology* (pp. 33-55). New York, NY: Hemisphere.

Lazowski, D. S., Ecclestone, N. A., Myers, A. M., Paterson, D. H., Tudor-Locke, C., Fitzgerald, C., Jones, G., Shima, N., & Cunningham, D. A. (1999). A randomized outcome evaluation of group exercise programs in long-term care institutions. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 54,* 621-628.

Leary, M. R. (1995). *Self-presentation: Impression management and interpersonal behavior*. Boulder, CO: Westview.

Leclerc, G., Lefrancois, R., Dube, M., Hebert, R., & Gaulin, P. (1998). *The Measure of Actualization of Potential Manual.* Research Centre on Aging, Sherbrooke Geriatric University Institute. Quebec: Canada.

Lee, R.M., Dean, B.L., Jung, K.R., (2008). Social connectedness, extraversion, and subjective well-being: Testing a mediation model. *Personality and Individual Differences, 45,* 414-419.

Lee, R. M., Draper, M., & Lee, S. (2001). Social connectedness, dysfunctional interpersonal behaviours, and psychological distress: Testing a mediator model. *Journal of Counselling Psychology, 48,* 310-318.

Lee, R. M., & Robbins, S. B. (1995). Measuring belongingness: The social connectedness and the social assurance scales. *Journal of Counselling Psychology, 42,* 232-241.

Lee, R. M., & Robbins, S. B. (1998). The relationship between social connectedness and anxiety, self-esteem, and social identity. *Journal of Counselling Psychology, 45,* 338-345.

Lee, R. M., & Robbins, S. B. (2000). Understanding social connectedness in college women and men. *Journal of Counselling and Psychology, 78,* 484-491.

Lee, Y. S., & Laffrey, S. C. (2006). Predictors of Physical Activity in Older Adults with Borderline Hypertension. *Nursing Research, 55,* 110-120.

Levy, S. S., & Cardinal, B. J. (2004). Effects of a self-determination theory-based mail mediated intervention on older adults exercise behaviour. *American Journal of Health Promotion, 18,* 345-349.

Lewis, J.A., & Machin, D. (1993). Intention to treat: Who should use ITT? *British Journal of Cancer, 68,* 4, 647-650.

Li, F. (1999). The exercise motivation scale: It's multifaceted structure and construct validity. *Journal of Applied Sport Psychology, 11,* 97-115.

Li, F., Harmer, P., McAuley, E., Fisher, K. J., Duncan, T. E., & Duncan, S. C. (2001). Tai chi, self-efficacy, and physical function in the elderly. *Prevention Science, 2,* 229-239.

Lowther, M., Mutire, N., & Scott, E. M. (2002). Promoting physical activity in a socially and economically deprived community: A 12 month randomized control trial of fitness assessment and exercise consultation. *Journal of Sports Sciences, 20,* 577-588.

Marcus, B. H., Williams, D. M., Dubbert, P. M., Sallis, J. F., King, A. C., Yancey, A. K., Franklin, B. A., Buchner, D., Daniels, S. R., & Claytor, R. P. (2006). Physical activity intervention studies: What we know and what we need to know: A scientific statement from the American Heart Association council on nutrition, physical activity, and metabolism (subcommittee on physical activity); Council on cardiovascular disease in the young; and the Interdisciplinary working group on quality of care and outcomes research. *Circulation, 114,* 2739-2752.

Marcus, B. H., Banspach, S. W., Lefebvre, R. L., Rossi, J. S., Carleton, R. A., & Abrams, D. B. (1992). Using the stages of change model to increase the adoption of physical activity among community participants. *American Journal of Health Promotion, 6,* 424-429.

Marcus, B. H., Selby, V. C., Niaura, R. S., & Rossi, J. S. (1992). Self-efficacy and the stages of exercise behavior change. *Research Quarterly in Exercise and Sport, 63,* 60–66.

Marcus, B. H., Simkin, L. R., Rossi, J. S., & Pinto, B. M. (1996). Longitudinal shifts in employee’s stages and processes of exercise behavior change. *American Journal of Health Promotion, 10,* 195-200.

Marsh, H. W. (1990). The structure of academic self-concept: The marsh/shavelson model. *Journal of Educational Psychology, 82,* 623-636.

Marsh, H. W. (1992). Content Specificity of Relations between Academic Achievement and Academic Self-Concept. *Journal of Educational Psychology, 84,* 35-42.

Marsh, A. P., Katula, J. A., Pacchia, C. F., Johnson, L. C., Koury, K. L., & Rejeski, W. J. (2006). Effect of treadmill and overground walking on function and attitudes in older adults. *Medicine and Science in Sports and Exercise, 38,* 1157-1164.

Marshall, A. L., Booth, M. L., & Bauman, A. E. (2005). Promoting physical activity in Australian general practices: A randomised trial of health promotion advice versus hypertension management. *Patient Education and Counselling, 56,* 283-290.

Martin, J. J., & Kulinna, P. H. (2004). Self-efficacy theory and the theory of planned behaviour: Teaching physically active physical education classes. *Research Quarterly for Exercise and Sport, 75,* 288-297

Martin, J. J., Kulinna, P. H., McCaughtry, N., Cothran, D., Dake, J., & Fahoome, G. (2005). The theory of planned behaviour: Predicting physical activity and cardiorespiratory fitness in African American children. *Journal of Sport and Exercise Psychology, 27,* 456-469.

Martin, K. A., Leary, M. R., & Rejeski, W. J. (2000). Self-presentational concerns in older adults: Implications for health and well-being. *Basic and Applied Social Psychology, 22,* 169-179.

Martin, K. A., & Sinden, A. R. (2001). Who will stay and who will go? A review of older adults adherence to randomised controlled trials of exercise. *Journal of Aging and Physical Activity, 9,* 91-114.

Martin, C. M., & Stevens, N. L. (2006). Breaking the cycle of loneliness? Psychological effects of a friendship enrichment program for older women. *Aging and Mental Health, 10,* 467-475.

Martin-Ginnis, K. A., Latimer, A. E., Brawley, L. R., Jung, M. E., & Hicks, A. L. (2006). Weight training to activities of daily living: Helping older adults make a connection. *Medicine and Science in Sports and Exercise, 38,* 116-121.

Maslow, A. H. (1970). *Motivation and Personality* (2nd ed). New York, NY: Harper and Row Publishers.

Maurase, Y., Kobaycishi, K., Kumei, S., & Matsui, H. (1981). Longitudinal study of aerobic power in superior junior athletes. *Medicine and Science in Sports and Exercise, 13,* 180-184.

McAuley, E., Bane, S. M., Rudolph, D. L., & Lox, C. L. (1995). Physique anxiety and exercise in middle-aged adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 50,* 229-235.

McAuley, E., Courneya, K. S., Rudolph, D. L., & Lox, C. L. (1994). Enhancing exercise adherence in middle-aged males and females. *Preventative Medicine, 23,* 498-506.

McAuley, E., Elavsky, S., Motl, R. W., Konopack. J.F., Hu, L., & Marquez, D. X., (2005). Physical activity, self-efficacy, and self-esteem: Longitudinal relationships in older adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 60,* 268-275.

McAuley, E., Jerome, G. J., Elavsky, S., Marquez, D. X., & Ramsey, S. N. (2003). Predicting long-term maintenance of physical activity in older adults. *Preventative Medicine, 37,* 110-118.

McAuley, E., Katula, J., Mihalko, S.L., Blissmer, B., Duncan, T. E., Pena, M., & Dunn, E. (1999). Mode of physical activity and self-efficacy in older adults: A latent growth curve analysis. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 54,* 283-292.

McAuley, E., Mihalko, S.L., Bane, S. (1996). Acute Exercise and Anxiety Reduction: Does the Environment Matter? *Journal of Sport and Exercise Psychology, 18,* 4, 408-419.

McCormack, G., Milligan, R., Giles-Corti, B., & Clarkson, J. P. (2003). *Physical Activity Levels of Western Australians 2002: Results from the adult physical activity survey and pedometer study.* Perth, Western Australia: Western Australian Government.

McLennan, W. (1996). *1996 Census of Population and Housing: Socio-Economic Indexes for Areas.* Australian Bureau of Statistics.

Menec, V. H., Chipperfield, J. G., & Perry, R. P. (1999). Self-perceptions of health: A prospective analysis of mortality, control, and health. *Journals of Gerontology Series B: Psychological and Social Sciences, 54*, 85-93.

Messer, B., & Harter, S. (1989). *The Self-Perception Profile for Adults.* Unpublished manual, University of Denver, Denver, CO.

Michels, T. C., & Kugler, J. P. (1998). Predicting exercise in older Americans: Using the theory of planned behavior. *Military Medicine, 163,* 524-529.

Midlarsky, E., Kahana, E., Corley, R., Nemeroff, R., & Schonbar, R. A. (1999). Altruistic moral judgement among older adults. *International Journal of Aging and Human Development, 49,* 27-41.

Morey, M. C., Ekelund, C., Pearson, M., Crowley, G., Peterson, M., Sloane, R., Pieper, C., McConnell, E., & Bosworth, H. (2006). Project LIFE: A partnership to increase physical activity in elders with multiple chronic illnesses. *Journal of Aging and Physical Activity, 14,* 324-343.

Motl, R. W., Konopack, J. F., McAuley, E., Elavsky, S., Jerome, G. J., & Marquez, D. X. (2005). Depressive symptoms among older adults: Long-term reduction after a physical activity intervention. *Journal of Behavioral Medicine, 28,* 385-394.

Mullan, E., & Markland, D. (1997). Variations in self-determination across the stages of change for exercise in adults. *Motivation and Emotion*, *21,* 349-362.

Mustian, K. M., Katula, J. A., & Zhao, H. (2006). A pilot study to assess the influence of tai chi chuan on functional capacity among breast cancer survivors. *The Journal of Supportive Oncology, 4,* 139-145.

Mutrie, N., Carney, C., Blamey, A., Crawford, F., Aitchison, T., & Whitelaw, A. (2002). "Walk in to work out": A randomised controlled trial of a self-help intervention to promote active commuting. *Journal of Epidemiology and Community Health*, *56,* 407-412.

Newman, A. B., Simonsick, E. M., Naydeck, B. L., Boudreau, R. M., Kritchevsky, S. B., Nevitt, M. C., Pahor, M., Satterfield, S., Brach, J. S., Studenski, S. A., & Harris, T. B. (2006). Association of long-distance corridor walk performance with mortality, cardiovascular disease, mobility limitation, and disability. *Journal of the American Medical Association*, *295,* 2018-2026.

Newton, R. L., & Perri, M. G. (2004). A randomized pilot trial of exercise promotion in sedentary African-American adults. *Ethnicity and Disease, 14,* 548-557.

Norris, S. L., Grothaus, L. C., Buchner, D. M., & Pratt, M. (2000). Effectiveness of physician-based assessment and counselling for exercise in a staff model HMO. *Preventative Medicine, 30,* 513-523.

O'Brien Cousins, S. (2000). "My heart couldn't take it": Older women's beliefs about exercise benefits and risks. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences, 55*, 283-294.

O'Brien Cousins, S. (2003). Grounding theory in self-referent thinking: Conceptualizing motivation for older adult physical activity. *Psychology of Sport & Exercise, 4*, 81-100.

O'Brien Cousins, S., & Vertinsky, P. A. (1995). Recapturing the physical activity experiences of the old: A study of three women. *Journal of Aging and Physical Activity, 3*, 146-162.

Oka, R. K., King, A. C., & Young, D. R. (1995). Sources of social support as predictors of exercise adherence in women and men ages 50 to 65 years. *Women's Health, 1,* 161–175.

Oldroyd, J. C., Unwin, N. C., White, M., Imrie, K., Mathers, J. C., & Alberti, K. G. (2001). Randomised controlled trial evaluating the effectiveness of behavioural interventions to modify cardiovascular disease risk factors in men and women with impaired glucose tolerance: Outcomes at 6 months. *Diabetes Research and Clinical Practice, 52*, 29-43.

Oman, R. F., & King, A. C. (1998). Predicting the adoption and maintenance of exercise participation using self-efficacy and previous exercise participation rates. *American Journal of Health Promotion, 12,* 154-161.

Ong, A. D., & Allaire, J. C. (2005). Cardiovascular intraindividual variability in later life: the influence of social connectedness and positive emotions. *Psychology and Aging, 20,* 476-485.

Paul, C., Ayis, S., & Ebrahim, S. (2006). Psychological distress, loneliness and disability in old age. *Psychology, Health and Medicine, 11,* 221-232.

Paul, D. R., Novotny, J. A., & Rumpler, W. V. (2004). Effects of the interaction of sex and food intake on the relation between energy expenditure and body composition. *The American Journal of Clinical Nutrition, 79,* 385-389.

Pelletier, L.G., Fortier, M.S., Vallerand, R.J., Tuson, K.M., Briere, N.M., & Blais, M.R. (1995). Toward a new measure of intrinsic motivation, extrinsic motivation and amotivation in sports: The sports motivation scale (SMS). *Journal of Sport and Exercise Psychology, 17,* 35-53.

Peterson, T. R., & Aldana, S. G. (1999). Improving exercise behaviour: An application of the stages of change model in a worksite setting. *American Journal of Health Promotion, 13,* 229-232.

Peterson, J. A., Yates, B. C., Atwood, J. R., & Hertzog, M. (2005). Effects of a physical activity intervention for women. *Western Journal of Nursing Research, 27,* 93-110.

Pettee, K. K., Brach, J. S., Kriska, A. M., Boudreau, R., Richardson, C. R., Colbert, L. H., Satterfield, S., Visser, M., Harris, T. B., Ayonayon, H. N., & Newman, A. B., (2006). Influence of marital status on physical activity levels among older adults. *Medicine and Science in Sports and Exercise, 38,* 541-546.

Pinto, B.M., Freirson, G.M., Rabin, C., Trunzo, J.J., & Marcus, B.H. (2005). Home-based physical activity intervention for breast cancer patients. *Journal of Clinical Oncology, 23,* 3577-3587.

Pinto, B. M., Friedman, R., Marcus, B. H., Kelley, H., Tennstedt, S., & Gillman, M. W. (2002). Effects of a computer-based, telephone-counselling system on physical activity. *American Journal of Preventative Medicine, 23,* 113-120.

Pinto, B. M., Goldstein, M. G., Ashba, J., Sciamanna, C. N., & Jette, A. (2005). Randomized controlled trial of physical activity counselling for older primary care patients. *American Journal of Preventative Medicine, 29,* 247-255.

Pinto, B. M., Lynn, H., Marcus, B. H., DePue, J., & Goldstein, M. G. (2000). Physician-based activity counselling: intervention effects on mediators of motivational readiness for physical activity. *Annals of Behavioural Medicine, 23,* 2-10.

Poston, W. S., Haddock, C. K., Olvera, N. E., Suminski, R. R., Reeves, R. S., Dunn, J. K., Hanis, C. L., & Foreyt, J. P. (2001). Evaluation of a culturally appropriate intervention to increase physical activity. *American Journal of Health Promotion, 25,* 396-406.

Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology, 51,* 390-395.

Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Application to addictive behaviours. *American Psychologist, 47,* 1102-1114.

Purath, J., Miller, A. M., McCabe, G., & Wilbur, J. (2004). A brief intervention to increase physical activity in sedentary working women. *Canadian Journal of Nursing Research, 36,* 76-91.

Pyorala, K., Karvonen M. J., Taskinen, P., Takkunen, J., Kyronseppa, H., & Peltokallio, P. (1967). Cardiovascular studies on former endurance athletes. *American Journal of Cardiology, 20,* 191-205.

Raglin, J. S. (2001). Psychological factors in sport performance: The mental health model revisited. *Sports Medicine, 31,* 875-890.

Ransdell, L. B., Robertson, L., Ornes, L., & Moyer-Mileur, L. (2004). Generations exercising together to improve fitness (GET FIT): A pilot study designed to increase physical activity and improve health-related fitness in three generations of women. *Women's Health, 40,* 77-94.

Reich, J. W., & Zatura, A. J. (1991). Experimental and measurement approaches to internal control in at-risk older adults. *Journal of Social Issues, 47,* 143-158.

Reinboth, M., & Duda, J. L. (2006). Perceived motivational climate, need satisfaction and indices of well-being in team sports: A longitudinal perspective. *Psychology of Sport and Exercise, 7,* 269-286.

Reinboth, M., Duda, J. L., & Ntoumanis, N. (2004). Dimensions of coaching behaviour; Need satisfaction, and the psychological and physical welfare of young athletes. *Motivation and Emotion, 28,* 297-313.

Rejeski, W. J., Brawley, L. R., Ambrosius, W. T., Brubaker, P. H., Focht, B. C., Foy, C. G., & Fox, L. D., (2003). Older adults with chronic disease: Benefits of group-mediated counselling in the promotion of physically active lifestyles. *Health Psychology, 22,* 414-423.

Resnick, B. (2002). Testing the effect of the WALC intervention on exercise adherence in older adults. *Journal of Gerontological Nursing, 28,* 40-49.

Resnicow, K., Jackson, A., Blissett, D., Wang, T., McCarty, F., Rahotep, S., & Periasamy, S. (2005). Results of the healthy body health spirit trial. *Health Psychology, 24,* 339-348.

Resnicow, K., Jackson, A., Braithwaite, R., DiIorio, C., Blisset, D., Rahotep, S., & Periasamy, S. (2002). Healthy body/healthy spirit: A church-based nutrition and physical activity intervention. *Health Education Research, 17,* 562-573.

Rhodes, R. E., Martin, A. D., & Taunton, J. E. (2001). Temporal relationships of self-efficacy and social support as predictors of adherence in a 6-month strength-training program for older women. *Perceptual and Motor Skills, 93,* 693-703.

Rikli, R. E., & Jones, C. J. (1999). Development and validation of a functional fitness test for community-residing older adults. *Journal of Aging and Physical Activity, 7,* 129-161.

Robinson-Whelan, S., Hughes, R. B., Taylor, H. B., Colvard, M., Mastel-Smith, B., & Nosek, M. A. (2006). Improving the health and health behaviors of women aging with physical disabilities: A peer-led health promotion program. *Women's Health Issues, 16,* 334-345.

Rodin, J., Timko, C., & Harris, S. (1985). The construct of control: Biological and psychological correlates. *Annual Review of Gerontology and Geriatrics, 5,* 3-55.

Ryan, R.M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology, 43*, 3, 450-461.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68-78.

Ryan, R. M., & Deci, E. L. (2006). Self-regulation and the problem of human autonomy: Does psychology need choice, self-determination, and will? *Journal of Personality, 74,* 1557-1586.

Ryan, R. M., Frederick, C. M., Lepes, D, Rubio N., & Sheldon, K. M. (1997). Intrinsic motivation and exercise adherence. *International Journal of Sports Psychology, 28*, 335-354.

Sallis, J. F., Hovell, M. F., Hofstetter, C. R., Elder, J. P., Hackley, M., Caspersen, C. J., & Powell, K. E. (1990). Distance between homes and exercise facilities related to frequency of exercise among San Diego residents. *Public Health Reports, 105*, 179-185.

Sallis, J. F., Bauman, A., & Pratt, M. (1998). Environmental and policy interventions to promote physical activity. *American Journal of Preventative Medicine, 15,* 379-397.

Sallis, J. F., & Owen, N. (1999). *Physical Activity and Behavioral Medicine.* Thousand Oaks, CA: Sage Publications.

Sallis, J.F., Prochaska, J.J., & Taylor, W.C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine & Science in Sports & Exercise, 32,* 5, 963-975.

Salmon, E., Owen, N., Bauman, A., Schmitz, M. K., & Booth, M. (2000). Leisure-time, occupational, and household physical activity among professional, skilled, and less-skilled workers and homemakers. *Preventative Medicine, 30*, 191-199.

Satariano, W. A., Haight, T. J., & Tager, I. B. (2002). Living arrangements and participation in leisure-time physical activities in an older population. *Journal of Aging and Health, 14,* 427-451.

Scholz, U., Knoll, N., Sniehotta, F. F., & Schwarzer, R. (2006). Physical activity and depressive symptoms in cardiac rehabilitation: Long-term effects of a self-management intervention. *Social Science and Medicine, 62,* 109-120.

Searle, M. S., Mahon, M. J., Iso-Ahola, S. E., Sdrolias, H. A., & van Dyck, J. (1995). Enhancing a sense of independence and psychological well-being in the elderly: A field experiment. *Journal of Leisure Research, 27*, 107-124.

Searle, M. S., Mahon, M. J., Iso-Ahola, S. E., Sdrolias, H. A., & van Dyck, J. (1998). Examining the long term effects of leisure education on a sense of independence and psychological well-being among the elderly. *Journal of Leisure Research, 30*, 331-340.

Seeman, T. E., Berkman, L. F., Charpentier. P. A., Balzer, D. G., Albert, M. S., & Tinetti, M. E. (1995). Behavioral and psychosocial predictors of physical performance: McArthur studies of successful aging. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 50,* 177-183.

Seligman, M. E. P. (1975). *Helplessness: On depression, development, and death.* San Francisco, CA: W.H. Freeman and Company.

Sevick, M. A., Dunn, A. L., Morrow, M. S., Marcus, B. H., Chen, G. J., & Blair, S. N. (2000). Cost-effectiveness of lifestyle and structured exercise interventions in sedentary adults: Results of project ACTIVE. *American Journal of Preventative Medicine, 19,* 1-8.

Shavelson, R. J., Hubner, J. J., & Stanton, G. C. (1976). Validation of construct interpretations. *Review of Education and Research, 46,* 407-441.

Shaw, R. M., Helmes, E., & Mitchell, D. (2006). Age related change in visual, spatial and verbal memory. *Australasian Journal on Ageing, 25,* 14-19.

Shephard, R. J. (2003). Limits to the measurement of habitual physical activity by questionnaires. *British Journal of Sports Medicine, 37,* 197-206.

Skender, M. L., Goodrick, G. K., Del Junco, D. J., Reeves, R. S., Darnell, L., Gotto, A. M., & Foreyt, J. P. (1996). Comparison of 2-year weight loss trends in behavioural treatments of obesity: Diet, exercise, and combination interventions. *Journal of the American Dietetic Association*, *96,* 342-346.

Sloan, N. (2002). *The importance of gross motor coordination in adolescent boys self-perceptions and level of physical activity.* Unpublished dissertation, Edith Cowan University, Western Australia.

Smith, B. J., Bauman, A. E., Bull, F. C., Booth, M. L., & Harris, M. F. (2000). Promoting physical activity in general practice: A controlled trial of written advice and information materials. *British Journal of Sports Science*, *34,* 262-267.

Sorensen, M., Anderssen, S., Hjerman, I., Holme, I., & Ursin, H. (1997). Exercise and diet interventions improve perceptions of self in middle-aged adults. *Scandinavian Journal of Medicine and Science in Sports, 7,* 312-320.

Speck, B. J., & Looney, S. W. (2001). Effects of a minimal intervention to increase physical activity in women: Daily activity records. *Nursing Research, 50,* 374-378.

Spence, J. C., & Blanchard, C. (2001). Publication bias in sport and exercise psychology: The games we play. *International Journal of Sports Psychology, 32,* 386-399.

Standage, M., Duda, J. L., & Ntoumanis, N. (2003). A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions. *Journal of Educational Psychology, 95,* 97-110.

Standage, M., Duda, J. L., & Ntoumanis, N. (2005). A test of self-determination theory in school physical education. *British Journal of Educational Psychology, 75,* 411-433.

Stein, C., Fisher, L., Berkey, C., & Colditz, G. (2007). Adolescent Physical Activity and Perceived Competence: Does Change in Activity Level Impact Self-Perception? *Journal of Adolescent Health, 40*, 5, 462-470.

Stephenson, J. Bauman, A., Armstrong, T., Smith, B., & Bellew, B. (2000). *The Costs of Illness Attributable to Physical Inactivity in the Australian Adult Population: A preliminary study.* Commonwealth of Australia, Canberra.

Steptoe, A., Doherty, S., Rink, E., Kerry, S., Kendrick, T., & Hilton, S. (1999). Behavioural counselling in general practice for the promotion of healthy behaviour among adults at increased risk of coronary heart disease: Randomised trial. *British Medical Journal, 319,* 943-947.

Stevens, W., Hillsdon, M., Thorogood, M., & McArdle, D. (1998). Cost-effectiveness of a primary care based physical activity intervention in 45-74 year old men and women: A randomised controlled trial. *British Journal of Sports Medicine, 32,* 236-241.

Stewart, A. L., Verboncoeur, C. J., McLellan, B. Y., Gillis, D. E., Rush, S., Mills, K. M., King, A. C., Ritter, P., Brown, B. W., & Bortz, W. M. (2001). Physical activity outcomes of CHAMPS II: A physical activity promotion program for older adults. *Journal of Gerontology Series A: Biological Sciences and Medical Sciences, 56,* 465-470.

Tan, E. J., Xue, Q. L., Li, T., Carlson, M. C., & Freid, L. P. (2006). Volunteering: A physical activity intervention for older adults--The experience corps program in Baltimore. *Journal of Urban Health, 83,* 954-969.

Taylor, A. H., Cable, N. T., Faulkner, G., Hillsdon, M., Narici, M., & Van Der Bij, A. K. (2004). Physical activity and older adults: A review of health benefits and the effectiveness of interventions. *Journal of Sports Sciences, 22,* 703-725.

Taylor, A. H., & Fox, K. R. (2005). Effectiveness of a primary care exercise referral intervention for changing physical self-perceptions over 9 months. *Health Psychology, 24,* 11-21.

Telama, R., Yang, X., Laakso, L., & Viikari, J. (1997). Physical activity in childhood and adolescence as predictor of physical activity in young adulthood. *American Journal of Preventative Medicine, 13,* 317-323.

The United Nations (2006). *World Population Prospects: The 2004 Revision Volume III Analytical Report.* (United Nations Publication, Sales No. E.05.XIII.7).

Thogerson-Ntoumanis, C., & Ntoumanis, N. (2006). The role of self-determined motivation in the understanding of exercise-related behaviours, cognitions and physical self-evaluations. *Journal of Sports Sciences, 24,* 393-404.

Trost, S. G., Owen, N., Bauman, A. E., Sallis, J. F., & Brown, W. (2002). Correlates of adults' participation in physical activity: review and update. *Medicine and Science in Sports and Exercise, 34,* 1996-2001.

Tsutsumi, T., Don, B. M., Zaichowsky, L. D., & Delizonna, L. L. (1997). Physical fitness and psychological benefits of strength training in community dwelling older adults. *Applied Human Science: Journal of Physiological Anthropology, 16,* 257-266.

Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In M. Zanna (Ed.), *Advances in experimental social psychology,* (pp. 271–360). New York: Academic Press.

Vallerand, R. J., & Fortier, M. S. (1998). Measures of intrinsic and extrinsic motivation in sport and physical activity: A review and critique. In J. L. Duda (Ed.), *Advances in sport and exercise psychology measurement,* (pp.81-101). Morgantown WV: Fitness Information Technology, Inc.

Van der Bij, A. K., Laurant, M. G., & Wensing, M. (2002). Effectiveness of physical activity interventions for older adults: A review. *American Journal of Preventative Medicine, 22,* 120-133.

Vanderhorst, R. K., & McLaren, S. (2005). Social relationships as predictors of depression and suicidal ideation in older adults. *Aging and Mental Health, 9,* 517-525.

Van Eldern-Van Kemenade, T., Maes, S., & Van Den Broek, Y. (1994). Effects of a health education programme with telephone follow-up during cardiac rehabilitation. *British Journal of Clinical Psychology, 33,* 367-378.

Vanreusel, B., Renson, R., Beunen, G., Claessens, A. L., Lefevre, J., Lysens, R., & Vanden Eynde, B. (1997). A longitudinal study of youth sport participation and adherence to sport in adulthood. *International Review for the Sociology of Sport, 32,* 373-387.

Ventura, A. K., Loken, E., Mitchell, D. C., Smiciklas-Wright, H., Birch, L. L. (2006). Understanding reporting bias in the dietary recall data of 11-year-old girls. *Obesity, 14,* 1073-1084.

Von Ah, D., Ebert, S., Ngamvitroj, A., Park, N., & Kang, D. (2004). Predictors of health behaviours in college students. *Journal of Advanced Nursing, 48,* 463-474.

Wankel, L. M., Mummery, K., Stephens, W., & Craig, C.L. (1994). Prediction of physical activity intention from social psychological variables: Results from the Campbell's survey of well-being. *Journal of Sport and Exercise Psychology, 16,* 56-69.

Washburn, R. A., & Ficker, J. (1999). Physical activity scale for the elderly (PASE): The relationship with activity measured by a portable accelerometer. *Journal of Sports Medicine and Physical Fitness, 39,* 473-483.

Washburn, R. A., Smith, K. W., Jette, A. M., & Janney, C. A. (1993). The physical activity scale for the elderly (PASE): Development and evaluation. *Journal of Clinical Epidemiology, 46,* 153-162.

Weiss, R.S. (1974). The provisions of social relationships. In Z. Rubin (Ed.), *Doing unto others* (pp. 17-26). Englewood, NJ: Prentice Hall.

Werts, C. E., Jöreskog, K. G., & Linn, R. L. (1971). Comment on "The estimation of measurement error in panel data". *American Sociological Review, 36*, 110-113.

Westerterp, K. R., Meijer, G. A., Tanssen, E. M., Saris, W. H., & Ten Hoor, F. (1992). Long-term effect of physical activity on energy balance and body composition. *British Journal of Nutrition, 68,* 21-30.

Wheaton, B., Muthen, B., Alwin, D. F., & Summers, G. F. (1977). Assessing reliability and stability in panel models. *Sociological Methodology, 8,* 84-136.

White, R.W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review, 66*, 297–333.

Williams, G. C., McGregor, H. A., Sharp, D., & Levesque, C. (2006). Testing and self-determination theory intervention for motivating tobacco cessation: Supporting autonomy and competence in a clinical trial. *Health Psychology, 25,* 91-101.

Wilson, P. M., & Rogers, W. M. (2004). The relationship between perceived autonomy support, exercise regulations and behavioral intentions in women. *Psychology of Sport and Exercise, 5,* 229-242.

Wood, R. H., Reyes, R., Welsch, M. A., Favaloro-Sabatier, J., Sabatier, M., Matthew, L. C., Johnson, L. G., & Hooper, P. F. (2001). Concurrent cardiovascular and resistance training in healthy older adults. *Medicine and Science in Sports and Exercise, 33,* 1751-1758.

World Health Organisation (1999). *Obesity: Preventing and managing the global epidemic: Report of a WHO consultation.* (Technical Report Series, No. 894). Geneva: World Health Organisation Publication.

World Health Organisation (2005). *Preventing chronic diseases: a vital investment: WHO global report.* Geneva: World Health Organisation Publication.

Wright, S. (1921). Correlation and causation. *Journal of Agricultural Research, 20,* 557-585.

Wright, S. (1934). The method of path coefficients. *The Annals of Mathematical Statistics, 5,* 161-215.

Yamuachi, H., & Tanaka, K. (1998). Relations of autonomy, self-referenced beliefs and self-regulated learning among Japanese children. *Psychological Reports, 82,* 803-816.

Yancey, A. K., McCarthy, W. J., Harrison, G. G., Wong, W. K., Siegel, J. M., & Lesilie, J. (2006). Challenged in improving fitness: Results of a community-based, randomized, controlled lifestyle change intervention. *Journal of Women's Health*, *15,* 412-429.

Yanek, L. R., Becker, D. M., Moy, T. F, Grittelsohn, J., & Koffman, D. M. (2001). Project Joy: Faith based cardiovascular health promotion for African American women. *Public Health Reports, 116,* 68-81.

Appendix A: Ethics Approval, Copies of Consent Forms, Sample Questionnaire Items and Exercise Diaries

Ethics Approval

Dear Alastair,

The ECU Human Research Ethics Committee have reviewed your responses to their concerns and have granted ethics clearance on your project:

03-145 STEWART
Self-Perceptions and Motivation Changes with a Walking Plus Behavioural Intervention Versus a Usual Care Program in Older Adults.

The approval period is from 24 October 2003 to 30 November 2005.

The Graduate School has been informed and they will issue formal notification of approval once your research proposal has been approved. Please note that the submission and approval of your research proposal is a separate process to obtaining ethics clearance and that no data collection can commence until formal notification of both ethics clearance and approval of your proposal has been received.

Please forward one signed paper copy of your finalised application, including all attachments to the ethics office (if this has not already been done).

Please note that the Human Research Ethics Committee has a requirement that all approved projects are subject to monitoring conditions, which include completion of an annual ethics report form. An outline of the monitoring conditions and an ethics report form are attached for your information.

Regards,
Kim Gifkins
Research Ethics Officer
Edith Cowan University
JOONDALUP
Phone: 6304 2170
Email: research.ethics@ecu.edu.au

THE UNIVERSITY OF WESTERN AUSTRALIA

Research Services
Registrar's Office

Nedlands WA 6907
Telephone: (08) 9380 3703
Facsimile: (08) 9380 1075
Email: kkirk@acs.uwa.edu.au
WWW: http//www.acs.uwa.edu.au/research/ahe.html

RA/4/1/0301

6 June 2001

Ms K Cox
Medicine
RPH

Dear Ms Cox

Project: Promoting Physical Activity in the Older Adult - A Community-Based Program

Please be advised that ethical approval of the above project has been granted by the Human Research Ethics Committee.

Whilst the Committee is satisfied that the protocol as submitted has adequate safeguards to protect the rights of individual participants it is the responsibility of the researcher to advise the Committee of any departure from the original protocol which could impact on this ethical approval. Please note that as a condition of this approval you are required to inform the Committee, giving reasons, if the research project is discontinued before the expected date of completion.

The Committee is bound by NHMRC Guidelines to monitor the progress of all approved projects until completion to ensure that they continue to conform to approved ethical standards. Therefore, you will be required to submit annual reports on the human rights aspects of your study. You will also be required, at this stage, to submit copies of advertisements which have been used to recruit subjects for your project. An annual report form will be sent to you twelve months from this date.

Please note that approval has been granted for a period of four years. Initial approval is for a period of one year and thereafter for future periods of one year at a time subject to the receipt of satisfactory annual reports. At the end of the four year period you will be required to complete a new *Application to Undertake Research Involving Human Subjects* should you wish to continue with your research. However, in special circumstances the Chair has the authority to extend the approval period for up to six months in order to complete a project.

Please quote Project No 0301 on all correspondence associated with this study.

Yours sincerely

[redacted]

KATE KIRK
Administrative Officer
(Human Research Ethics Committee)

HREC/APP-PROJ.wp

Participant Information and Consent Form

School of Medicine & Pharmacology
Royal Perth Hospital Unit
Research Studies Unit
Medical Research Foundation Building
Level 3, Rear 50 Murray Street
PERTH Western Australia 6000

Postal Address
GPO Box X2213
PERTH Western Australia 6847
Telephone : 61 8 9224 0237
Facsimile : 61 8 9224 0246
E-mail: kaycox@cyllene.uwa.edu.au

A Community Physical Activity Program for Older Adults
PATH – Physical Activity Time for Health
SUBJECT INFORMATION SHEET

Purpose of the Study

In this project we will evaluate the effectiveness of a walking and promotion package (PATH), and a self-managed physical activity program in a community setting. The aim is to increase the level of physical activity in older adults to 150 minutes of moderate physical activity per week. In the walking and promotion package approach we will develop and implement a physical activity promotion package for 60-80 year old men and women. Trained physical activity coordinators in recreation centres will deliver the PATH package. They will be assisted by trained mentors. In the self-managed approach we will advise participants on how to develop and undertake a moderate physical activity program, in their local area. Our secondary objectives are to determine what health benefits may be derived from this long-term physical activity promotion intervention. These include evaluation of risk factor profiles for cardiovascular disease, body weight, blood pressure, functional capacity psychological health and quality of life.

The study will also evaluate the relative safety of carefully supervised physical activity programs in older individuals.

Subjects and Groups

Approximately 1200 healthy men and women aged 60-80 years will be required for this study and each will be involved for a total period of 12 months. There will be 2 different physical activity groups. The type of physical activity program you do will be decided by random selection (by chance) of your local recreation centre. You will be allocated to a centre according to the proximity of your home to that centre. The experimental design of the study does not allow you to select which centre you attend. Approximately 6 centres will be allocated to give advice on physical activity with information about local programs and resources. Another 6 centres will conduct walking sessions 3 times a week for 3 months and then once a week for another 3 months. These centres will also give out newsletters. At the end of this period participants at all centres will be evaluated and asked to continue their physical activity program without supervision for a further 6 months. After which a last set of evaluations will be conducted.

Procedures

Screening

As a participant you will be initially screened by telephone by trained staff at your local community centre. You will be asked to provide a medical certificate from your doctor stating that you are healthy and fit to participate in a moderate exercise program.

Familiarisation and Baseline

Once you have fulfilled the initial criteria for inclusion you will be asked to visit your local centre to complete questionnaires to provide information about your usual activity, diet, alcohol intake, medications etc. You will also have height, weight, girths and fitness evaluated. Blood pressure at entry will be less than 160/100 mm Hg. Those participants who meet the entry criteria will be invited to participate in the study and will enter a 3-5 week 'run in' to familiarise them with procedures and measurements

Body composition and blood pressure

Height, weight, girths (to estimate body fat distribution) and blood pressure will be measured. During baseline you will be shown how to use a home blood pressure monitor and asked to measure blood pressure during the baseline and follow-up periods.

Fitness and physical activity assessments

In order to assess the level of fitness you will be asked to complete a functional fitness tests. The test includes (a) 30-s chair stand, (b) arm curl, (c) chair sit-and-reach, (d) back scratch, and (e) 2.5 metre up-and-go. You will also be asked to participate in a 6-min walk test. Heart rate will be monitored throughout all the tests. We may stop the test at any time because of signs of fatigue or you may stop because of personal feelings of fatigue or discomfort. There exists the possibility of certain changes occurring during the fitness tests. They include abnormal blood pressure, fainting, disorder of heartbeat, and in very rare instances, heart attack, stroke, or death. Every effort will be made to minimize these risks by evaluation of preliminary health information (Doctor’s medical certificate) relating to your health and fitness and by observations during testing. Trained personnel are available to deal with unusual situations if they arise. You are free to stop the test at any stage.

To assess the amount of activity you do you may be asked to complete activity diaries and may be asked to wear an activity meter for one week.

Lifestyle Psychological Health and Well-being

You will be asked to maintain diet and other aspects of your lifestyle largely unchanged throughout the study. Life-style questionnaires including those that measure psychological aspects and well-being will be administered before and after 6 and 12 months intervention to assess any changes in physical activity or changes to quality of life

Focus Groups

You may be asked to participate in a focus group (group discussion) designed to enable us to find the best ways of helping you to be successful in your physical activity program. These sessions will be recorded on audio tape.

Content and Process Evaluation

After 6 and 12 months you will be asked to complete questionnaires on the content of the program and the elements of process evaluation.

Exercise Intervention

Walking plus PATH

If you are in this group you will be asked to attend your local community centre 3 times/week for 3 months. All exercise sessions will start with a 5-minute warm-up and a 5-minute stretching session, 40 minutes walking at a moderate intensity (about 55-65% or your best effort), a 5-minute cool down and 5 minutes of stretching. After 3 months you will attend sessions once a week for further 3-months. Newsletters will be given out during some of the supervised sessions. At the end of 6 months you will be asked to continue doing the same amount of exercise but without supervision and with choice of activity. You will be asked to complete exercise logs, and exercise diaries for the unsupervised sessions. During the 6 months of unsupervised exercise these records will be returned in prepaid envelopes.

In order to meet the costs of employing the coordinators the participants in the exercise intervention group will be asked to pay $2 per session. This will amount to a maximum of $6/week for the first 3 months a $2/week for the following 3 months. You will also be assigned a mentor who will assist you by giving advice on how to overcome the barriers to being physically active.

Self-Managed Group

If you are in this group you will attend a 2-hour session on how to exercise, exercise alternatives, safe exercise and asked to exercise at the same frequency, duration and intensity as the other group. You will be given an information package including 'Walk There Today' (National Heart Foundation, 2003), the 'Add Life to Your Years' booklet (SRC, Seniors Recreation Council 2003), and information about your centre's activities. You will be advised to do the same amount of activity at the same intensity as the other group, but you will have a choice of activity and where you do it. You will be advised of the resources available in your community centre. You will be asked to record any exercise done. At 6 months you will attend another session to review your activities and be given advice on how to continue for another 6 months. At baseline and after 6 and 12 months you will undergo the same evaluations as the other group.

Disability, Injury and Illness

You will also be asked to keep a record of illness, medications, injury and any falls that are sustained.

Follow-Up of Withdrawals from the program

Individuals who withdraw from the program will be asked to complete a telephone interview-questionnaire within 2 weeks of them 'withdrawing' to allow us to obtain more in-depth information of why people give up an exercise program.

All assessments for both groups will be done at baseline and repeated at 6 and 12 months.

Group Meeting

All participants will be asked to attend a group meeting before the start of the exercise program so that the project may be explained to them. Photographs and video recordings may be taken for educational and presentation purposes.

At the completion of the study you will be given a full report of all your results. Any abnormal results will be made available to you and your nominated doctor. Participation in this study will give you the opportunity to undergo a physical fitness assessment and have an exercise program planned, monitored and assessed for you.

Through your involvement and completion of the study researchers will be in a better position to determine what types of exercise programs are safe, appropriate, acceptable and effective in reducing cardiovascular risk factors in older adults.

All personal information collected in this study will be kept strictly confidential. If at any time you wish to withdraw from the study, you are free to do so. If you have any concerns about this study or require further information please do not hesitate to contact, *Dr Kay Cox on* [redacted] *or Professor Ian Puddey on* [redacted] *at the University Department of Medicine.*

THE UNIVERSITY OF WESTERN AUSTRALIA
FACULTY OF Medicine and Dentistry

School of Medicine & Pharmacology
Royal Perth Hospital Unit
Research Studies Unit
Medical Research Foundation Building
Level 3, Rear 50 Murray Street
PERTH Western Australia 6000

Postal Address
GPO Box X2213
PERTH Western Australia 6847

Telephone : 61 8 9224 0237
Facsimile : 61 8 9224 0246
E-mail: kaycox@cyllene.uwa.edu.au

Promoting Physical Activity in the Older Adult – A Community-Based Program.

CONSENT FORM FOR PARTICIPATION

1. I have read a summary of the study and its nature has been fully explained to me. I consent to take part.
2. I understand that I will undergo functional fitness tests at the beginning of the study and after 6 and 12 months. The potential risks and discomforts of these tests have been explained to me and I am aware of the possibility of certain changes occurring during the test including abnormal blood pressure, fainting, disorder of heart beat, and in very rare instances, heart attack, stroke or death. I have been informed that every effort will be made to minimize these risks by preliminary medical examination and assessment (by my medical practitioner) and that during the test my progress and heart rate will be monitored and that the test will be supervised by trained staff. I understand my participation is voluntary and I am free to deny consent or stop the test at any point.
4. I understand I will be required to measure my resting blood pressure using a home blood pressure monitor for one week before the study, and at 6 and 12 months
5. I know I will be asked to complete activity diaries and may be asked to wear an activity meter for 7 days at 0, 6 and 12 months.
6. It has been explained that I will be asked to do 3 exercise sessions per week for 60 minutes duration with 40 minutes at moderate intensity. Also that I may be asked to attend supervised sessions 3 times a week for the first 3 months followed 1 session supervised and 2 sessions per week at home. Or that during this 6 months I will be asked to complete 3 sessions a week of unsupervised physical activity. I know I will be asked to continue the same level of activity for a further 6 months unsupervised, (a total of 12 months).
7. I understand that if I am in the walking group I will be assigned a mentor.
8. I know that I will be asked to complete questionnaires about my lifestyle, diet, psychological health and well-being, the content and process of the program.
9. I understand that if I withdraw from the program I will be asked to complete a telephone questionnaire.
10. I know that I will be asked to attend a group meeting at the start of the study.
11. I know that I may be asked to participate in a Focus Group discussion during the study.
12. I understand that if I am in the walk program group I will be asked to pay $2.00 per supervised session of physical activity during the first 6 months of the study (maximum of $6 per week).

13. I understand that all personal information collected during the study will be held strictly confidential.
13. I understand that photographs and video recordings may be taken for educational purposes and presentation of reports.
14. I understand that I am free at any time to withdraw consent to further participation without prejudice in any way. In the case that I withdraw from participation my record is to be destroyed unless I agree otherwise.
15. I agree that any abnormal results will be made available to me and my nominated doctor.

Your participation in this study does not prejudice any right to compensation, which you may have under statute or common law.
Any questions concerning the *Promoting Physical Activity in the Older Adult – A Community-Based Program,* study can be directed to: *or Dr Kay Cox on* [redacted] *or Professor Ian Puddey on* [redacted] *at the University Department of Medicine.*

I (please print)...………………have read the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this activity, realising that I may withdraw at any time without reason and without prejudice.
I understand that all information provided is treated as strictly confidential and will not be released by the investigator unless required to by law.
I agree that research data gathered for the study may be published provided my name or other identifying information is not used.

...................................……………….. ....
(Signature of Participant) (Date)

...................................……………….. ....
(Investigator) (Date)

The Human Research Ethics Committee at the University of Western Australia requires that all participants are informed that, if they have any complaint regarding the manner in which a research project is conducted, it may be given to the researcher or, alternatively, to the Secretary, Human Research Ethics Committee, Registrar's Office, University of Western Australia, 35 Stirling Highway, Crawley, WA. 6009, (telephone number, 9380 3703). All study participants will be provided with a copy of the Information Sheet and Consent Form for their personal records.

Screening Questionnaire

ID : | | | | |

University of Western Australia Department of Medicine and Pharmacology (RPH)

Community Physical Activity Program for Seniors

PATH – *Physical Activity Time for Health* Project 2003-2005

Screening Questionnaire

Thank you for your interest in participating in this important study designed to assess the best methods for encouraging older adults to increase their levels of physical activity. Approximately 50 subjects will be chosen for the study at this centre after analysis of answers to the following questionnaire.
The questionnaire should take approximately 10 minutes to complete.

If you have any queries please call Kay Cox on tel: 9224 0237.

1. What is your name? ____

2. Your date of birth: Day _________ Month _________ Year ________

3. What is your present age (as of last birthday): ___________ Years

4. Today's date : _____________________

5. Telephone number where you can be contacted:

   At work: _______________ Most convenient time: ____________

   At home: _______________ Most convenient time: ____________

N.B. ALL INFORMATION WILL REMAIN STRICTLY CONFIDENTIAL

FOR OFFICE USE ONLY:

DATE SCREENED		Pressure Setting mmHg
HEIGHT	cms	
$HEIGHT^2$	m^2	
WEIGHT	kg	
BMI	kg/m^2	
BP1	mmHg	HR
BP2	mmHg	HR
BP3	mmHg	HR
BP4	mmHg	HR
MEAN BP	mmHg	MEAN HR INCLUDE / EXCLUDE
		REASON FOR

YOUR HEALTH

6. Has your doctor ever said you have a heart condition <u>and</u> that you should only do physical activity recommended by a doctor? YES NO

7. Do you feel pain in your chest when you do physical activity? YES NO

8. In the past month, have you had chest pain when you were not doing physical activity? YES NO

9. Do you lose your balance because of dizziness or do you ever lose consciousness? YES NO

10. Do you have a bone or joint problem (for example back, knee or hip) that could be made worse by a change in your physical activity? YES NO

11. Is your doctor currently prescribing drugs for your blood pressure or heart condition? YES NO

12. Do you know of <u>any other reason</u> why you should not do physical activity? YES NO

If you answered YES to any of the above questions, please provide details below.

____

MENSTRUAL HISTORY (females only, males please go to question 17)

13. Are you presently taking any form of oral contraceptive? YES NO

14. Have you been through menopause? YES NO

15. Have you had a period in the last year? YES NO

16. Are you taking or have you ever taken oestrogen replacement after menopause? YES NO

If YES, how long for? ____________________

When was this? ____________________

17. Do you or have you ever taken any calcium supplements in the past 6 months? YES NO

Brand Name ______________ Amount ________ How Often __________

18. USE OF NON-PRESCRIBED MEDICINES
HOW OFTEN, ON AVERAGE DO YOU TAKE THE FOLLOWING?
(Circle the appropriate response for <u>each</u> of the categories A to H)

	Rarely/ never	1-3 times per month	1-3 times per week	4-6 times per week	At least once a day
A. Painkillers (eg Aspirin, Bex)	1	2	3	4	5
B. Tranquilizers (eg Valium)	1	2	3	4	5
C. Medicine for indigestion (eg. Quickeze, Enos, etc)	1	2	3	4	5
D. Vitamin tablets	1	2	3	4	5
E. Sleeping pill	1	2	3	4	5
F. Salt tablets	1	2	3	4	5
G. Trimolets (or other weight reducing tablets)	1	2	3	4	5
H. Any other medicine prescribed by a doctor	1	2	3	4	5

19. PLEASE LIST ALL PRESCRIBED AND NON-PRESCRIBED MEDICATIONS WHICH YOU ARE PRESENTLY TAKING.

____

____

____

____

YOUR DRINKING DETAILS

20. HOW FREQUENTLY DO YOU USUALLY DRINK THE FOLLOWING ALCOHOL-
CONTAINING BEVERAGES? (Please circle the appropriate response)

	Every day	5-7 times per week	1-4 times per week	1-4 times per month	Less than once per month
A. Beer	1	2	3	4	5
B. Wine	1	2	3	4	5
C. Spirits	1	2	3	4	5

21. WHAT IS THE HEAVIEST THAT YOU HAVE EVER DRUNK FOR A PERIOD OF THREE MONTHS OR MORE?

Please write the average amount you were drinking per week in the table below.

	AMOUNT PER WEEK (EG NUMBER OF BOTTLES, CANS, GLASSES, ETC)
BEER	
WINE	
SPIRITS	

22. FOR HOW LONG HAVE YOU CONSUMED THE AMOUNT OF ALCOHOL-CONTAINING BEVERAGES YOU NOW CONSUME?

For less than one year________________ 1

1-2 years___________________________ 2

2-5 years___________________________ 3

More than 5 years___________________ 4

23. ON WHICH DAY(S) WERE ALCOHOL-CONTAINING BEVERAGES CONSUMED?

(Please tick the appropriate columns)

	Last Week	On an Average Week
Monday		
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		
Sunday		

24. PLEASE WRITE THE DETAILS OF THE PREVIOUS WEEK'S DRINKING IN THE TABLE BELOW

Please indicate as accurately as possible, the <u>type</u> and <u>amount</u> of beverage consumed.

TYPE OF BEVERAGE:

Examples: BEER: Swan Lager, Emu Draft, Tooheys Blue etc

WINE: Sherry, Claret Chardonnay etc

SPIRITS: Gin, Whisky, Baileys, Midori etc.

AMOUNT CONSUMED: Indicate the number of bottles, glasses, cans etc. whichever measure you are most familiar with.

DAY	DATE	LAST WEEK	AN AVERAGE WEEK
Example: Monday	*5/3/98*	*1 bottle of Swan lager 3 glasses of Moselle*	*2 cans of Swan lager 1 Nip of whisky*

OFFICE USE ONLY:

TOTAL LAST WEEK

TOTAL AVERAGE WEEK

YOUR SMOKING HISTORY

25. DO YOU <u>NOW</u> SMOKE CIGARETTES AT ALL?

    Circle the number next to the correct answer.

    YES_______1 NO________2

26. HAVE YOU EVER SMOKED ONE OR MORE CIGARETTES PER DAY FOR AS LONG AS ONE YEAR?

    Circle the number next to the correct answer.

    YES_______1 NO________2

    If your answer was YES, please also complete the following questions.

27. DO YOU NOW SMOKE <u>AT LEAST</u> ONE CIGARETTE PER DAY?

    YES_______1 NO________2

    If <u>Yes</u>, please answer question (a) below.

    If <u>No</u>, please answer question (b) below.

    (a) HOW MANY CIGARETTES DO YOU USUALLY SMOKE NOW?

    _______cigarettes per day

    or _______ounces tobacco, per week

    or _______grams tobacco, per week

    (b) HOW LONG IS IT SINCE YOU LAST SMOKED AT LEAST ONE CIGARETTE PER DAY?

    _______months

    or _______years

28. IF YOU ARE AN EX-SMOKER OF CIGARETTES HOW MANY <u>DID</u> YOU USUALLY SMOKE WHEN YOU WERE SMOKING?

    _______cigarettes per day

    _______ounces tobacco, per week

    _______grams tobacco per week

29. DO YOU <u>NOW</u> SMOKE A PIPE OR CIGARS?

    No______________ 1

    A pipe only________ 2

    Cigars only________ 3

    A pipe and cigars___ 4

YOUR LEVEL OF PHYSICAL ACTIVITY

30. PHYSICAL ACTIVITY AT WORK (Paid or Volunteer)

(a) Occupation ____________________________ Paid / Volunteer (Please circle)
(if you don't work at all place NA in the space above and go to question 31)

(b) Average hours spent at work each week ____________________

(c) Number of days spent at work each week ____________________

(d) **Recall an average** day at work in the **past week** and record the amount of activity during that day. (none = 0 hours)

ACTIVITY		LEVEL OF EFFORT REQUIRED				
Description	Total hours spent/day	No Effort	Little Effort	Tiring	Very Tiring	Exhausting
		1	2	3	4	5
Sitting						
Standing						
Walking (slowly)						
Walking (briskly)						
Lifting/Carrying						
Digging						
Moving furniture						
General Office Work						
Cooking						
Typing						
Waitressing						
Strenuous repairs						
Driving						
Gardening						
Vacuuming						
Sweeping						
Heavy labour						
Child Care						
Cleaning						
Other please specify						

31. <u>TIME SPENT ON HOUSEHOLD CHORES</u>

a) Recall the **past week's** activities around the house and answer the following question
PLEASE ANSWER EACH ITEM.

ACTIVITY	FREQUENCY (times /week)	INTENSITY (effort needed)					DURATION (in minutes)
	eg 2 per week	1 = none 2 = little effort 3 = tiring 4 = very tiring 5 = exhausting (Please tick appropriate columns)					eg 25 mins
		1	2	3	4	5	
Washing							
Cleaning							
Sweeping							
Vacuuming							
Gardening (light)							
Gardening (heavy digging)							
Lifting (light)							
Lifting (heavy)							
Carrying (light)							
Carrying (heavy)							
Lawn Mowing							
Child Care							
Ironing							
Bed Making							
Other- specify							

b) Is this typical of your normal week's activities? Yes No
(Circle appropriate answer).

c) If no, why? ____

____

32. TIME SPENT IN PHYSICAL LEISURE ACTIVITIES

a) Recall the past week's **physical leisure activities** and complete the following details. PLEASE ANSWER EACH ITEM.

ACTIVITY	FREQUENCY (times /week)	INTENSITY (effort needed)					DURATION (in minutes)
	eg 2 per week	1 = none 2 = little effort 3 = tiring 4 = very tiring 5 = exhausting (Please tick appropriate columns)					eg 25 mins
		1	2	3	4	5	
Walking less than 4 mph/6.5kph (moderate pace)							
Brisk walking over 4 mph/6.5kph							
Cycling less than 11mph (recreational/ slow)							
Cycling more than 11mph (fast)							
Golf (flat course)							
Golf (hilly course)							
Stair climbing (500+)							
Skipping							
Exercises							
Aerobics							
Aqua-aerobics							
Ballroom dancing							
Folk dancing							
Bootscooting							
Prime Movers							
Weight training							
Running							
Horse Riding							
Swimming							

PHYSICAL LEISURE ACTIVITIES continued.

ACTIVITY	FREQUENCY (times /week)	INTENSITY (effort needed)					DURATION (in minutes)
	eg 2 per week	1 = none 2 = little effort 3 = tiring 4 = very tiring 5 = exhausting (Please tick appropriate columns)					eg 25 mins
		1	2	3	4	5	
Tennis (singles)							
Tennis (doubles)							
Squash							
Croquet							
Basketball/ Netball							
Hockey							
Cricket							
Softball							
Sailing							
Windsurfing/ Boardriding							
Body Surfing							
Rollerskating/ Ice Skating							
Canoeing/ Rowing							
Lawn Bowls							
Ten-pin bowling							
Supervised (circuit) gym work							
Other-specify							

b) IS THIS TYPICAL OF YOUR USUAL WEEK? YES NO
(Circle appropriate answer).

c) If no, why? ______________________________

33. a) IF YOU ARE NOT PRESENTLY ENGAGED IN ANY PHYSICAL ACTIVITY OUTSIDE WORK, HAVE YOU BEEN IN THE PAST 12 MONTHS?
(Circle appropriate response.)

YES NO

b) IF YES, WHEN WAS THE LAST TIME?

____

c) WHAT ACTIVITY/ACTIVITIES DID YOU ENGAGE IN?

____

____

____

____

d) HOW MANY TIMES PER WEEK?
(Tick the appropriate box)

1. 1-2 ☐
2. 3-5 ☐
3. 6-7 ☐
4. 7+ ☐

e) HOW LONG WAS EACH SESSION?
(Tick the appropriate box)

1. 0-15 minutes ☐
2. 15-30 ☐
3. 30-45 ☐
4. 45-60 ☐
5. 60+ ☐

f) WHAT WAS THE INTENSITY?
(Circle the appropriate number)

1. No effort ☐
2. Little effort ☐
3. Tiring ☐
4. Very tiring ☐
5. Exhausting ☐

34. HOW FIT DO YOU FEEL AT THE MOMENT?
(Tick the appropriate box)

1. Unfit ☐
2. Below average ☐
3. Average ☐
4. Above average ☐
5. Very fit ☐

35. Are you prepared to participate in an exercise programme?	YES	NO
36. Are you able to attend 3 organised exercise sessions per week at a central venue?	YES	NO
37. Are you available to participate for 6 months?	YES	NO
38. Are you able to walk for 30 minutes?	YES	NO

Please ensure you have answered all questions

THANK YOU FOR YOUR TIME.

Baseline Health and Lifestyle Questionnaire

0 / 6 / 12 months ID : | | | | |

University of Western Australia Department of Medicine and Pharmacology (RPH)
Community Physical Activity Program for Seniors

PATH –*Physical Activity Time for Health* Project 2003-2005

Health and Lifestyle Questionnaire - Baseline

PLEASE WRITE TODAY'S DATE HERE

Day ________________ Month _____________ Year _______________

SECTION I : INFORMATION ABOUT YOU

1. DATE OF BIRTH

   Day ________________ Month _____________ Year _______________

2. WHAT IS YOUR PRESENT AGE (as of last birthday) _______________Years

3. WHERE WAS YOUR FATHER BORN? ____________________________
   (Write state or country)

4. WHERE WAS YOUR MOTHER BORN? ____________________________
   (Write state or country)

5. WHERE WERE YOU BORN? ____________________________________
   (Write state or country)

6. IF YOU WERE NOT BORN IN AUSTRALIA, HOW LONG HAVE YOU LIVED IN AUSTRALIA?
   ____________ Years

7. WHICH OF THE FOLLOWING GROUPS BEST DESCRIBES YOUR ETHNIC BACKGROUND?

   Australian Aboriginal 1

   Asian 2

   White (European) 3

   Black African 4

   Other (please specify) .... 5 ______________________________

8 WHAT IS YOUR **CURRENT** MARITAL STATUS?

Single (never married)	1
Married	2
Widowed	3
Divorced	4
Separated	5
De-facto	6

9 HOW MANY CHILDREN DO YOU HAVE?
(either your own or adopted)

_______________ child/children

How many children are currently living at home

_______________ child/children

Do you have any other dependents (children) living
in your household? YES ❑ NO ❑

If YES, how many? ___________________________

Do you have an adult dependent living in your household?

YES ❑ NO ❑

10. WHAT IS THE **HIGHEST** EDUCATIONAL LEVEL THAT YOU AND, IF YOU HAVE BEEN MARRIED, YOUR SPOUSE HAVE **COMPLETED**? (If you are widowed, separated or divorced, give the educational level of your former spouse)

	Yourself	Your spouse
Never attended school	1	1
Primary School	2	2
Some high school	3	3
Passed Junior, Achievement or similar certificate, Leaving Certificate or Matriculation	4	4
Obtained a Trade or Technical Qualification	5	5
Graduate from University or other College of Advanced Education, Masters or Doctoral Degree	6	6

11. A SUMMARY OF YOUR EDUCATIONAL BACKGROUND.
(Please indicate the number of years you have completed at each educational level.

Level	You	Your Spouse
Primary School		
Secondary School		
Technical Trade Studies		
Tertiary Institution (University/Teachers College etc.).		
Total ***(Office Use Only)***		

12. WHAT IS YOUR POSITION AT WORK? (e.g. accountant, bus driver, etc.)

____

SECTION II : YOUR MEDICAL HISTORY

13. Have you ever had any of the following health problems?

			Comments
Heart trouble or chest pain	YES	NO	
Asthma	YES	NO	
Epilepsy	YES	NO	
High Blood Pressure	YES	NO	
Diabetes	YES	NO	
Arthritis	YES	NO	
Kidney Disease	YES	NO	
Joint/Muscular or Back Problems	YES	NO	
Stroke	YES	NO	
Osteoarthritis	YES	NO	
Rheumatoid arthritis	YES	NO	
Any other serious illnesses, operations or	YES	NO	

14. Are you presently taking any form of oral contraceptive? YES NO

If YES, how long for __________ years   What type ______________

Dose _________________

15. Have you been through menopause?
(no period for 12 months or longer)   YES   NO

16. Are you currently on Hormone Replacement Therapy (HRT)?   YES   NO

If YES, when did you start? ______________   Type (name) ________________

Dose ______________________

How long have you been consistently taking HRT? ______________________

17. Have you ever taken Hormone Replacement Therapy (HRT)?   YES   NO

If YES, how long for? ______________   When was this? _________________

Type ____________________________   Dose ___________________________

If you have stopped taking HRT, why did you stop taking it? ________________

____

____

18. Do you or have you ever taken any calcium supplements
in the past 6 months?   YES   NO

Brand Name _______________   Amount __________   How Often ________________

SECTION III : YOUR LIFESTYLE

19. When you were younger, did you enjoy participating in physical activity and sports? YES NO

If NO, why not ____

____

20. What has been your best sporting/physical activity experience?

____

____

21. What has been your worst sporting/physical activity experience?

____

____

22. HAVE YOU EVER PARTICIPATED IN COMPETITIVE SPORT?

No 1

Yes 2

IF YES, WHAT SPORTS?

1. ____

2. ____

3. ____

4. ____

23. AT WHAT LEVEL DID YOU PARTICIPATE?
(Circle only the highest level)

(a)	School	1
(b)	Club	2
(c)	State	3
(d)	National	4
(e)	International	5

24. FOR HOW MANY YEARS DID YOU PARTICIPATE IN COMPETITIVE SPORT?

____

25. HOW MANY YEARS **SINCE** YOU WERE **LAS**T INVOLVED IN A VIGOROUS PHYSICAL ACTIVITY?

____

HOW MANY HOURS PER WEEK TRAINING DID YOU DO?

____

26. MARK THE ITEM BELOW WHICH BEST DESCRIBES YOUR CURRENT EXERCISE PATTERN.

Substantial and regular	1
Moderate and regular	2
Moderate and irregular	3
Physically inactive	4

27. WHAT IS YOUR MODE OF COMMUTING TO AND FROM WORK?

Walk	1
Bus	2
Bicycle	3
Drive car or vehicle	4
Passenger car/vehicle	5

28. IN A TYPICAL WEEK, OUTSIDE OF WORKING HOURS, HOW MANY HOURS WOULD YOU SPEND IN **VIGOROUS** PHYSICAL EXERCISE?

______________________________ hrs

Name the vigorous physical exercise. 1. ____________________

2. ____________________

3. ____________________

29. HAS YOUR LEVEL OF PHYSICAL ACTIVITY CHANGED NOTICEABLY IN THE PAST 6 MTHS?

No 1

Yes 2

If you answered Yes, please answer the next question (a) below, then go straight to the next question.

(a) HAS YOUR LEVEL OF ACTIVITY INCREASED OR DECREASED?

Increased 1

Decreased 2

30. IN YOUR OPINION ARE YOU MORE PHYSICALLY ACTIVE OR LESS PHYSICALLY ACTIVE THAN MOST PEOPLE YOUR AGE?

Much more active 1
A little more active 2
About as active 3
A little less active 4
Much less active 5

31. Have you attempted to commence an activity program in the last 12 months?

YES NO

If YES:

a) on how many occasions?____________times

b) what program? (walk, gym etc.). ____________________________

c) what was the main reason for stopping the activity?____________

____

32. On a scale of 1 to 5, how would you rate your swimming ability?

Poor	1
Less than average	2
Average	3
Above average	4
Excellent	5

33. On a scale of 1 to 5, how would you rate your walking ability?

Poor	1
Less than average	2
Average	3
Above average	4
Excellent	5

34. HAVE YOU EVER SMOKED AT LEAST ONE CIGARETTE PER DAY FOR AS LONG AS ONE YEAR? (Please circle the number alongside the most correct statement and fill in the blanks)

No 1

Yes, and I am ***currently*** smoking ___________ cigarettes per day

(OR ______ grams of tobacco per week) 2

(OR ______ ounces of tobacco per week) 2

Yes, I ***used*** to smoke __________ cigarettes per day

(OR ______ grams of tobacco per week) 3

(OR ______ ounces of tobacco per week)

but I have not smoked for ______ years 3

35. IF YOU HAVE EVER SMOKED, HOW OLD WERE YOU WHEN YOU FIRST BEGAN TO SMOKE AT LEAST ONE CIGARETTE PER DAY?

______________________________ years old.

36. DO YOU NOW SMOKE A PIPE OR CIGARS?

No 1
A pipe only 2
Cigars only 3
A pipe and cigars 4

37. How frequently do you usually drink the following alcohol containing beverages?

	Every Day	5-7 times per week	1-4 times per week	1-4 times per month	Less than once per month
A. Beer	1	2	3	4	5
B. Wine	1	2	3	4	5
C. Spirits	1	2	3	4	5

38. WHAT IS THE **HEAVIEST** THAT YOU HAVE EVER DRUNK FOR A PERIOD OF THREE MONTHS OR MORE?
Please write the average amount you were drinking **per week** in the table below.

	Amount per week (e.g. Number of bottles, cans, glasses, etc)
Beer	
Wine	
Spirits	

39. FOR HOW LONG HAVE YOU CONSUMED THE AMOUNT OF ALCOHOL-CONTAINING BEVERAGES YOU ***NOW*** CONSUME?

For less than one year 1
1-2 years 2
2-5 years 3
More than 5 years 4

40. ON WHICH DAY(S) WERE ALCOHOL-CONTAINING BEVERAGES CONSUMED?
(Please tick the appropriate columns)

	Last Week	On an Average Week
Monday		
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		
Sunday		

41. PLEASE WRITE THE DETAILS OF THE PREVIOUS WEEK'S DRINKING IN THE TABLE BELOW

Starting from yesterday and working your way back through the week, please indicate as accurately as possible, the <u>type</u> and <u>amount</u> of beverage consumed.

TYPE OF BEVERAGE:

Examples: BEER: Swan Lager, Emu Draft, Tooheys Blue etc

WINE: Sherry, Claret Chardonnay etc

SPIRITS: Gin, Whisky, Baileys, Midori etc.

AMOUNT CONSUMED: Indicate the number of bottles, glasses, cans etc. whichever measure you are most familiar with.

DAY	DATE	LAST WEEK	AN AVERAGE WEEK
Example: Monday	*5/3/98*	*1 bottle of Swan lager* *3 glasses of Moselle*	*2 cans of Swan lager* *1 Nip of whisky*

OFFICE USE ONLY:

TOTAL LAST WEEK

TOTAL AVERAGE WEEK

SECTION IV : YOUR DIET

42. WHICH OF THE FOLLOWING BEST DESCRIBES YOUR **REGULAR** USE OF TEA AND COFFEE? (Please circle the appropriate number).

	Never regularly used	Ex-regular user	Current regular user
A. Tea	1	2	3
B. Coffee	1	2	3

If you are a current regular user, please indicate the number of cups you drink per day **or** per week, whichever is more appropriate.

	Cups per day	Cups per week
Tea		
Coffee		

43. PLEASE INDICATE THE CHANGES IN YOUR EATING HABITS **DURING THE PAST YEAR.**
(Circle the number under the correct answer for each food type)

	Eat more **now**	Eat less **now**	Amount Eaten has not **changed**
A. Total amount of food eaten	1	2	3
B. Meats	1	2	3
C. Animal fat	1	2	3
D. Sweet / starch	1	2	3
E. Vegetables	1	2	3
F. Fruit	1	2	3
G. Salt	1	2	3
H. Dairy products	1	2	3
I. Eggs	1	2	3
J. Fish	1	2	3

44. HOW MUCH DID YOU WEIGH?
(answer in pounds, stones and pounds, or kilograms)

(a) WHEN YOU WERE HEAVIEST

_________ stones _________ pounds **OR** _________ kilograms

(b) AT AGE 21

_________ stones _________ pounds **OR** _________ kilograms

SECTION V : FAMILY MEDICAL HISTORY

45. PLEASE ANSWER THE FOLLOWING ABOUT YOUR FATHER AND MOTHER.

FATHER	***MOTHER***
1. Is he alive or deceased? Alive ....1 Deceased ....2 2. What is your father's age now if alive **or** at death if dead? _________ years	1. Is she alive or deceased? Alive ....1 Deceased ....2 2. What is your mother's age now if alive **or** at death if dead? _________ years

46. HAVE ANY OF YOUR BLOOD RELATIVES HAD ANY OF THE FOLLOWING?
(Include grandparents, parents, brothers, sisters, uncles and aunts. Exclude cousins, relatives by marriage and half relatives).

If at least one of your blood relatives has had the listed disease place a circle around the number (YES) beside it.

		YES
A.	Heart attack under the age of 50	1
B.	Stroke under the age of 50	2
C.	High blood pressure	3
D.	Diabetes	4
E.	Kidney disease	5
F.	If none of your blood relatives have had **any** of the above diseases, circle the following number	6

47. HAVE ANY OF YOUR BLOOD RELATIVES SUFFERED FROM THE FOLLOWING? (Please tick the appropriate boxes).

	Mother		Father		Mothers Parents		Fathers Parents	
	Yes	No	Yes	No	Yes	No	Yes	No
A. Heart Attack	€	€	€	€	€	€	€	€
If yes, did this occur under the age of 50?	€	€	€	€	€	€	€	€
B. Stroke	€	€	€	€	€	€	€	€
If yes, did this occur under the age of 50?	€	€	€	€	€	€	€	€
C. High Blood Pressure (excluding high blood pressure during pregnancy).	€	€	€	€	€	€	€	€
D. Diabetes	€	€	€	€	€	€	€	€
E. High Cholesterol	€	€	€	€	€	€	€	€

PLEASE CHECK TO SEE THAT YOU HAVE ANSWERED ALL THESE QUESTIONS.

THANK YOU FOR YOUR CO-OPERATION.

The Adult Self-Perception Profile
(Messer & Harter, 1989)

0 / 6 / 12 months ID : | | | | |

University of Western Australia Department of Medicine and Pharmacology (RPH)

Community Physical Activity Program for Seniors

PATH –*Physical Activity Time for Health* Project 2003-2006

What I Am Like

These are statements which allow people to describe themselves. There are no right or wrong answers since people differ markedly. Please read the entire sentence across. *First* decide which one of the two parts of each statement *best* describes *you*; then go to that side of the statement and tick whether that is just *sort of* true for you or *really* true for you. You will just tick ONE of the four boxes for each item.

	Really True for Me	Sort of True for Me				Sort of True for Me	Really True for Me
1.	☐	☐	Some adults like the way they are leading their lives	BUT	Other adults don't like the way they are leading their lives	☐	☐
2.	☐	☐	Some adults feel that they are enjoyable to be with	BUT	Other adults often question whether they are enjoyable to be with	☐	☐
3.	☐	☐	Some adults are not satisfied with the way they do their work	BUT	Other adults are satisfied with the way they do their work	☐	☐
4.	☐	☐	Some adults see caring or nurturing others as a contribution to the future	BUT	Other adults do not gain a sense of contribution to the future through nurturing others	☐	☐
5.	☐	☐	In games and sports some adults watch instead of play	BUT	Other adults usually play rather than just watch	☐	☐

The Exercise Motivation Scale
(Li, 1999)

0 / 6 / 12 months ID :

University of Western Australia Department of Medicine and Pharmacology (RPH)

Community Physical Activity Program for Seniors

PATH –*Physical Activity Time for Health* Project 2003-2005

EXERCISE MOTIVATION SCALE

Direction: I would like you to please think about the last time you were physically active. Now indicate how strongly you agree or disagree with each reason by circling the appropriate response to the right using the categories below:

Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
(SD) 1	(D) 2	(MD) 3	(MA) 4	(A) 5	(SA) 6

	SD	D	MD	MA	A	SA
1. For the pleasure it gave me to experience positive sensations from the activity.	1	2	3	4	5	6
2. For the satisfaction it gave me to increase my knowledge about this activity.	1	2	3	4	5	6
3. Because other people believed that it was a good idea for me to exercise.	1	2	3	4	5	6

The Social Connectedness Scale – Revised
(Lee, Draper, & Lee, 2001; Lee & Robbins, 1995)

0 / 6 / 12 months ID : | | | | |

University of Western Australia Department of Medicine and Pharmacology (RPH)

Community Physical Activity Program for Seniors

PATH –Physical Activity Time for Health Project 2003-2005

SOCIAL CONNECTEDNESS SCALE - REVISED

Following are a number of statements that reflect various ways in which we view ourselves. Rate the degree to which you agree or disagree with each statement using the following scale (1 = Strongly Disagree and 6 = Strongly Agree). There are no right or wrong answers. Do not spend too much time with any one statement and do not leave any unanswered.

Strongly Disagree **(SD)**	Disagree **(D)**	Mildly Disagree **(MD)**	Mildly Agree **(MA)**	Agree **(A)**	Strongly Agree **(SA)**
1	**2**	**3**	**4**	**5**	**6**

		SD	*D*	*MD*	*MA*	*A*	*SA*
1.	I feel comfortable in the presence of strangers.	1	2	3	4	5	6
2.	I am in tune with the world................................	1	2	3	4	5	6

Measure of Actualisation Potential – Autonomy
(Leclerc, Lefrancois, Dube, Herbert, & Gaulin, 1998)

0 / 6 / 12 months ID : | | | | |

University of Western Australia Department of Medicine and Pharmacology (RPH)

Community Physical Activity Program for Seniors

PATH –*Physical Activity Time for Health* Project 2003-2005

Perceived Autonomy Scale

To answer this questionnaire you will need to read the statement and place a tick in the circle that best describes you.

1. I am a person who values him/herself________________.

○ very little ○ a little ○ somewhat ○ very much ○ enormously

The Physical Activity Scale For the Elderly
(Washburn, Smith, Jette, & Janney, 1993)

0 / 6 / 12 months ID : | | | | |

University of Western Australia Department of Medicine and Pharmacology (RPH)

Community Physical Activity Program for Seniors

PATH –*Physical Activity Time for Health* Project 2003-2005

PASE Questionnaire

Instructions: This set of questions are about your current level of physical activity and exercise. Please remember there are no right or wrong answers. We simply need to assess your current level of activity.

LEISURE TIME ACTIVITY

Q1. Over the past ***7 days*** how often did you participate in sitting activities such as reading, watching TV or doing handcrafts?

0. NEVER (SKIP TO Q2)
1. SELDOM (1-2 DAYS)
2. SOMETIMES (3-4 DAYS)
3. OFTEN (5-7 DAYS)

1a. What were these activities?

____

1b. On average, how many hours per day did you engage in these sitting activities?

[1.] LESS THAN HOUR [2.] 1 BUT LESS THAN 2 HOURS

[3.] 2-4 HOURS [4.] MORE THAN 4 HOURS

The PATH Project Physical Activity Diary

PATH Project Physical Activity Diary (Front Page)

ID: ☐☐☐☐

Centre: ____________________ Name: ____________________ Predicted Heart Rate Max: ____________

Heart Rate Max: ____________

Study Period: 0 / 6 / 12 months Study Week: ____________ Target Heart Rate Range: ____________

Date	Exercise Type	Heart Rate					Distance	Heart Rate Measurement Method	Rating of Perceived Exertion	Where did you exercise? (eg, rec centre, park, beach etc)	Office Use Only
		Rest	End of Warm up	20 mins in session	At end of session	After Cooldown					
											Mean HR %HRR
											Mean HR %HRR
											Mean HR %HRR

Office Use Only Mean HR %HRR # Sessions

Study Week: ____________

Date	Exercise Type	Heart Rate					Distance	Heart Rate Measurement Method	Rating of Perceived Exertion	Where did you exercise? (eg, rec centre, park, beach etc)	Office Use Only
		Rest	End of Warm up	20 mins in session	At end of session	After Cooldown					
											Mean HR %HRR
											Mean HR %HRR
											Mean HR %HRR

Office Use Only Mean HR %HRR # Sessions

HEART RATE CONVERSION

b/10sec		beats/min	b/10sec		beats/min	b/10sec		beats/min
9	=	54	15	=	90	21	=	126
10	=	60	16	=	96	22	=	132
11	=	66	17	=	102	23	=	138
12	=	72	18	=	108	24	=	144
13	=	78	19	=	114	25	=	150
14	=	84	20	=	12=	26	=	156

PERCEIVED EXERTION SCALE

6	
7	Very, Very Light
8	
9	Very Light
10	
11	Fairly Light
12	
13	Somewhat Hard
14	
15	Hard
16	
17	Very Hard
18	
19	Very. Very Hard
20	

Appendix B: Pilot Study Participant Briefing

Appendix B: Pilot Study Participant Briefing

University of Western Australia

School of Medicine and Pharmacology

PATH Pilot Study Protocol

Visit One

Participants will be asked to go to the level 3 reception. From here they will be taken to level 4 meeting room, where the testing will take place.

Once all of the participants have been seated in the meeting room and the time is 9:00am you will say:

"Thank you all very much for agreeing to participate in this study. The first thing I would like you all too do is read through the information sheets and consent forms. If these are to your satisfaction then please sign the consent form and hand it to me. If you have any questions I will be happy to answer them."

Once the consent forms have been collected and signed by the participants you must sign them and then give out the ID Cards. You will say:

"I am now handing out the ID numbers you will need to keep these and not give them to anyone. These are the numbers you must write at the top right of each questionnaire in the four boxes provided."

Once the ID cards have been handed out switch the overhead projector on and explain the method for answering each type of question. You will say:

"There are three types of questions in these questionnaires. You will be required to circle the answer, tick the answer or write the answer. If you make a mistake put a cross through the wrong answer and tick the right one"

You will now go through the overhead and explain each questionnaire

Adult Self-Perception Profile

"The first questionnaire is called the Adult Self-Perception Profile (Indicate this on the overhead). It will ask you how you feel about different aspects of your life. In this questionnaire you will need to read the entire statement first."

"This question reads: *Some adults like the way they are leading their lives BUT Some adults don't like the way they are leading their lives*. You will need to decide which statement best describes you. Once you have done this indicate if it Really True for You or only Sort of True for You. Then move on to question number two. You should only have one tick for each question."

Perceptions of Autonomy Scale

"The second questionnaire is called the Perceptions of Autonomy Scale (Indicate this on the overhead). It will ask you about how independent you feel. In this questionnaire you will need to read the question and tick the answer that fills in the blank. In this example I am a person who values him/herself very little. Once you have ticked the answer move on to question two."

Social Connectedness Scale-Revised

"The third questionnaire is called the Social Connectedness Scale – Revised (Indicate this on the overhead. It will ask you questions about how you feel in the community and with friends. In this questionnaire you will need to circle the most appropriate response. This question reads: *I feel comfortable in the presence of strangers* and I have indicated that I *Strongly Disagree* with the statement. Once you have circled the answer then move on to question two."

CHANGE OVERHEADS

Exercise Motivation Scale

"The fourth questionnaire is called the Exercise Motivation Scale. This questionnaire will ask you to think about the last time you were physically active and why you were doing it. This example reads: *For the pleasure it gave me to experience positive sensations from the activity* and I have indicated that I *Moderately Disagre*e with this. Once you have circled the appropriate answer move on to question two."

Exercise Self-Efficacy Questionnaire

"The fifth questionnaire is called the Exercise-Self Efficacy Questionnaire. This questionnaire will ask you how sure are you that you could perform certain activities. This example reads: *I could walk 500m in half an hour* and I have answered *YES* and I *am 60% sure I could do it*. If I answer *NO* I have to write *0%*."

CHANGE OVERHEADS

PASE (Physical Activity Scale for the Elderly

"The sixth questionnaire is the PASE Physical Activity Scale for the Elderly. This questionnaire will ask you about you activity levels and types of activity you do. The example asks how often over the past 7 days did you participate in sitting activities such as reading, watching TV or doing handcrafts. You need to circle the answer that is closest to what you do. You then need to list what they were; in this case I have done the following. You then need to circle the amount of time you would have spent on these activities."

SWITCH OVERHEAD OFF

Hand out copies of the health and lifestyle questionnaire and say:

"The questionnaire I am handing out now is called the health and lifestyle questionnaire."

Once you have finished handing them out say:

"If you have a look at it there are four boxes for you to put your ID number in, could you please do this. These are on every questionnaire and need to be filled out on every one. The first two pages of this questionnaire are examples on how to fill it out. There are instructions at the beginning of every questionnaire and you need to read these before beginning. If you could turn to the last page you will see something called the Questionnaire Difficulty Form. There is one of these at the end of each questionnaire; you must also fill this out. Once you have completed a questionnaire bring it over to me and I will give you the next one. Once you have finished all of the questionnaires I will give you an appointment slip for your next visit."

"Are there any questions before we start?" (If there are answer them)

“If you do have any put your hand up and I will come over and answer them. You can now begin the questionnaires.”

As you receive each questionnaire give them the next one in the pile then bring the completed questionnaire to Alastair and he will check over it. When you give out the appointment slip thank them for their time and say:

“I hope to see you next week” or something to this effect.

Appendix C: Contents of the Intervention Packages

Table C1. The contents of the behavioural intervention and self-managed packages

Behavioural Intervention Program	Self-Managed Program
About the PATH program	About the PATH program
Walking and the PATH group	Self-managed physical activity group
Personal health issues and physical activity	Selecting an activity program
Taking your heart rate	The Walking Program
Safe walking hints	The Water Walking Program
‘Your mentor’ and the mentoring program	The Cycling Program
Benefits and costs of being active	The Swimming Program
Rewards of exercise	Personal health issues and physical activity
Goal setting and your physical activity program	Taking your heart rate
Worksheet goal setting 1	Safe walking hints
Worksheet goal setting 2	Doing it with style – Walking Techniques
Sticking with your exercise program	The stretching program
Personal time management worksheet	Internet resources
Time management	Injury recording sheet
Daily time management	Illness recording sheet
Handling hurdles – Stepping into spring	Change of medication recording sheet
Correct walking technique – Doing it with style	Change of address recording sheet
Keeping your physical activity injury free	Emergency contact details
Choosing an exercise partner	Programs for seniors at your recreation centre
The stretching program	Prime movers information sheet
Injury recording sheet	Instruction on recording activity
Illness recording sheet	Physical activity diaries
Change of medications recording sheet	*Walk There Today Find Thirty: 2003-2004 walking guide* (2003).

Table C1 (continued). *The contents of the behavioural intervention and self-managed packages*

Behavioural Intervention Program	Self-Managed Program
Change of address recording sheet	*Seniors Recreation Council 2003/2004 Add Life to your Years: Sport and recreation for adults* (2003).
Emergency contact number	
Physical activity diaries	

Appendix D: Procedures for Measuring Height, Weight, Blood Pressure, and Waist and Hip Circumference

Height

1. The stadiometer was placed on a flat level surface.
2. Participants removed their shoes and any heavy items of clothing.
3. Stood with their back to the stadiometer, with arms by their sides and heels together.
4. The body position, heels, buttocks, upper part of the back, and the back of the head against the stadiometer, was checked.
5. The participant's head was position in the Frankfort plane and the headpiece was firmly lowered down in contact with the vertex (topmost part of the head).
6. The participant stepped down and away from the stadiometer and the height was recorded to the nearest 0.1cm.

Weight

1. The scales were placed on a hard level surface.
2. Participants remove their shoes, any jewellery, coats or jumpers.
3. Stood squarely on the scale and remained still while their weight was recorded to the nearest 0.05kg.

Blood Pressure

The procedure for measuring blood pressure was as follows, in a closed environment (quiet, with minimal distractions).

1. The participant was asked to sit down.
2. Informed on what a home blood pressure machine was, and that it was to be used to measure their blood pressure.
3. The cuff was placed on the participant's left arm, at least 2-3cm (2 finger space) above the inside of the elbow and tightened until it was tight but comfortable.

4. The white strip on the cuff was placed so it was facing the inside of the participant's elbow and the 2-3cm gap (2 finger space) was checked to make sure it was present.
5. The participant was seated for 5 minutes, with their left arm raised on cushions level with their heart.
6. The AND UA-767PC home blood pressure monitor was activated and a stopwatch was started simultaneously.
7. The systolic and diastolic blood pressures were recorded.
8. The blood pressure monitor was activated again at 1min 55sec. The systolic and diastolic blood pressures for the 2nd test were recorded.
9. The blood pressure monitor was activated again at 3min 55sec. The systolic and diastolic blood pressures for the 3rd test were recorded.
10. The blood pressure monitor was activated again at 5min and 55sec. The systolic and diastolic blood pressures for the 4th test were recorded.

Waist and Hip Circumference

The waist and hip circumference were measured in closed environment. Participants were instructed to wear shorts and a t-shirt to visits where waist and hip circumference would be measured. When measuring girths the researcher kept a constant tension on the tape and made sure the tape is not tight so that it indented the skin.

Waist Circumference

1. The participant was asked to stand upright with their feet together and lift the bottom of their t-shirt to reveal their waist line.
2. The researcher placed the tape horizontally around the participant's waist at the level of the minimum girth and instructed the participant to breathe normally. On exhalation the measurement was recorded to the nearest millimetre.
3. Waist circumference was measured three times and the median figure was used for data analysis.

Hip Circumference

1. The participant was asked to stand upright with their feet together and lift their arms out to the side.
2. The researcher placed the tape horizontally around the participant's hips (over their shorts) at the level of the greatest posterior protuberance of the buttocks. The measurement was recorded to the nearest millimetre.
3. Hip circumference was measured three times and the median figure was used for data analysis.

Appendix E: The Functional Fitness Test Warm-Up and Procedures

The Functional Fitness Test Warm-Up

The warm-up consisted of:

1. 5-minute moderate paced walk
2. Left shoulder and Right shoulder stretch
3. Left triceps and Right triceps stretch
4. Left quadriceps and Right quadriceps stretch
5. Left hamstring and Right hamstring stretch
6. Left calf and Right calf stretch
7. A post warm-up heart rate was recorded

The Functional Fitness Test Procedures

The 30s chair stand

The purpose of the 30-s Chair Stand is to assess lower body strength. The researcher instructed the participant on how to complete the test before attempting it. Firstly the researcher demonstrated the correct technique of the 30-second chair stand by performing 3 repetitions. The instructions to participants were as follows.

1. Do not throw your head back when sitting down.
2. Do not rock forward to stand up.
3. Keep your back straight at all times.
4. Look ahead at all times.
5. Keep your arms folded across your chest at all times
6. Keep your feet flat on the floor and stationary throughout the test.
7. Be careful not to hit your head against the wall.

The researcher instructed the participant to practice *2* times before starting and ensured they have proper technique. Prior to the test the researcher asked participants to:

1. Sit in the middle of the chair, with your back straight, and your feet flat on the floor.
2. Keep your knees bent at 90 degrees.
3. Cross your arms at the wrists and hold them to your chest, remain so for the duration of the 30-second test.
4. When I say ‘go’ rise to a full standing position and return to a fully seated position and complete as many full stands as possible within the 30 seconds.

Once the participant was in the correct position the researcher said ‘ready…go’ and counted the number of stands in 30-seconds.

The 30s Arm-curl Test

The purpose of the 30s Arm-Curl Test is to assess upper body strength. For males an 8lb weight is used, for females a 5lb weight is used. The participants were instructed on how to complete the test before attempting it. Firstly the researcher demonstrated the correct technique of the 30s Arm-Curl Test by performing 5 repetitions. The instructions given to participants were as follows:

1. Sit on the chair with your back straight, feet flat on the floor, and with the dominant side of your body close to the side edge of the chair.
2. Hold the weight at your side in your dominant hand (handshake grip) making sure that your arm is down beside your body, perpendicular to the floor with your palm was facing inward.
3. Place your non-dominant hand on the top of the thigh or on the edge of the chair for the duration of the test.
4. Keep your upper arm still throughout the test.

5. On ‘go’ turn your palm up while curling your arm through a full range of motion and then return it to a fully extended position. At the down position the weight should be back in the handshake grip position.
6. Perform as many correct lifts as possible within 30-seconds.
7. Do not hold your breath at any time during the lift

The researcher knelt next to the participant on the dominant arm side and placed his or her fingers on the participant’s mid biceps. This was done to prevent the upper arm from moving and ensure a full curl is made. The researcher then placed the other hand behind the participant’s elbow so he/she would know when full extension was reached and to prevent backswing motion of the arm. Once the participant was in the correct position the researcher said ‘ready…go’ and counted the number of arm curls in 30-seconds.

Sit and Reach Test

The purpose of the Sit and Reach Test was to assess lower body, primarily hamstring, flexibility. Prior to the test the researcher demonstrated the correct technique of the Sit and Reach Test to participants by performing 2 tests. The participants were instructed to not hold their breath at any time, bounce or move rapidly, and never stretch to the point of pain. The instructions to participants are as follows:

1. Sit on the chair, and then move forward so that the crease between the top of the legs and the buttocks is on the edge of the chair.
2. Keep one leg bent with the foot flat on the floor, and extend the other leg straight in front of the hip with the heel on the floor and the foot flexed (at approximately 90º).
3. Keep the knee of the extended leg straight at all times.

4. Slowly bend forward at the hip joint, keep your head up and slide your hands (one on top of the other with the tips of the middle fingers even) down the extended leg in an attempt to touch the toes.
5. Hold the reach for 2 seconds.
6. If your knee starts to bend sit back until it straightens again.
7. Choose the preferred leg.
8. Perform two practice trials on the preferred leg.
9. Perform two testing trials on the preferred leg.

Once the participant was in the correct position the researcher said ‘ready…go’ and measured the reach distance for both trials.

Back-Scratch Test

The purpose of the Back Scratch Test is to assess upper body, specifically shoulder flexibility. The participants were instructed on how to complete the test before attempting it. Firstly the researcher demonstrated the correct technique of the Back Scratch Test by performing 1 test on each arm. The participants were informed, prior to the demonstration, that they should not hold their breath at any time, bounce or move rapidly, and never stretch to the point of pain. The instructions given to participants were as follows:

1. Stand up and place the dominant hand behind the same-side shoulder, palm facing the back and fingers extended.
2. Reach down the back as far as possible (elbow pointing up).
3. Place the other hand behind the back, palm out and reaching up as far as possible in an attempt to touch or overlap the other hand.
4. I will orient the fingers of your top hand so they are pointing at the fingers of your bottom hand.

5. Please do not to grab your fingers together and pull.

6. Have two practice trials with the dominant hand.

7. Perform two test trials with the preferred hand.

This process is repeated for the non-dominant hand reaching over the same-side shoulder.

2.5m Up and Go Test

The purpose of the 2.5m Up and Go Test is to assess agility and dynamic balance. Prior to the test being demonstrated by the researcher the equipment was set up as follows:

1. The chair was positioned against a wall to prevent tipping during testing.
2. The test was conducted on a non-slippery, even surface, and clear of any obstructions.
3. The chair was facing a cone 2.5m away (measured from a point on the floor even with the front of the chair to the far side of the marker).
4. There was 1.5m clearance around the marker that was free of any objects to allow the participant ample turning room.

The instructions given to participants were as follows:

1. Sit upright in the chair (back straight and head in line with back).
2. Place your hands on your thighs, feet flat on the floor with one foot slightly in front of the other.
3. On ‘go’ push off from the chair and walk around the marker (without running) and return to the original seated position.
4. You must go up the right hand side of the marker and come back on the left hand side.
5. You must perform the test as quickly as possible.

6. Please walk through the test one time and have two practice trials at full pace.

Once the participant was in the correct position the researcher said ‘ready…go’ and the trial time was recorded. Participants were given two attempts.

6-min Walk Test

The purpose of the 6-min Walk Test was to assess aerobic endurance. The test involved assessing the maximum distance a participant could cover while walking for 6 minutes along a 50m course marked into 5m segments (see Figure C1). Heart rate in beats per min was recorded at 1, 2, 3, 4, 5, 6 minute intervals. Heart rate was also recorded 5, 10, and 15 minutes after completing the 6 minute walk test.

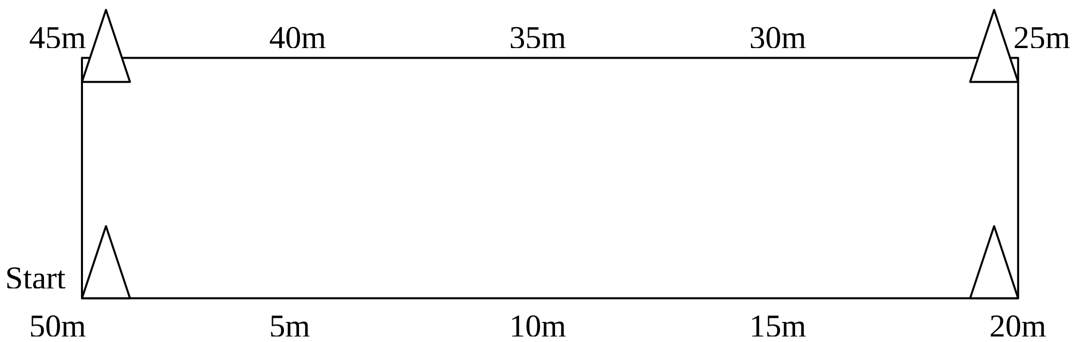


Figure E1. Six minute walk test course layout.

The four corners of the course were marked with cones and the segments in between marked with masking tape and chairs were placed at each 5 meter interval. To keep track of the number of laps participants were handed a popsicle stick each time they round the start cone. Prior to the test participants were re-informed of the risk of participating in this type of test. The instructions given to participants were as follows.

1. For this test you are to walk as fast as possible (not run) around the course as many times as you can in 6-minutes. If necessary you may stop and rest on the

chairs spaced at 5m intervals around the course, then resume walking, during the 6-minutes.

2. Every minute during the test I will ask you to look at your heart rate monitor and read off the heart rate in a loud clear voice. Every time you come past me at the end of each lap collect a pop stick from me. Please do not drop these as I will count them at the end to see how many laps you have completed.
3. I will say ‘ready…go’ and on go you will start. I will tell you when you are halfway through at 3 minutes, when there is 2 minutes to go, 1 minute to go, 30 seconds to go and I will count down the last 10 seconds.

When I say stop please stop where you are so and remain there until I record how far around the course you have reached. After the test is completed I will ask you for an RPE score for the test.

Appendix F: LISREL Structural Equations

Structural Equation Model 1

The structural equations for the relationships between the latent variables (η_1) to (η_4) are:

$$\eta_1 = \gamma_{11}\xi_1 + \gamma_{12}\xi_2$$

$$\eta_2 = \gamma_{21}\xi_1 + \gamma_{22}\xi_2$$

$$\eta_3 = \gamma_{31}\xi_1 + \gamma_{32}\xi_2$$

$$\eta_4 = \beta_{41}\eta_1\gamma_{11}\xi_1 + \gamma_{12}\xi_2 + \beta_{42}\eta_2\gamma_{21}\xi_1 + \gamma_{22}\xi_2 + \beta_{43}\eta_3 + \gamma_{31}\xi_1 + \gamma_{32}\xi_2 + \gamma_{41}\xi_1 + \gamma_{42}\xi_2$$

The measurement model equations for the observed variables (y_1) to (y_8) are:

$$y_1 = \eta_1 + \varepsilon_1$$

$$y_2 = \lambda_{21+}\eta_1 + \varepsilon_2$$

$$y_3 = \lambda_{31} + \eta_1 + \varepsilon_3$$

$$y_4 = \lambda_{42} + \eta_2 + \varepsilon_4$$

$$y_5 = \eta_2 + \varepsilon_5$$

$$y_6 = \lambda_{63} + \eta_3 + \varepsilon_6$$

$$y_7 = \eta_3 + \varepsilon_7$$

$$y_8 = \eta_4 + \varepsilon_8$$

The measurement model equations for the observed variables (x_1) and (x_2) are:

$$x_1 = \xi_1 + \delta_1$$

$$x_2 = \xi_2 + \delta_2$$

Structural Equation Model 2

The measurement model equation for the unconstrained, or saturated, model (version 2.0) is:

$$y_1 = \gamma_{11}\chi_1 + \gamma_{12}\chi_2 + \gamma_{13}\chi_3$$

The measurement model equation for the model with baseline physical self-perceptions held constant (version 2.1) is:

$$y_1 = \chi_1 + \gamma_{12}\chi_2 + \gamma_{13}\chi_3$$

The measurement model equation for the model with baseline autonomy held constant (version 2.2) is:

$$y_1 = \gamma_{11}\chi_1 + \chi_2 + \gamma_{13}\chi_3$$

The measurement model equation for the model with baseline social connectedness held constant (version 2.3) is:

$$y_1 = \gamma_{11}\chi_1 + \gamma_{12}\chi_2 + \chi_3$$

Structural Equation Model 3

The measurement model equations (x_1) to (x_{11}) for the first CFA model are:

$$x_1 = \lambda_{11}\xi_1 + \delta_1$$

$$x_2 = \lambda_{12}\xi_1 + \delta_2$$

$$x_3 = \lambda_{13}\xi_1 + \delta_3$$

$$x_4 = \lambda_{14}\xi_1 + \delta_4$$

$$x_5 = \lambda_{15}\xi_1 + \delta_5$$

$$x_6 = \lambda_{26}\xi_2 + \delta_6$$

$$x_7 = \lambda_{27}\xi_2 + \delta_7$$

$$x_8 = \lambda_{38}\xi_3 + \delta_8$$

$$x_9 = \lambda_{39}\xi_3 + \delta_9$$

$$x_{10} = \lambda_{310}\xi_3 + \delta_{10}$$

$$x_{11} = \lambda_{311}\xi_3 + \delta_{11}$$

The measurement model equations (x_1) to (x_9) for the second CFA model are:

$$x_1 = \lambda_{11}\xi_1 + \delta_1$$

$$x_2 = \lambda_{12}\xi_1 + \delta_2$$

$$x_3 = \lambda_{13}\xi_1 + \delta_3$$

$$x_4 = \lambda_{14}\xi_1 + \delta_4$$

$$x_5 = \lambda_{25}\xi_2 + \delta_5$$

$$x_6 = \lambda_{26}\xi_2 + \delta_6$$

$$x_7 = \lambda_{37}\xi_3 + \delta_7$$

$$x_8 = \lambda_{38}\xi_3 + \delta_8$$

$$x_9 = \lambda_{39}\xi_3 + \delta_9$$

$$x_{10} = \lambda_{310}\xi_3 + \delta_{10}$$

As model 3 contains three separate pathways between latent variables, the three structural equation models (η_1) to (η_3) are:

$$\eta_1 = \gamma_{11}\xi_1$$

$$\eta_2 = \gamma_{21}\xi_1$$

$$\eta_3 = \gamma_{31}\xi_1$$

The measurement model equations for the observed y variables (y_1) to (y_9) are:

$$y_1 = \eta_1 + \varepsilon_1$$

$$y_2 = \lambda_{21+}\eta_1 + \varepsilon_2$$

$$y_3 = \lambda_{31} + \eta_1 + \varepsilon_3$$

$$y_4 = \eta_2 + \varepsilon_4$$

$$y_5 = \lambda_{52} + \eta_2 + \varepsilon_5$$

$$y_6 = \lambda_{62} + \eta_2 + \varepsilon_6$$

$$y_7 = \lambda_{72} + \eta_2 + \varepsilon_7$$

$$y_8 = \lambda_{83} + \eta_3 + \varepsilon_8$$

$$y_9 = \eta_3 + \varepsilon_9$$

As there is only one observed x variable, the measurement model equation for this is:

$$x_1 = \xi_1 + \delta_1$$

Appendix G: Reliability Coefficients

Table G1

Reliability coefficients for ASPP, ASPP importance ratings, global self-worth and ASPP sub-domains

Dependent Variable	Baseline Alpha	6-Month Alpha
Global Self-Worth	.89	.89
Sociability	.81	.85
Job Competence	.75	.75
Nurturance	.77	.84
Athletic Competence	.81	.81
Physical Appearance	.79	.85
Adequacy as a Provider	.76	.80
Morality	.74	.82
Household Management	.83	.81
Intimacy in Relationships	.82	.83
Intelligence	.79	.80
Humour	.79	.79

Note. ASPP (Adult Self-Perception Profile).

Table G2

Reliability Coefficients for the EMS Sub-Domains

Dependent Variable	Baseline Alpha	6-Month Alpha
Amotivation	.74	.85
External Regulation	.79	.80
Introjected Regulation	.74	.73
Identified Regulation	.73	.76
Integrated Regulation	.78	.76
Intrinsic Motivation to Learn	.90	.92
Intrinsic Motivation to Accomplish	.75	.82
Intrinsic Motivation to Experience	.89	.88

Note. EMS (Exercise Motivation Scale).

Table G3

Reliability Coefficient for the MAP-A

Dependent Variable	Baseline Alpha	6-Month Alpha
MAP-A	.74	.67

Note. MAP-A (Measure of Actualisation Potential – Autonomy)

Table G4

Reliability Coefficient for the SCS-R

Dependent Variable	Baseline Alpha	6-Month Alpha
SCS-R	.93	.93

Note. SCS-R (Social Connectedness Scale – Revised)

Appendix H: Socio Economic Status Differences

Table H1

Comparisons between socio economic status (SES) for physiological measures at baseline

Measure	Mean (±SD)			*p* Value
	Low SES	Medium SES	High SES	
Age (yrs)	65.67 (3.61)	66.34 (4.89)	67.03 (5.19)	= 0.131
Height (cm)	163.94 (8.88)	162.94 (6.90)	164.84 (8.29)	= 0.069
Weight (kg)	75.70 (12.13)	75.32 (12.18)	73.21 (12.63)	= 0.262
Body Mass Index ($kg.m^2$)	28.10 (3.57)	28.34 (4.08)	26.88 (3.79)	= 0.043
Waist Girth (cm)	91.99 (11.37)	92.81 (11.30)	90.57 (12.00)	= 0.233
Hip Girth (cm)	105.41 (7.97)	104.94 (8.03)	102.65 (8.23)	= 0.044
Waist to Hip Ratio	0.87 (0.09)	0.88 (0.08)	0.88 (0.09)	= 0.706

Table H2

Marital status and educational background comparisons by socio economic status (SES)

Marital Status and Educational Background	Number (% within SES)			
	Low SES	Medium SES	High SES	Total
Single	5 (5.7)	2 (2.4)	3 (3.9)	10 (4.0)
Married	52 (59.1)	49 (59.0)	55 (71.4)	156 (62.9)
Widowed	12 (13.6)	16 (19.3)	6 (7.8)	34 (13.7)
Divorced	16 (18.2)	13 (15.7)	11 (14.3)	40 (16.1)
Separated	2 (2.3)	2 (2.4)	1 (1.3)	3 (1.2)
De-facto	1 (1.1)	1 (1.2)	1 (1.3)	3 (1.2)
Total	**88 (100)**	**83 (100)**	**77 (100)**	**248 (100)**
Primary School	2 (2.3)	1 (1.2)	1 (1.3)	4 (1.6)
Some High School	21 (23.9)	15 (18.1)	5 (6.5)	41 (16.5)
Passed High School	24 (27.3)	19 (22.9)	27 (35.1)	70 (28.2)
Trade or Technical Qualification	20 (22.7)	18 (21.7)	11 (14.3)	49 (19.8)
University Graduate	21 (23.9)	30 (36.1)	33 (42.9)	84 (33.9)
Total	**88 (100)**	**83 (100)**	**77 (100)**	**248 (100)**

	Mean (± SD)			
	Low SES	Medium SES	High SES	Total
Total Years of Education	12.12 (4.06)	12.24 (3.30)	13.41 (3.28)	12.57 (3.60)

Note. Values in bold are within group totals
* indicates *p* value <0.05 (adjusted for clustering effects)

Table H3

Physical activity background comparisons by socio economic status (SES)

	Number (% within SES)			
Physical Activity Background	Low SES	Medium SES	High SES	Total
Enjoyed physical activity when younger	72 (81.8)	71 (85.5)	63 (81.8)	206 (83.1)
Competed in a competitive sport*	51 (58.0)	60 (72.3)	50 (64.9)	161 (64.9)
Started a program in the last 12 months	21 (23.9)	25 (30.5)	17 (22.7)	63 (25.7)
	Mean (±SD)			
	Low SES	Medium SES	High SES	Total
Years you participated in competitive sport	11.83 (12.52)	12.24 (3.30)	13.41 (3.28)	12.75 (13.70)
Years since you were last vigorously active	16.53 (16.30)	19.13 (17.06)	20.40 (15.41)	18.58 (16.32)
Walk ability	3.07 (0.72)	3.05 (0.66)	2.96 (0.76)	3.03 (0.71)

* indicates $p < 0.05$ (adjusted for clustering effects)

Table H4

Comparisons between socio economic status (SES) for each self-perception sub-domain

Self-Perception Sub-Domains	Mean (±SD)			p value
	Low SES	Medium SES	High SES	
Sociability	2.95 (0.61)	2.84 (0.66)	2.99 (0.61)	= 0.266
Job Competence	3.27 (0.58)	3.14 (0.55)	3.26 (0.52)	= 0.213
Nurturance	3.29 (0.53)	3.24 (0.50)	3.27 (0.55)	= 0.685
Athletic Competence	2.00 (0.70)	1.97 (0.63)	2.07 (0.66)	= 0.509
Physical Appearance	2.66 (0.63)	2.55 (0.61)	2.69 (0.63)	= 0.204
Adequacy as a Provider	3.39 (0.52)	3.23 (0.53)	3.43 (0.49)	= 0.019
Morality	3.57 (0.46)	3.46 (0.43)	3.48 (0.53)	= 0.239
Household Management	3.07 (0.66)	2.97 (0.70)	3.14 (0.68)	= 0.065
Intimacy in Relationships	2.78 (0.69)	2.62 (0.66)	2.73 (0.74)	= 0.148
Intelligence	2.96 (0.61)	2.98 (0.54)	3.15 (0.54)	= 0.178
Sense of Humour	3.11 (0.70)	3.15 (0.57)	3.14 (0.63)	= 0.911
Global Self-Worth	3.27 (0.62)	3.07 (0.59)	3.19 (0.54)	= 0.084

Table H5

Comparisons between socio economic status (SES) for each exercise motivation sub-domain

Exercise Motivation Sub-Domains	Mean (±SD)			
	Low SES	Medium SES	High SES	*p* value
Amotivation	1.64 (0.73)	1.71 (0.79)	1.75 (0.85)	= 0.315
Extrinsic Regulation	2.06 (0.98)	2.33 (0.94)	2.25 (1.08)	= 0.919
Introjected Regulation	2.93 (1.05)	3.40 (1.10)	3.00 (1.23)	= 0.321
Identified Regulation	4.95 (0.70)	4.96 (0.69)	4.66 (1.00)	= 0.037
Integrated Regulation	4.53 (0.76)	4.58 (0.81)	4.25 (1.07)	= 0.022
Intrinsic Motivation to Learn	4.39 (1.09)	4.42 (0.99)	4.17 (1.24)	= 0.273
Intrinsic Motivation to Achieve	4.64 (0.74)	4.65 (0.73)	4.38 (1.13)	= 0.112
Intrinsic Motivation to Experience	4.80 (0.87)	4.94 (0.71)	4.64 (1.11)	= 0.205

Table H6

Comparisons between socio economic status (SES) for autonomy and social connectedness

	Mean (±SD)			
Measures	Low SES	Medium SES	High SES	*p* value
Autonomy	3.86 (0.55)	3.70 (0.52)	3.78 (0.46)	= 0.072
Social Connectedness	94.88 (14.75)	91.65 (14.85)	94.96 (11.91)	= 0.051

Table H7

Comparisons between socio economic status (SES) for physical activity level

Measure	Mean (±SD) Low SES	Medium SES	High SES	*p* value
Total Physical Activity	101.93 (45.38)	100.92 (40.38)	98.29 (44.31)	= 0.912
Leisure Time Physical Activity	6.78 (8.68)	8.68 (10.44)	6.47 (6.97)	= 0.355

Table H8

Comparisons between socio economic status (SES) for each functional fitness parameter

Functional Fitness Tests	Mean (±SD) Low SES	Medium SES	High SES	*p* value
Arm Strength	13.86 (2.60)	13.45 (2.77)	14.11 (3.16)	= 0.010
Agility	5.37 (0.78)	5.55 (0.83)	5.49 (0.97)	= 0.048
Shoulder Flexibility Dominant Side	-4.09 (8.38)	-4.12 (7.93)	-2.66 (7.45)	= 0.240
Shoulder Flexibility Non-Dominant Side	-8.92 (8.53)	-9.08 (9.14)	-7.69 (9.23)	= 0.546
Leg Strength	11.88 (2.74)	11.75 (2.78)	12.16 (2.77)	= 0.645
Hamstring Flexibility	2.16 (12.61)	1.82 (12.32)	-0.39 (12.50)	= 0.597
Aerobic Endurance	583.13 (59.96)	571.72 (60.70)	591.85 (65.90)	= 0.288

Appendix I: Occupational Background

Table I1

Occupational background comparisons by intervention type

	Number (% of Total)		
Occupational Background	Self Managed	Behavioural Intervention	Total
Not Retired	19 (7.6)	21 (8.4)	40 (15.9)
Semi Retired	0 (0.0)	2 (0.8)	2 (0.8)
Fully Retired	95 (37.8)	114 (45.4)	209 (83.3)
Previous Occupation (Retired)			
Professional and Management	37 (18.1)	56 (27.5)	93 (45.6)
Trades, Labour and Transport	9 (4.4)	10 (4.9)	19 (9.3)
Clerical, Sales and Service	38 (18.6)	27 (13.2)	65 (31.9)
Home Duties	10 (4.9)	17 (8.3)	27 (13.2)
Current Occupation (Not Retired)			
Professional and Management	13 (20.3)	13 (20.3)	26 (40.6)
Trades, Labour and Transport	1 (1.6)	4 (6.3)	5 (7.8)
Clerical, Sales and Service	5 (7.8)	7 (10.9)	12 (18.8)
Home Duties	9 (14.1)	12 (18.8)	21 (32.8)

Table I2

Occupational background comparisons by gender

Occupational Background	Number (% of Total)		
	Male	Female	Total
Not Retired	13 (5.2)	27 (10.8)	40 (15.9)
Semi Retired	0 (0.0)	2 (1.1)	2 (0.8)
Fully Retired	52 (20.7)	157 (62.5)	209 (83.3)
Previous Occupation (Retired)			
Professional and Management	32 (15.7)	61 (29.9)	93 (45.6)
Trades, Labour and Transport	7 (3.4)	12 (5.9)	19 (9.3)
Clerical, Sales and Service	8 (3.9)	57 (27.9)	65 (31.9)
Home Duties	0 (0.0)	27 (13.2)	27 (13.2)
Current Occupation (Not Retired)			
Professional and Management	10 (15.6)	16 (25.0)	26 (40.6)
Trades, Labour and Transport	2 (3.1)	3 (4.7)	5 (7.8)
Clerical, Sales and Service	2 (3.1)	10 (15.6)	12 (18.8)
Home Duties	0 (0.0)	21 (32.8)	21 (32.8)

Table I3

Occupational background comparisons by withdrawal status

Occupational Background	Number (% of Total)		
	Retained	Withdrawn	Total
Not Retired	29 (11.6)	11 (4.4)	40 (15.9)
Semi Retired	2 (0.8)	0 (0.0)	209 (83.3)
Fully Retired	163 (64.9)	46 (18.3)	2 (0.8)
Previous Occupation (Retired)			
Professional and Management	73 (35.8)	20 (9.8)	93 (45.6)
Trades, Labour and Transport	17 (8.3)	2 (1.0)	19 (9.3)
Clerical, Sales and Service	49 (24.0)	16 (7.8)	65 (31.9)
Home Duties	20 (9.8)	7 (3.4)	27 (13.2)
Current Occupation (Not Retired)			
Professional and Management	18 (28.1)	8 (12.5)	26 (40.6)
Trades, Labour and Transport	4 (6.3)	1 (1.6)	5 (7.8)
Clerical, Sales and Service	10 (15.6)	2 (3.1)	12 (18.8)
Home Duties	17 (26.6)	4 (6.3)	21 (32.8)

Table I4

Occupational background comparisons by socio economic status (SES)

	Number (% of Total)			
Occupational Background	Low SES	Medium SES	High SES	Total
Not Retired	12 (4.8)	15 (6.0)	13 (5.2)	40 (15.9)
Semi Retired	0 (0.0)	0 (0.0)	2 (0.8)	2 (0.8)
Fully Retired	76 (30.3)	69 (27.5)	64 (25.5)	209 (83.3)
Previous Occupation (Retired)				
Professional and Management	21 (10.3)	33 (16.2)	19 (19.1)	93 (45.6)
Trades, Labour and Transport	12 (5.9)	4 (2.0)	3 (1.5)	19 (9.3)
Clerical, Sales and Service	34 (16.7)	18 (8.8)	13 (6.4)	65 (31.9)
Home Duties	8 (3.9)	11 (5.4)	8 (3.9)	27 (13.2)
Current Occupation (Not Retired)				
Professional and Management	8 (12.5)	9 (14.1)	9 (14.1)	26 (40.6)
Trades, Labour and Transport	0 (0.0)	2 (3.1)	3 (4.7)	5 (7.8)
Clerical, Sales and Service	4 (6.3)	6 (9.4)	2 (3.1)	12 (18.8)
Home Duties	7 (10.9)	7 (10.9)	7 (10.9)	21 (32.8)